Texas Commission on Environmental Quality
Interoffice Memorandum

To: Commissioners **Date:** November 16, 2012

Thru: Bridget C. Bohac, Chief Clerk
Zak Covar, Executive Director

From: Brent Wade, Deputy Director
Office of Waste

Subject: Consideration of a Petition for Rulemaking

Docket No.: 2012-2045-RUL

Project No.: 2013-006-PET-NR

Who Submitted the Petition:
On October 8, 2012, the executive director received a Petition for Rulemaking request from Baker Botts L.L.P on behalf of ProTechnics Division of Core Laboratories LP.

ProTechnics provides oil and gas diagnostic services to well operators to optimize reservoir performance and maximize hydrocarbon recovery from producing fields. These services include the use of radioactive tracers that are introduced into hydraulic fracturing fluids that enable well operators to take well log measurements to identify the intervals where the fluids are placed.

Occasionally, the fracking fluids and tracer material can be released back out of the well during a "sandout" and is returned to the surface. The Texas Department of State Health Services (DSHS) and the Railroad Commission of Texas have previously authorized the disposal of the returned material in earthen pits at the well site.

What the Petitioner Requests:
The petitioner requests that the Texas Commission on Environmental Quality (TCEQ) adopt a rule that would conditionally exempt minimal amounts of properly disposed radioactive proppant tracers in hydraulic fracturing flowback from TCEQ low-level radioactive waste licensing and disposal requirements.

Recommended Action and Justification:
The executive director recommends that the commission initiate a rulemaking proceeding. During the rulemaking process, the executive director's staff can evaluate the issues raised in the petition and provide further recommendations on proposed rules, as needed, to assure that any exemption will not constitute a significant risk to the public health and safety and the environment as required in Texas Health and Safety Code, §401.106(a).

The petitioner is requesting that TCEQ adopt a rule that would conditionally exempt minimal amounts of properly disposed radioactive proppant tracers in hydraulic fracturing flowback from TCEQ low level radioactive waste licensing disposal requirements.

Until recently, DSHS had authorized the disposal of these tracers in earthen pits. However, with the passage of SB 1604 (80th Legislature) the authority to exempt materials from the licensing requirements under the TCEQ's jurisdiction was conferred upon the TCEQ rather than DSHS. Therefore, the DSHS removed the license exemption in petitioner's license that had provided for the disposal of the proppant tracers and informed the petitioners that they must obtain permission from the TCEQ.

According to the petition, the use and DSHS approved disposal of the tracer materials have not resulted in a significant risk to public health and safety or the environment. In fact, the petition asserts that since May 12, 1992 the disposal of ZeroWash® tracer flowback in earthen pits has occured without any reported or known harm to public health and safety or the environment.

The petitioner states that proppant tracers themselves pose very little risk to the environment. First, the tracers are ceramic pellets which are insoluble in water. Consequently, the likelihood of radioactive material entering groundwater is negligible. Also, radiation dose calculations show that the dose to a person standing 24 hours a day, 365 days a year on top of an earthen pit filled with the maximum concentration of radioactive tracer (1,000 pCi/g) would only receive a dose of 5.56 mrem, which is equivalent to the extra dose an airplane passenger would receive flying for 11 hours.

The petitioner also represents that without a rule creating the exemption, the regulated community is left without a longstanding and economical practice for disposal of the material.

Applicable Law:

- Texas Government Code, §2001.021, which establishes the procedures by which an interested person may petition a state agency for the adoption of a rule
- 30 TAC §20.15, which provides such procedures specific to the commission
- 30 TAC Chapter 336, Subchapter C, General License Requirements
- Texas Health and Safety Code, §401.106(a) authorizes the TCEQ by rule to exempt a source of radiation from the licensing requirements under the TCEQ's jurisdiction.

Agency contacts:

Hans Weger, Rule Project Manager, 239-6465, Radioactive Materials Division
Don Redmond, Staff Attorney, 239-0612
Michael Parrish, Texas Register Coordinator, 239-2548

Attachment

Petition

Re: Docket No. 2012-2045-RUL

cc: Chief Clerk, 2 copies
Executive Director's Office
Susana M. Hildebrand, P.E.
Anne Idsal
Curtis Seaton
Tucker Royall
Office of General Counsel
Hans Weger
Michael Parrish

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October 8, 2012

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EXECUTIVE DIRECTOR

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molly.cagle@bakerbotts.com

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OLS
cc-Stephanie

Via Hand Delivery

Mr. Zak Covar
Executive Director
Texas Commission on Environmental Quality
12100 Park 35 Circle, Building F
Austin, Texas 78753

Re: Petition for Rulemaking under TEX. HEALTH & SAFETY CODE § 401.106(a)

Dear Mr. Covar:

This rulemaking petition is submitted on behalf of the ProTechnics Division of Core Laboratories LP, 6510 W. Sam Houston Parkway N., Houston, Texas 77041 ("ProTechnics") pursuant to TEX. HEALTH & SAFETY CODE § 401.106(a) and 30 TEX. ADMIN. CODE § 20.15. ProTechnics specifically requests that the Texas Commission on Environmental Quality ("TCEQ") adopt a rule that would conditionally exempt minimal amounts of properly disposed radioactive proppant tracers in hydraulic fracturing flowback from TCEQ low level radioactive waste licensing and disposal requirements.

BACKGROUND

Since May 12, 1992, ProTechnics has overseen the management and disposal of flowback containing proppant with ZeroWash® tracers in earthen pits. These earthen pits are, and have been managed by oil and gas well operators under the jurisdiction of the Railroad Commission. For two decades, this method of management and disposal has been authorized by the Department of State Health Services (*see* Attachment 1) and the Nuclear Regulatory Commission (*see* Attachment 2) through a license exemption. In fact, the Nuclear Regulatory Commission recently confirmed ProTechnics' method of management and disposal of ZeroWash® tracers via a license amendment issued on August 30, 2012. With the passage of S.B. 1604 (80th Leg., 2007) and subsequent TCEQ rulemakings under that act, it appears that a licensing exemption from TCEQ may now be required so that this product can continue to be managed in the same manner going forward.

1. FACTUAL BACKGROUND

For over two decades, ProTechnics has been an innovator in "completion diagnostic" services that enable oil and gas companies to optimize reservoir performance and maximize hydrocarbon recovery from producing fields. A key feature of the services provided

by ProTechnics to its clients over the last twenty years involves the established use of ZeroWash® proppant tracer beads in hydraulic fracturing operations. These tracers are introduced at low concentrations into hydraulic fracturing fluid containing proppant during hydraulic fracturing operations. The tracers provide a small signal above background that enables well operators taking subsequent well log measurements to identify the interval(s) where the proppant and tracers were placed, allowing well operators to increase recoverable reserves by identifying and recovering bypassed pay and providing information that identifies opportunities to optimize well completion processes.

This use of ZeroWash® tracers takes place at various drilling sites across the world. In Texas, it is authorized by Department of State Health Services License No. L03835 (the "DSHS License"). Historically, when ZeroWash® tracer material was released during a "sandout" or returned to the surface in flowback, the DSHS License authorized the diversion of the released and/or returned material to earthen pits subject to the jurisdiction of the Railroad Commission and the subsequent covering of that material with two feet of clean soil. ZeroWash® tracer flowback has been disposed of in this manner for the last twenty years.

The Department of State Health Services previously authorized this method of disposal, as did the Nuclear Regulatory Commission, because it does not result in a significant risk to public health and safety or the environment, and because it complies with the "as low as reasonably achievable" ("ALARA") principle for exposure to radiation. Critical in both agencies' decision-making was the unique properties of ProTechnics' tracers—ProTechnics uses ZeroWash® proppant tracer beads consisting of an insoluble material that ensures by its design that radioactivity will not migrate or leach into groundwater (*see* Attachments 3 & 6).

2. BRIEF EXPLANATION OF PROPOSED RULE

ProTechnics markets and sells its ZeroWash® tracers to oil and gas companies across the world. Current regulatory uncertainty regarding the management of flowback in Texas hampers ProTechnics' business goals and threatens the viability of a valuable service used in various shale plays across the United States. ProTechnics and its customers need certainty regarding acceptable management and disposal of ZeroWash® tracer flowback. ProTechnics believes that pursuant to TEX. HEALTH & SAFETY CODE § 401.106(a), the Commission should reach the same conclusion that the Department of State Health Services and the Nuclear Regulatory Commission have reached—that this long-standing disposal practice does not result in a significant risk to public health and safety or the environment, and thus should be conditionally exempt from TCEQ licensing and disposal requirements. ProTechnics also believes that the long standing management and disposal practices previously approved by Department of State Health Services and the Nuclear Regulatory Commission should continue to be available in lieu of, or in addition to the State's otherwise applicable disposal rules.

3. INJURY AND INEQUITY THAT COULD RESULT FROM THE FAILURE TO ADOPT THE PROPOSED RULE

Without a rule from TCEQ, the regulated community is left with serious uncertainty regarding the acceptability of a longstanding, safe, sound and economical management practice for disposing of such wastes, a practice approved by the Texas Department of State Health Services (*see* Attachment 1) and the Nuclear Regulatory Commission (*see* Attachment 2). The conditional exemption would apply only if disposal of the flowback material is conducted in accordance with the proposed TCEQ rule requirements.

TECHNICAL ANALYSIS

Adoption of a rule conditionally exempting disposal of ZeroWash® tracer flowback from licensing and disposal requirements will not pose a significant risk to public health and safety or the environment. This is a sound conclusion from a technical perspective for three reasons.

First, ZeroWash® tracer flowback has been disposed of in earthen pits since May 12, 1992, without any reported or known harm to public health and safety or the environment. Not only do the typical isotopes ProTechnics is licensed to use by the Department of State Health Services have a half-life of less than 90 days, but only a very small amount of tracer material is used to log a well—a 20-mCi vial containing 15 ccs of ZeroWash® tracer material traces 50,000 pounds of proppant (*see* Attachment 4). Further, the concentration of any tracers brought to the surface in flowback will always be relatively low because the tracer material is mixed into fracturing proppant prior to being injected into a well, meaning that only a small fraction of the proppant tracer returns to the surface. Additionally, although flowback sometimes occurs in fracturing operations, based on experience, flowback of ZeroWash® tracer only occurs in approximately one in ten applications.

Second, ProTechnics has undertaken calculations—computed over a broad and systematic range of possible scenarios with worst-case conditions of exposure time, isotope energy and half-life—to demonstrate that earthen pit disposal of ZeroWash® tracer flowback will not result in harm to public health and safety. For purposes of the calculations, dose was calculated for varying amounts of flowback (from 500 pounds to 23,000 pounds), containing the maximum 1,000 pCi/g ZeroWash® tracer concentration of Scandium-46. Dose was also calculated over a range of possible physical geometries. To be conservative, ProTechnics used worst case scenarios of an individual standing on top of a covered earthen pit and standing next to an uncovered pit for a year to determine maximum exposure to ZeroWash® tracer flowback.

The results of the calculations demonstrate that a rule which conditionally exempts from licensing and disposal flowback containing ZeroWash® tracer and similar products will not result in a significant risk to public health and safety. A person standing on a covered earthen pit for twenty-four hours a day for an entire year would accumulate only 5.56 mrem (*see*

Attachment 5).[1] To put this in context, a similar amount of radiation could be expected in a roundtrip flight from New York to Los Angeles (0.5 mrem/Hr). In addition, without any half-life decay, the first day calculates an activity above background at the surface of only 0.0057 mrem/Hr. No elevated readings have ever been measured above one of ProTechnics' covered earthen pits.[2] The parameters for the above calculations reflect *worst-case scenarios*, and when more realistic exposure times and distances are used, the dose is *essentially negligible*. All worst case scenarios clearly exhibit that exposure levels to the general public will be well below the 100 mrem limit allowed per year under TCEQ rules.

Third, the unique characteristics of ProTechnics' patented ZeroWash® tracer material protect against any dangers of leaching or migration into groundwater. Testing performed by scientists at Texas A&M University confirm that there is no appreciable "wash-off" from ProTechnics' ZeroWash® tracer material (*see* Attachment 6). This means that the tracer material will not contaminate any other materials it contacts, thereby leaving fluids and solids free of contamination from the tracer material so that there is no danger of transfer to a water table and no significant risk to the environment. Because of the unique properties of the ZeroWash® tracer material, regulatory agencies of the United States and Canada have approved elevated release limits.

The characteristics of ProTechnics' ZeroWash® tracers ensure that flowback disposal in earthen pits regulated by the Railroad Commission will not result in a significant risk to public health and safety or the environment. And because any alternative method of disposal would require pre-disposal transportation, disposal on-site in earthen pits is at least as protective, if not more protective, of public health, safety and the environment than other waste disposal methods. As such, disposal on-site in earthen pits complies with the "as low as reasonably achievable" ALARA principle for exposure to radiation.

STATUTORY AUTHORITY FOR PROPOSED RULEMAKING

The Texas Radiation Control Act grants TCEQ the general power and authority to adopt rules relating to control of sources of radiation. *See* TEX. HEALTH & SAFETY CODE § 401.051. The TCEQ has general jurisdiction to regulate and license the disposal of radioactive substances. *See id.* at § 401.011(b). Pursuant to TEX. HEALTH & SAFETY CODE § 401.106(a), the TCEQ has specific authority to exempt flowback containing ZeroWash® tracer from licensing and disposal requirements. Texas Health and Safety Code Section 401.106(a) provides:

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[1] Attachment 5 is confidential under Texas Public Information Act § 552.110, and is being submitted separately.

[2] Because the ZeroWash® tracer flowback is always covered with at least 2 feet of overburden soil, and that is the requirement for the conditional exemption in the proposed rule to apply, this is the calculation that is most useful for purposes of showing protectiveness. However, even if you assume that a person stands next to an uncovered earthen pit for four hours a day for an entire year, the exposure is still only 66 mrem per year.

> The board or commission[3] by rule may exempt a source of radiation or a kind of use or user from the licensing or registration requirements provided by this chapter and under the agency's jurisdiction if the board or commission finds that the exemption of that source of radiation or kind of use or user will not constitute a significant risk to the public health and safety and the environment.

Id. at § 401.106(a).

The Memorandum of Understanding ("MOU") between the TCEQ, the State Department of Health Services, and the Railroad Commission, which is codified in the Texas Administrative Code, specifically contemplates that disposal of radioactive tracer material will qualify for an exemption under Section 401.106(a). The applicable sections of the MOU provide:

> (f) Radioactive material.
>
> ...
>
> (4) Management of radioactive tracer material.
>
> > (A) Radioactive tracer material is subject to the definition of low-level radioactive waste under Texas Health and Safety Code, §401.004, and must be handled and disposed of in accordance with the rules of the TCEQ and the Department of State Health Services.
> >
> > (B) Exemption. Under Texas Health and Safety Code, §401.106, the TCEQ may grant an exemption by rule from a licensing requirement if the TCEQ finds that the exemption will not constitute a significant risk to the public health and safety and the environment.

16 TEX. ADMIN. CODE § 3.30(f)(4).

The TCEQ is also specifically authorized to provide exemptions from records relating to the disposal of a source of radiation by rule. *See id.* at § 401.057(b).

TEXT OF PROPOSED RULE

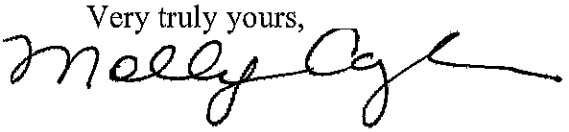
The proposed text of the rule is enclosed and has been included electronically on CD.

* * * * *

[3] "Commission" means the Texas Commission on Environmental Quality. TEX. HEALTH & SAFETY CODE § 401.003(2).

We appreciate your consideration of this rulemaking petition. Should you have any questions about the petition or the draft rule, please do not hesitate to contact me at 512.322.2535 or molly.cagle@bakerbotts.com.

Very truly yours,



Molly Cagle

cc: Charles Maguire, TCEQ (via U.S. mail)
Patricia Duron, TCEQ (via U.S. mail)
Tom Hampton, Core Lab (via U.S. mail)
Carlos Romo, Baker Botts L.L.P.

TEXT OF PROPOSED RULE

Texas Administrative Code

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 336	RADIOACTIVE SUBSTANCE RULES
SUBCHAPTER C	GENERAL LICENSING REQUIREMENTS
RULE §336.230	**Disposal of Radioactive Tracer Material Used in Oil and Gas Exploration or Production Operations**

(a) Purpose. The purpose of this Section is to conditionally exempt the on-site disposal of qualified tracer materials used in oil and gas operations pursuant to 30 TAC §336.203 and Texas Health & Safety Code §401.106(a).

(b) Eligibility and Qualification for the conditional exemption. Only Radioactive Materials License Holders may apply for the conditional exemption provided by this Section. In order for the disposal of solid tracer material used in oil and gas exploration and/or production operations to qualify for the conditional exemption from general licensing and disposal requirements provided by this Section, the following requirements must all be met:

(1) The Radioactive Materials License Holder seeking the conditional exemption must file an administratively complete registration with the Executive Director in accordance with this Section, and the Executive Director must confirm that the registration is accepted and that tracer materials are qualified tracer materials.;

(2) The tracer materials for which the conditional exemption is sought must meet the following criteria:

(A) The tracer materials are short half-life isotopes Iridium (Ir)-192, Scandium (Sc)-46 or Antimony (Sb)-124;

(B) The tracer materials are mixed with a combination of inorganic earthen material in the form of metal oxides and sintered at up to 500° C to form a strong ceramic structure incorporating a small amount of isotopes Ir, Sc, or Sb;

(C) The Ir, Sc or Sb isotopes are in a form that is non-water soluble; and

(D) The total radioactive concentration of all Ir, Sc or Sb isotopes is 1,000 picocuries/gram or less, and the physical half life of the qualified tracer materials is less than 90 days; and

(3) The qualified tracer materials are disposed of in accordance with the Registration, Disposal, Closure, and Annual Certification requirements of this Section.

(c) Definitions. The following words and terms when used in this section shall have the following meanings:

(1) "Closure" means the amount of time needed to return a pit to unrestricted release levels.

(2) "Flowback" means the process of allowing fluids to flow from the oil and gas well following a treatment, either in preparation for a subsequent phase of treatment or in preparation for cleanup and returning the well to production.

(3) "Job Site Survey Form" means a form signed by the Operator or Well Owner and Logging/Tracer Supervisor with survey information indicating that the pit where qualified tracer materials are disposed is at unrestricted release levels.

(4) "Logging/Tracer Supervisor" means an individual trained in a training program for the handling and disposal of qualified tracer materials including 25 TAC §289.253(o) requirements.

(5) "Operator" means the person responsible for managing oil and gas exploration and production activities and flowback at an oil and gas well site.

(6) "Pit" means earthen barrier used to dispose of qualified tracer material used in oil and gas exploration and/or production operations and permitted under applicable Railroad Commission rules.

(7) "Proppant" means sand or any natural or man-made material that is used in a hydraulic fracturing treatment to prop open the artificially created or enhanced fractures once the treatment is completed.

(8) "Qualified Tracer Materials" means radioactive tracer materials that meet all the criteria under Subsection (b)(2) of this Section.

(9) "Radioactive Materials License Holder" means a person issued a license by the Texas Department of State Health Services authorizing the licensee to receive, acquire, store, possess and transfer radioactive material listed in the license.

(10) "Tracer Material" means radioactive material with half-lives less than 90 days used in subsurface oil and gas exploration and production operations.

(11) "Well Owner," if different from the Operator, means the oil and gas lessee responsible for contracting with the Operator for oil and gas exploration and production activities and flowback at an oil and gas well site.

(12) "Well reversal material" means solid material, such as sand and other proppants used in hydraulic fracturing, flowing from the well following a treatment.

(13) "Well Site Agreement" means an agreement signed by the Operator or Well Owner and Radioactive Materials License Holder providing for each person's respective responsibilities in handling and disposing of qualified tracer materials.

(d) Registration. A Radioactive Materials License Holder seeking the conditional exemption from licensing and disposal requirements under this Section shall submit a registration, on a form prepared by the Executive Director. The registration shall include:

(1) A demonstration that tracer materials are qualified tracer materials;

(2) A complete description of the qualified tracer materials for which the conditional exemption is sought, including the identity, form and estimate of the typical total radioactive concentration of the qualified tracer material used per well in oil and gas exploration and/or production operations;

(3) a description of how qualified tracer materials are used in oil and gas exploration and/or production operations;

(4) information related to the training of a Logging/Tracer Supervisor;

(5) a description of the procedures a Logging/Tracer Supervisor will use to monitor and otherwise confirm and prepare a record to document closure of pits where qualified tracer materials are disposed; and

(6) a description of how and where the Radioactive Materials License Holder will maintain records showing compliance with this Section.

(e) Disposal. All of the following disposal procedures must be followed for qualified tracer materials to be conditionally exempt from Chapter 336 licensing and disposal requirements:

(1) A Radioactive Materials License Holder and Operator or Well Owner shall sign a Well Site Agreement indicating that the Operator or Well Owner has been informed of disposal procedures for on-site disposal of qualified tracer materials in a pit in accordance with this Subsection.

(2) An Operator or Well Owner disposing of qualified tracer materials must:

(A) Direct well reversal material (including any proppant or sand screened out of flowback fluid) to an on-site pit; and

(B) Backfill the pit with two (2) feet of clean soil within 30 days of final well clean up.

(f) Closure. The Radioactive Materials License Holder must:

(1) Maintain as part of the Well Site Agreement, an agreement with the Operator or Well Owner to control access to the pit until the radioactivity has decayed to unrestricted release levels, subject to inspection by representatives of the Executive Director; and

(2) Complete a Job Site Survey Form within 30 days of receipt of notice of closure of the pit documenting that a Logging/Tracer Supervisor has surveyed the pit with an End Window Geiger Muller Detector or equivalent device and found radioactivity at unrestricted release levels and identifying all information on which that documentation is based; and

(3) Maintain for a period of two years after closure the Well Site Agreement and Job Site Survey Form (including back-up documentation) associated with each pit where qualified tracer materials are disposed in lieu of any other recordkeeping requirements under Texas Health & Safety Code §401.057 relating to disposal of tracer materials under this Section. Records must include information regarding the date of disposal, the survey instrument used, the background radiation level, the radiation level measured at the surface of each disposal area, and the name of the Logging/Tracer Supervisor who completed the Job Site Survey Form. Records shall be kept readily available for inspection by representatives of the Executive Director.

(g) Annual certification. To maintain its eligibility for the conditional exemption provided by this Section, a Radioactive Materials License Holder shall submit a certification to the TCEQ on an annual basis confirming the accuracy or otherwise demonstrating compliance with the registration information and requirements under Subsection (d).

Attachment 1

Department of State Health Services

RADIOACTIVE MATERIAL LICENSE

Pursuant to the Texas Radiation Control Act and Texas Department of State Health Services (Agency) regulations on radiation, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess and transfer radioactive material listed below; and to use such radioactive material for the purpose(s) and at the place(s) designated below. This license is subject to all applicable rules, regulations and orders of the Agency now or hereafter in effect and to any conditions specified below.

LICENSEE	
1. Name	PROTECHNICS DIVISION OF CORE LABORATORIES LP ATTN WILL C WILLIAMS
2. Address	6510 WEST SAM HOUSTON PKWY STE 100 HOUSTON TX 77041

This license is issued in response to a letter

Dated: November 14, 2011

Signed by: Will Williams

3. License Number	Amendment Number
L03835	59

PREVIOUS AMENDMENTS ARE VOID

4. Expiration Date: August 31, 2015

RADIOACTIVE MATERIAL AUTHORIZED

5. Radioisotope	6. Form of Material	7. Maximum Activity	8. Authorized Use
A. Any radioactive material with atomic number less than 83 (except Se-75) and with a half-life less than 120 days	A. Any (except sealed sources)	A. No single unit quantity to exceed 40 millicuries Total activity of any single radioisotope not to exceed 100 millicuries	A. Tracer studies in oil, gas and geothermal wells. Field flood studies and inter-well tracer studies.
B. Ir-192, Ir-194	B. Any (except sealed sources)	B. No tracer single unit quantity to exceed 40 millicuries of either isotope. Markers not to exceed 50 microcuries each Total: 15 curies	B. Tracer studies in oil, gas and geothermal wells. Field flood studies and inter-well tracer studies and radioactive markers.
C. Sc-46	C. Any (except sealed sources)	C. No tracer single unit quantity to exceed 40 millicuries of either isotope. Markers not to exceed 50 microcuries each Total: 4000 millicuries	C. Tracer studies in oil, gas and geothermal wells. Field flood studies and inter-well tracer studies and radioactive markers.

Department of State Health Services

RADIOACTIVE MATERIAL LICENSE

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5. Radioisotope (Continued...)	6. Form of Material (Continued...)	7. Maximum Activity (Continued...)	8. Authorized Use (Continued...)
L. Xe-133	L. Any (except sealed sources)	L. No single unit quantity to exceed 100 millicuries Total: 2 curies	L. Casing integrity tests on injection wells in gas storage fields.

9. Radioactive material shall only be stored at:

Site Number	Location
007	Midland - 2001 Commerce Street
009	Fort Worth – 518 Aviator Drive
010	Houston – 6510 West Sam Houston Pkwy, Ste. 100
011	Alice – 5038 South Highway 281
012	Kilgore – **183 Old Post Oak Road**

10. The authorized place of use is at temporary sites, in areas not under exclusive Federal jurisdiction, throughout Texas.

11. Radioactive material shall not be stored or used at a permanent site unless that site is specifically authorized on this license. A site is considered permanent if radioactive material is stored and/or used at that location for more than 90 days in any twelve-month period.

12. The licensee shall limit storage of Ir-192 and Ir-194 to 5000 millicuries at all storage locations except the Kilgore, Texas facility which is authorized to maintain no more than 15 curies of Ir-192 and Ir-194 total. This condition does not supersede the maximum allowable activity authorized in Part B of Condition 7.

13. The individual designated to perform the functions of Radiation Safety Officer (RSO) for activities covered by this license and Site 010 is Will C. Williams. The Site Radiation Safety Officer (SRSO) for Site 007 is Roberto Sanchez. The SRSO for Site 009 is David R. Jackson. The SRSO for Site 011 is Frank Garcia. The SRSO for Site 012 is Todd Sasche.

14. The licensee shall comply with the provisions (as amended) of Title 25 Texas Administrative Code (TAC) §289.201, §289.202, §289.203, §289.204, §289.205, §289.251, §289.252, §289.253 and §289.257.

15. Radioactive material shall be used by, or under the direct supervision of, individuals designated by the RSO only after each worker has successfully completed an Agency accepted training course. Documentation verifying the successful completion of the training for each worker shall be maintained by the licensee for inspection by the Agency.

Department of State Health Services

RADIOACTIVE MATERIAL LICENSE

LICENSE NUMBER	AMENDMENT NUMBER
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20. The licensee is exempted from the requirements of 25 TAC §289.253(o)(1)(D) only for users of radioactive material authorized in Part I of Conditions 5, 6, 7 and 8. The licensee shall maintain a separate utilization log containing, as a minimum, the make and model number and/or serial number (or if absent, a unique description) of each sealed source authorized by Part I of Conditions 5, 6, 7 and 8 removed from storage, the identity of the logging supervisor receiving the sources of radiation, the locations where used and dates of use. These utilization logs shall be kept available for inspection by the Agency for five years from the date of the recorded event.

21. Except as specifically provided otherwise by this license, the licensee shall possess and use the radioactive material authorized by this license in accordance with statements, representations, and procedures contained in the following:

application dated July 22, 2005,
letters dated October 6, 2006, January 8, 2008, February 5, 2008, July 29, 2010, August 13, 2010, September 21, 2010, February 19, 2011, March 7, 2011.
facsimiles received January 23, 2007 and February 28, 2007.

Title 25 TAC §289 shall prevail over statements contained in the above documents unless such statements are more restrictive than the regulations.

SEG:seg

FOR THE DEPARTMENT OF STATE HEALTH SERVICES

Date November 17, 2011

Ray Fleming, Program Coordinator
Industrial Licensing Program

Attachment 2

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 EAST LAMAR BOULEVARD
ARLINGTON, TEXAS 76011-4511

August 30, 2012

Core Laboratories, Inc.
dba ProTechnics Division of Core Laboratories
ATTN: Will C. Williams
Radiation Safety Officer
6316 Windfern Road
Houston, Texas 77040

SUBJECT: LICENSE AMENDMENT

Please find enclosed copy of Amendment Number 44 to NRC License Number 42-26928-01. **As a result of your July 30, 2012 letter, the NRC has created a new license condition 18 reinstating an alternate disposal method that was previously approved, by means of tie-down conditions, on February 21, 1996, with the issuance of Amendment No. 18 to this license. The new license condition 18 makes it easier to the reader to understand what authorization is being granted as opposed to an authorization granted by tie-down conditions. Other license conditions were also updated. For your benefit, these changes are identified in boldface. In addition, I have included copies of the tie-down letters referenced in conditions 20.A. through 20.G. for your review.**

An environmental assessment for this action is not required, since this action is categorically excluded under 10 CFR 51.22(c)(14)(xi). You should review the enclosed document carefully and be sure that you understand all conditions. You can contact me at 817-200-1189 if you have any questions about this license.

The NRC's Safety Culture Policy Statement became effective in June 2011. While a policy statement and not a regulation, it sets forth the agency's expectations for individuals and organizations to establish and maintain a positive safety culture. You can access the policy statement and supporting material that may benefit your organization on NRC's safety culture Web site at http://www.nrc.gov/about-nrc/regulatory/enforcement/safety-culture.html. We strongly encourage you to review this material and adapt it to your particular needs in order to develop and maintain a positive safety culture as you engage in NRC-regulated activities.

NRC's Regulatory Issue Summary (RIS) 2005-31, provides criteria to identify security-related sensitive information and guidance for handling and marking of such documents. This ensures that potentially sensitive information is not made publicly available through ADAMS. The RIS may be located on the NRC Web site at: http://www.nrc.gov/reading-rm/doc-collections/gen-comm/reg-issues/2005/. Pursuant to NRC's RIS 2005-31, the enclosed materials license will not be made publicly available.

NRC expects licensees to conduct their programs with meticulous attention to detail and a high standard of compliance. Because of the serious consequences to employees and the public that can result from failure to comply with NRC requirements, you must conduct your radiation safety program according to the conditions of your NRC license, representations made in your license application, and NRC regulations. In particular, note that you must:

1. Operate by NRC regulations 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," 10 CFR Part 20, "Standards for Protection Against Radiation," and other applicable regulations.

2. Notify NRC in writing of any change in mailing address.

3. By 10 CFR 30.36(d) and/or license condition, notify NRC, promptly, in writing, and request termination of the license:

   a. When you decide to terminate all activities involving materials authorized under the license whether at the entire site or any separate building or outdoor area;

   b. If you decide not to acquire or possess and use authorized material; or

   c. When no principal activities under the license have been conducted for a period of 24 months.

4. Request and obtain a license amendment before you:

   a. Change Radiation Safety Officers;

   b. Order byproduct material in excess of the amount, radionuclide or form authorized on the license;

   c. Add or change the areas or address(es) of use identified in the license application or on the license; or

   d. Change the name or ownership of your organization.

5. Submit a complete renewal application or termination request at least 30 days before the expiration date on your license. You will receive a reminder notice approximately 90 days before the expiration date. Possession of radioactive material after your license expires is a violation of NRC regulations.

NRC will periodically inspect your radiation safety program. Failure to conduct your program according to NRC regulations, license conditions, and representations made in your license application and supplemental correspondence with NRC may result in enforcement action against you. This could include issuance of a notice of violation; imposition of a civil penalty; or an order suspending, modifying, or revoking your license as specified in the NRC Enforcement Policy. The NRC Enforcement Policy is available on the following internet address: http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Thank you for your cooperation.

Sincerely,

Roberto J. Torres, Senior Health Physicist
Nuclear Materials Safety Branch B

Docket: 030-30429
License: 42-26928-01
Control: 578115

Enclosure: As stated

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U.S. NUCLEAR REGULATORY COMMISSION Amendment No. 44

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	In accordance with letter dated July 30, 2012
1. Core Laboratories, Inc. dba ProTechnics Division of Core Laboratories 2. 6316 Windfern Road Houston, Texas 77040	3. License number 42-26928-01 is amended in its entirety to read as follows: 4. Expiration date February 28, 2016 5. Docket No. 030-30429 Reference No.

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Hydrogen-3	A. Any	A. Not to exceed 999 millicuries total and 100 millicuries per injection
B. Scandium-46	B. Any	B. Not to exceed 8,000 millicuries total and 40 millicuries per injection
C. Bromine-82	C. Any	C. Not to exceed 3,000 millicuries total and 400 millicuries per injection
D. Zirconium-95	D. Any	D. Not to exceed 750 millicuries total and 40 millicuries per injection
E. Antimony-124	E. Any	E. Not to exceed 8,000 millicuries total and 40 millicuries per injection
F. Iodine-131	F. Any	F. Not to exceed 200 millicuries total and 50 millicuries per injection
G. Iridium-192	G. Any	G. Not to exceed 12,000 millicuries total and 40 millicuries per injection
H. Gold-198	H. Any	H. Not to exceed 1,000 millicuries total and 200 millicuries per injection
I. Bromine-82	I. Any	I. Not to exceed 3,000 millicuries total and 400 millicuries per injection
J. Barium-133	J. Sealed Source (Isotope Products Labs. Model HEG-133 Series, Capsule A-3015)	J. No single source to exceed 2 millicuries; total possession 40 millicuries

UNITED STATES NUCLEAR REGULATORY COMMISSION

NRC FORM 374A U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
42-26928-01

Docket or Reference Number
030-30429

Amendment No. 44

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
K. Cesium-137	K. Sealed Source (Isotope Products Model HEG-137 Series, Capsule A-3015)	K. No single source to exceed 500 millicuries; total possession 10 curies
L. Americium-241	L. Sealed Source (Gammatron AN-H, Gulf Nuclear VL-1)	L. No single source to exceed 500 microcuries; 10 millicuries total
M. Americium-241	M. Sealed Source (IPL HEG-241 Series, Capsule A-3015)	M. No single source to exceed 500 microcuries; 10 millicuries total
N. Scandium-46	N. Solid	N. No single marker to exceed 50 microcuries
O. Cobalt-60	O. Solid	O. No single marker to exceed 50 microcuries
P. Antimony-124	P. Solid	P. No single marker to exceed 50 microcuries
Q. Cesium-137	Q. Solid	Q. No single marker to exceed 100 microcuries
R. Iridium-192	R. Solid	R. No single marker to exceed 50 microcuries

9. Authorized use:

A. through H. For use in tracer studies in oil, gas and geothermal wells.

I. For use in above ground tracer studies in process equipment and pipelines.

J. and K. For use in Cedar Bluff Group Fluid Identification logging tool.

L. and M. For use as a calibration/stabilization source in Halliburton Model TSCAN logging tool.

N. through R. For use in pipe collar markers in oil and gas wells.

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MATERIALS LICENSE **SUPPLEMENTARY SHEET**	License Number 42-26928-01
	Docket or Reference Number 030-30429
	Amendment No. 44

CONDITIONS

10. Licensed material shall be stored or used only at the following:

    A. i. Alaska Department of Natural Resources, Deadhorse Tract 57, Spine Road, Prudhoe Bay, Alaska
    ii. 1701 Old St. Mary's Pike, Parkersburg, West Virginia
    iii. 570 Jonah Drive, Rock Springs, Wyoming, and
    iv. 1030 Silurian Lane, Sidney, Montana

    B. Licensed material may be stored at Shell Offshore Inc. Gas Well: OSG-C 11553, Well No. 2, Field: Garden Banks Block 602, Offshore Louisiana, in accordance with letter December 16, 1999, pending final abandonment

    C. Licensed material identified in letter dated March 02, 2006, may be stored at Exxon Mobil Production Company's Gas Well: Tip Top T65-30G2, Section 30 Township 29N Range 113W, Sublette County Wyoming, API #49-035-23389, in accordance with letter dated March 02, 2006, pending final abandonment.

    D. Licensed material identified in letter dated May 08, 2006, may be stored at Anadarko Petroleum Company's Well: Green Canyon 518#1 St00BP2, Offshore Gulf of Mexico, OCS-G21801, API#60-811-40377-02, in accordance with letter dated May 08, 2006, pending final abandonment.

    E. Temporary job sites anywhere in the United States where the U.S. Regulatory Commission maintains jurisdiction for regulating the use of licensed material, including areas of exclusive Federal jurisdiction within Agreement States.

    If the jurisdiction status of a Federal facility within an Agreement State is unknown, the licensee should contact the federal agency controlling the job site in question to determine whether the proposed job site is an area of exclusive Federal jurisdiction. Authorization for use of radioactive materials at job sites in Agreement States no under exclusive Federal jurisdiction shall be obtained from the appropriate state regulatory agency.

11. A. Licensed materials shall be used by or under the supervision and in the physical presence of, or individuals who have been trained as specified in letters dated December 16, 2005 and February 21, 2006.

    B. The Radiation Safety Officer for this license is Will C. Williams.

12. The licensee shall not vacate or release to unrestricted use a field office or storage location whose address is identified in Condition 10, without prior U.S. Nuclear Regulatory Commission approval.

13. The licensee is authorized to transport licensed material only in accordance with the provisions of 10 CFR Part 71, "Packaging and Transport of Radioactive Material."

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MATERIALS LICENSE SUPPLEMENTARY SHEET	License Number 42-26928-01
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14. Pursuant to 10 CFR 39.91, the licensee is exempted from the requirements of 10 CFR 39.63(b) for use of remote handling tools. This exemption will remain in effect until formally withdrawn by the U.S. Nuclear Regulatory Commission.

15. Notwithstanding the periodic leak test required by 10 CFR 39.35, the requirement does not apply to sources, except sources containing plutonium, that are stored and not being used. The sources exempted from this periodic test shall be tested for leakage before use or transfer to another person. No sealed source shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

16. Notwithstanding the requirements of 10 CFR 39.47 and pursuant to 10 CFR 39.91, and in accordance with the statements, representations and procedures contained in letters dated July 14, 1997 **(ML003724357)**, **November 14, 1997 (ML003724675)**, **January 20, 1998 (ML003724684)**, February 4, 1998 **(ML003724694)**, and February 27, 2004 **(ML040580735)**, the licensee may use radioactive markers with activities of 50 microcuries or less of iridium-192, scandium-46, antimony-124, and cobalt-60, and 100 microcuries or less of cesium-137 as pipe collar markers in oil and gas wells.

17. The licensee is authorized to hold byproduct material with a physical half-life of less than or equal to 120 days for decay-in-storage before disposal without regard to its activity if the licensee:

    A. Monitors byproduct material at the surface before disposal and determines that its radioactivity cannot be distinguished from the background radiation level with an appropriate radiation detection survey meter set on its most sensitive scale and with no interposed shielding; and

    B. Removes or obliterates all radiation labels, except for radiation labels on materials that are within containers and that will be managed as biomedical waste after they have been released from the licensee; and

    C. Maintains records of the disposal of licensed materials for up to 3 years. The record must include the date of disposal, the survey instrument used, the background radiation level measured at the surface of each waste container, and the name of the individual who performed the disposal.

18. Notwithstanding the requirements of 10 CFR 20.2007, pursuant to 10 CFR 20.2002, and in accordance with the statements, representations, and procedures contained in correspondence dated May 4, 1993 (ML12243A227), April 20, 1994 (ML12243A209), January 17, 1996 (ML12243A188), February 13, 1996 (ML12243A188), and December 16, 2005 (ML060260462), the licensee may release well-logging sandouts and well returns, containing residual radioactive materials, into on-site shallow earthen pit provided that:

    A. The total radioactive concentration of all isotopes is 1,000 picocuries/gram or less, and the physical half-life of the radioactive material is 120 days or less.

    B. The residual radioactive tracer material (scandium-46, bromine-82, zirconium-95, antimony-124, iodine-131, iridium-192, or gold-198) being disposed of will be in the form of the patented "Zero-Wash" product in sandouts or well returns.

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C. The licensee is required to use well logging beads known as "Zero-Wash", which are insoluble where the radioactivity will not migrate or leach into groundwater, as described in letter dated July 11, 1991 (ML033040193).

D. The on-site shallow earthen pit disposal method has been permitted by the State, Territory, or Federal jurisdiction regardless of whether the job site is in an area where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating licensed material, including areas of exclusive Federal jurisdiction within Agreement States.

E. The licensee is required to maintain access control over the on-site shallow earthen pit until the radioactivity has decayed to unrestricted release levels.

F. The licensee maintains an agreement with the owner or operator to control access to the on-site shallow earthen pit until the radioactivity has decayed to unrestricted release levels.

G. The licensee is required to maintain records of disposal in accordance with 10 CFR 20.2108.

19. Notwithstanding the requirements of 10 CFR 20.2007, pursuant to 10 CFR 20.2002, and in accordance with the statements, representations, and procedures contained in correspondence dated August 23, 2000 **(ML003758270)**, January 23, 2002 **(ML033070068)**, and October 30,2003 **(ML033070340)**, the licensee may release well-logging sandouts and well returns containing residual radioactive materials, into Class II Disposal Wells provided that:

A. The total radioactive concentration of all isotopes is 1,000 picocuries/gram or less, and the physical half-life of the radioactive material is 120 days or less.

B. The residual radioactive trace material (scandium-46, **bromine-82**, **zirconium-95**, antimony-124, **iodine-131**, iridium-192, or gold-198) being disposed of will be in the form of the patented "Zero-Wash" product in sandouts or well returns.

C. The licensee is required to use well logging beads known as "Zero-Wash", which are insoluble where the radioactivity will not migrate or leach into groundwater, as described in letter dated July 11, 1991 (ML033040193).

D. The well has been permitted by the State, Territory, or Federal jurisdiction to accept non-hazardous oil and gas waste regardless of whether the job site is in an area where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating licensed material, including areas of exclusive Federal jurisdiction within Agreement States.

E. The licensee is required to maintain access control over the Class II Disposal Well until the radioactivity has decayed to unrestricted release levels.

F. The licensee maintains an agreement with the owner or operator to control access to the Class II Disposal Well until the radioactivity has decayed to unrestricted release levels.

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G. The licensee is required to maintain records of disposal in accordance with 10 CFR 20.2108.

20. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A.	**Letter dated May 4, 1993**	**[ML12243A227, ML12243A209]**
B.	**Letter dated April 20, 1994 with procedures**	**[ML12243A209]**
C.	**Letter dated January 17, 1996**	**[ML12243A188, ML12235A437]**
D.	**Letter dated February 13, 1996**	**[ML12243A188, ML12235A437]**
E.	**Letter dated July 14, 1997**	**[ML003724357]**
F.	**Letter dated November 14, 1997**	**[ML003724675]**
G.	**Letter dated January 20, 1998**	**[ML003724684]**
H.	Letter dated February 4, 1998	[ML003724694]
I.	Letter dated December 16,1999	[ML003703009]
J.	Letter dated August 28, 2000	[ML003758270]
K.	Letter dated January 23, 2002	[ML033070068]
L.	Letter dated October 30, 2003	[ML033070340]
M.	Letter dated February 27, 2004	[ML040580735]
N.	Letter dated December 16, 2006 (renewal)	[ML060260462]
O.	Letter dated January 7, 2006 (renewal)	[ML060080505]
P.	Letter dated February 21, 2006	[ML060620583]
Q.	Letter dated March 7, 2006	[ML060620583]
R.	Letter dated January 27, 2006	[ML060410348]
S.	Letter dated May 8, 2006	[ML061290405]
T.	Letter dated February 27, 2008	[ML080740266]
U.	Letter dated June 7, 2011 with enclosures	[ML111720084]

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date August 30, 2012

By _____
Roberto J. Torres, Senior Health Physicist
Nuclear Materials Safety Branch B
Region IV
Arlington, Texas 76011-4511

Attachment 3

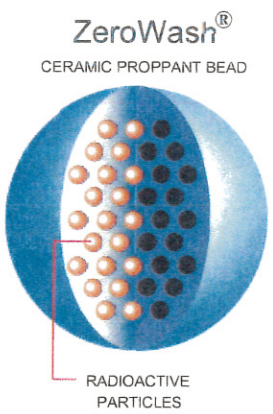
ZeroWash®
Isotope Tracer Technology

ZeroWash® tracers are manufactured using a patented process that prevents the isotope from being washed off the proppant-emulating carrier particle.This process fixes non-water-soluble metals in a ceramic matrix. After the resulting ceramic beads are kiln fired and sieved, they are activated by neutron bombardment in a nuclear reactor.

Because the resulting tracer particles are so effectively formed with no potential for wash off, ZeroWash® tracers provide unsurpassed environmental stewardship. They are HSE preferred and U.S. Nuclear Regulatory Commission (NRC) approved for burial.

ZeroWash® tracers, available in three primary isotopes, are produced in two forms:

- ZeroWash® ZW – an intermediate strength ceramic particle
- ZeroWash® ZWLD – a low-density ceramic particle



ISOTOPE TABLE

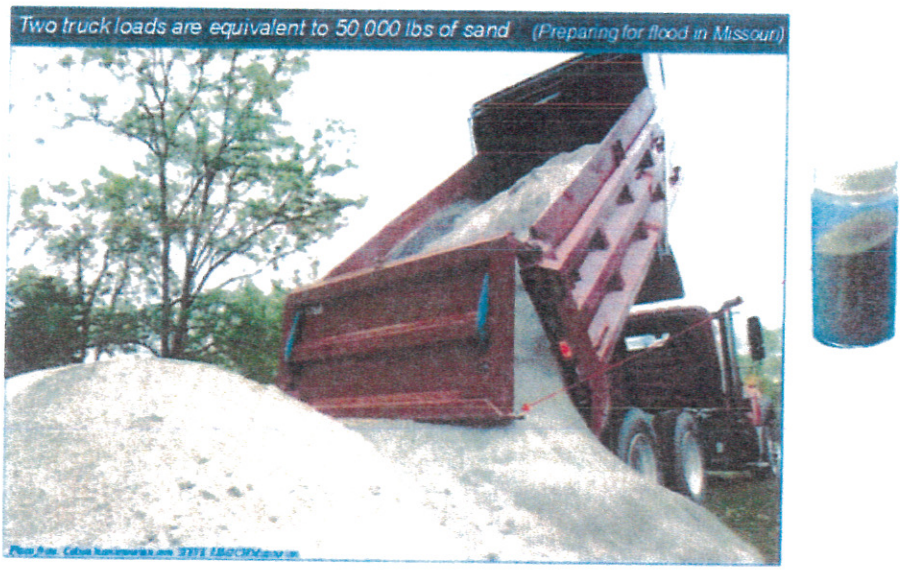
Isotope	Symbol	Form	Half Life Days	Energy Spectrum (million electron volts)
Iridium 192	Ir-192	ZW, ZWLD	74 days	0.315, 0.470, 0.605
Scandium 46	Sc-46	ZW, ZWLD	83.8 days	0.889, 1.121
Antimony 124	Sb-124	ZW, ZWLD	60.2 days	0.603, 0.722, 1.69

TRACER PROPERTIES AND USAGE

Tracer Form	Description	Mesh Size	Specific Gravity	Crush Strength (psi)	Color	Application
ZeroWash® (ZW)	Intermediate strength ceramic bead imbedded with oxide form of the isotpe	40/70 16 - 80 mesh available	2.65	>8,000	Various shades of gray	Designed to emulate particulate materials. Primarily used to trace pad fluids and acids at matrix rate
ZeroWash® (ZWLD)	Low density ceramic bead imbeded with oxide form of the isotope	40/70 30-100 mesh available	1.3 - 1.48	1,500 - 2,000	Dark green to brown	Designed to emulate fluid and low density materials. Used to trace pad fluids and acids at matrix rate

Attachment 4

Visual of Low Concentration



A 20-mCi vial of ZeroWash® traces 50,000 pounds of proppant

This low concentration is what allows us to operate without potential for exposure to the public.

Attachment 5

BAKER BOTTS LLP

FROM _____

ATTACHMENT 5

CONFIDENTIAL

CONFIDENTIAL

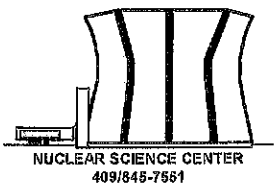
Attachment 6

TEXAS ENGINEERING EXPERIMENT STA

TEXAS A&M UNIVERSITY

COLLEGE STATION TEXAS 77843-3575

11 July 1991



ProTechnics International
14760 Memorial Drive, Suite 206
Houston, Texas 77079

We have completed the wash test on your patent pending radioactive carrier PTI-ZW under the testing criteria that you included in your guidelines and our input that we discussed. The test was performed and completed on June 19, 1991. Listed below are the test results.

Sincerely,

John L. Krohn
Assistant Director

RECEIVED 13 JUL 1991

JLK/ym

Radioactive Wash Test Results
(PTI-ZW)

	Temp	KCL Water	15% HCL
Washoff	80° F	12/1000 of 1%	17/1000 of 1 %
Washoff	180° F	40/1000 of 1%	41/1000 of 1 %

Note : These washoff amounts could be considered negligible in view of the probability of filter washby of production fines.