CONOCOPHILLIPS ALASKA

Health Safety and Environmental

Radioactive Tracer Use and Disposal

North Slope Alaska

Reviewed: 9/10/2025

Retention Code	Owner/Author	SOP No	Review Frequency
CG01	Environmental Coordinator	W-013	3 years

Purpose

This procedure outlines steps for safe handling and disposal of Radioactive Tracer (RA) beads that will be manifested down COPA's North Slope Class I and Class II Disposal Wells.

Scope

This procedure is specific to ProTechnics' (PTI) Zero Wash RA tracer beads and RA Tritium Tracer Tritiated Water.

In scope	Out of scope
• ProTechnics' (division of Core Lab) Zero Wash Tracer Beads and Tritium Tracer Tritiated Water	• Other Radioactive Tracer (RA) companies and RA Tracers that have not been reviewed for radioactivity levels or applicability of products

Authorized users

ProTechnics Vender Representatives, COPA Employees and Contractors involved with well flowback and frac returns from wells that a RA tracer or Tritiated Water will be used on.

FEC Contact Information

Contact the AK Wells FEC or Kuparuk Waste FEC with RA Tracer disposal questions:

- Class I Well Disposal; AK Wells FEC; n1662, x4930 or 907-231-9309
- Class II Well Disposal; Kuparuk FEC; n1438, x7212 or 907-659-0430, pager 669

Procedure:

Prerequisites

Before you start, confirm that:

- Review PTI's Radiation Safety Handout (SOP Exhibit A) during Pre-Job.
- ProTechnics Vendor Representatives or COPA Safety Representatives are on site and can perform the Radiation Surveys.
- Notify Class I or Class II Well Waste Injection Facilities (WIFs) that a low-level RA Tracer load will be coming to their facility and that a RA survey will be conducted and noted on the manifest to demonstrate the load is below any action levels.
- Approved North Slope Generators fill out the North Slope Manifests.

Pumping the Frac

Step	Action
1	Conduct a pre-Frac radiation survey to determine background radiation levels. Also conduct a radiation survey of the pump in point to the well head. **North Slope background radiation levels can vary from <0.005 to 0.1 milliroentgen per hour (mR/hr).** **NOTE:** Measured levels of radioactive energy **must be less than 2 milliroentgen per hour (mR/hr)**. This is the occupational exposure limit for non-radiation workers.
2	**Pump the Frac/Tracer.** A ProTechnics representative will handle pumping the RA Tracer.
3	**Following the pumping, survey the above ground piping from the pump-in point downstream to the wellhead to verify no RA tracer remains**

If:	Then:
Measured instrument levels of radiation energy are less than 2 mR/hr	Unrestricted access to area (levels are below limits for non-radiation workers)
Instrument levels are above 2 mR/hr	If the instrument readings are above or equal to 2 mR/hr, post the tank/area with caution signs and erect temporary personnel barrier. Notify the COPA Radiation Safety Officer (RSO).
Frac “sanded off” or was aborted While RA tracer is in the above ground piping	Divert fluid to a holding tank and conduct a radiation survey on well fluid contained in the tank. If below 2 mR/hr, no restrictions; if 2mR/hr follow procedure above.

Frac Tracer General Procedures

Post Frac CTU Cleanout.

Survey tank bottoms periodically during the cleanout and at job completion to determine the level of radioactivity. Measured levels of radioactivity must be less than 2mR/hr measured as close as practical to the surface of the pipe or tank bottoms.

If	Then
Levels are less than 2mR/hr.	**No restrictions**
Levels are greater than or equal to 2mR/hr.	**Contact COPA RSO, put up caution signs and temporary barrier**

Frac Tracer General Procedures

Frac Flowback

Survey tank bottoms periodically during the cleanout and at job completion to determine the level of radioactivity. Measured levels of radioactivity must be less than 2mR/hr measured as close as practical to the surface of the pipe or tank bottoms.

If	Then
Levels are less than 2mR/hr.	**No restrictions**
Levels are greater than or equal to 2mR/hr.	**Contact COPA RSO, put up caution signs and temporary barrier**

If the well is flowed back to portable or fixed test separation units, test separator vessel bottoms and piping must also be surveyed.

NOTE: The radioactivity associated with the Zero Wash beads is designed to stay in the beads and not contaminate equipment or liquids.

Frac Tracer General Procedure

Operations Facilities Sand Jetting

Based on historical data results, monitoring /survey data of sand jet solids will not normally be necessary following RA tracer procedures. The sheer volume of produced fluids and solids dilutes any RA tracer processed back to the facility, and the short half-life of the typical RA tracers negates the radioactive energy levels.

Tracer Coring General Procedure

Coring and Application of Tritium Tracer

Step	Action
1	a.) Prior to starting the job, all parties involved in the use of the tracer will read and understand the Core Lab Tracer Operation Manual. It can be obtained from the Core Labs representative or Drilling Engineer. b.) Once the core point has been reached the driller will trip out the drilling bottom hole assembly (BHA) and pick up the coring BHA. c.) Once the coring BHA reaches depth, the well is displaced with low invasion coring fluid. d.) At this time drilling personnel will double-check all hoses, fittings, and tanks to ensure they are secure and not leaking.
2	**Licensed Personnel with the vendor company will then add the Tritium tracer into the mud tanks and circulate for 3-4 surface to surface circulations.** **NOTE:** The target tracing concentration of the tritiated water is 500 picoCuries per milliliter (pCi/mL in a water-based drilling mud system, which is half of the regulated release limit of 1E-3 (uCi/ml) = 1,000 pCi/mL. The concentration in which the tracer is injected into the mud system, coupled with the volume of mud in the system, effectively dilutes any RA tracer concentrations. Using logs and simple stoichiometric calculations, tritium concentration in the mud is shown to be below the 1,000 pCi/mL threshold. **This results in an un-regulated concentration of tracer in the mud system**
3	Once coring is completed, core barrels are tripped out of the hole. Core is laid down, the drilling BHA is picked back up, and drilling resumes to total depth. The same mud system is used for the remainder of the hole.

Disposal

Flowback Materials- Muds, Cuttings, and Well Returns (Class II E&P Exempt)

Step	Action
1	a.) Ensure a survey is conducted on the returns. If materials are surveyed at levels less than 2mR/hr (Zero Wash Beads) or shown by calculation to result in an un-regulated concentration (Tritiated Water), the materials may be disposed of at the DS 1B Class II Disposal Well in Kuparuk or the Alpine CD1-33a Class I Disposal Well. b.) Note the radioactive surveyor calculation or measured survey level on the North Slope manifest.  **NOTE:** The 3 radioactive isotopes used in Zero Wash Beads have a short half-life of between 60 to 83 days, and the radioactivity associated with the beads is designed to stay in the beads and not contaminate equipment or liquids.
2	If radiation survey results are greater than or equal to 2mR/hr, contact the RSO prior to additional handling (Zero Wash Beads, put up barricades and post signs noting the hazard Materials greater than or equal to 2mR/hr will likely be consolidated in a single tank and held at the designated disposal location until radiation levels have fallen below the 2mR/hr levels.
3	After the trucks have been surveyed and demonstrated to be below the unrestricted radiation level of 2 mR/hr and offloaded at the Waste Injection Facility, the trucks should be sent to the Wash Bay. The rinsate may be manifested to Class I or Class II Disposal Wells as appropriate for E&P Exempt rinse loads.
4	Provided that empty containers and PPE have not contacted unmixed tritiated water the levels of empty containers and PPE will be below background radiation levels and may be placed in C&D dumpsters for landfill disposal.