geno-MIC

microbiologically influenced corrosion

STANDARD OPERATIONG PROCEDURES

for

Generic FPSO Liquids

for

Chemical and Genomics Analysis

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TABLE OF CONTENTS

Contents

Introduction

This document is intended to provide protocols for sampling crude oil and produced water from Terra Nova offshore operations for the geno-MIC Project. The manual covers all aspects of physical, chemical and biological sampling for offshore facilities to provide more detailed information. To avoid potential sampling error, sampling packages have been designed. This package includes sampling supplies, labels and forms.

Protocols are provided for the following kinds of samples for:

A. Genomic analysis – liquids and solids (samples of opportunity)
B. Chemical and live microbiological analysis of liquids (non-oil, such as produced water)
C. Chemical analysis of oil

Sampling packages

Sampling supplies are provided in form of packages for each sampling point. To avoid any potential confusion, these packages consist of bottles already containing labels, swabs, containers, plastic bags, and chain of custody forms. Bottles are labeled according to their destination laboratories (Genomic, Chemical, etc.).

General Contents:

In each sampling package, the following supplies can be found:

Sampling package for liquid samples (See Figure 1):

1- Pre-labeled 1-liter amber glass bottles with PTFE cap
2- Pre-labeled Bubble wrap sleeves
3- Latex or nitrile gloves
4- Seal tape
5- Rubber band

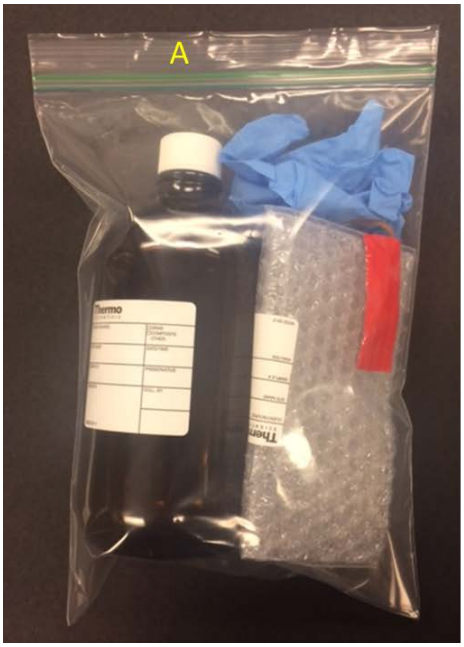
Figure 1- sampling Package for liquid samples

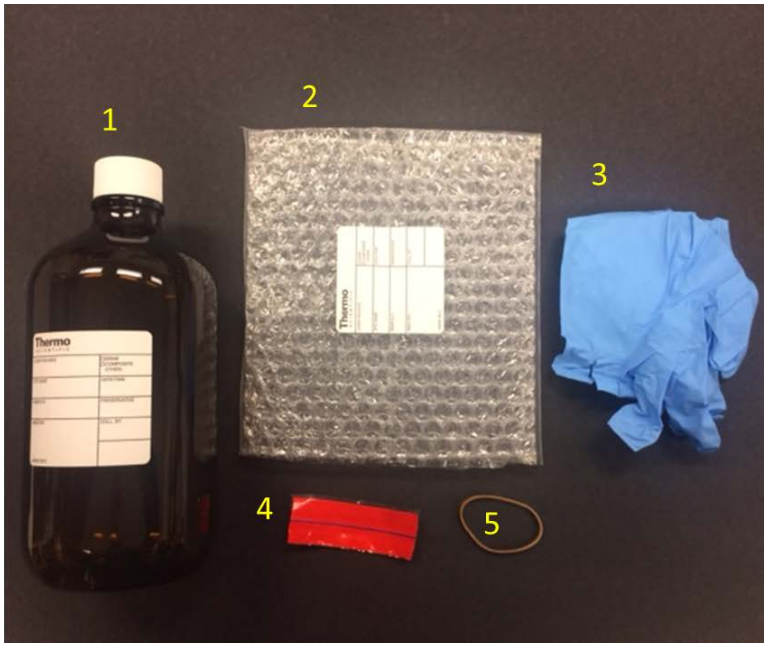
1- Sampling Liquids for Genomic Analysis:

Packages are labeled 'Genomic'

Supplies and Protocols below are for liquid samples:

1- Sterile 1-L amber glass bottle with PTFE cap and label
   - Bottles will be pre-loaded with a preservative (4 mL per 1-L bottle)
2- Bubble wrap sleeve containing chain of custody label
3- Latex or nitrile gloves
4- Sealing tape
5- Rubber band





Protocol for sampling liquids for Genomic Analysis:

1. For collecting each sample, put on **clean** latex/nitrile gloves. Use a new pair of gloves for each sampling point.

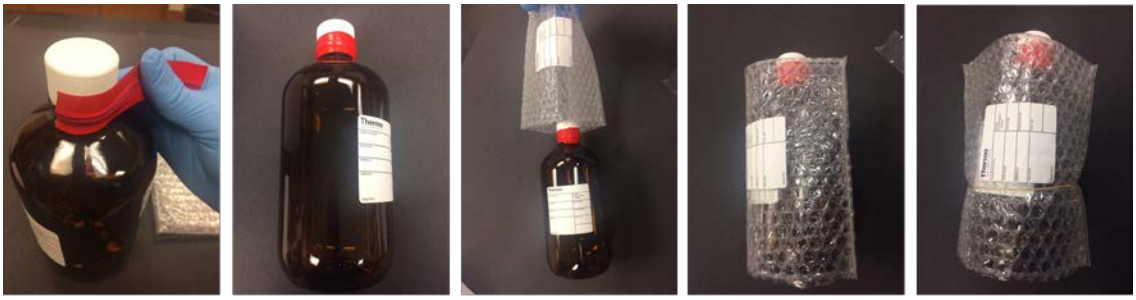
2. Fill out the sample label information on the bottle – the information should minimally include the sample name (ID), date, time, temperature, and other operating information (as available – such as pressure or H_2S concentrations).

3. Purge the water line with at a couple of volumes of liquid (approximately 2 litres, or for 1 min) and discard this liquid before collecting sample.

4. Unscrew the sample bottle, taking care not to touch the brim of the sample bottle or the inside of the lid; set lid down in an inverted manner. **DO NOT DISCARD THE SMALL AMOUNT OF LIQUID INSIDE – THIS IS THE PRESERVATIVE**.

5. Sample bottles will be pre-loaded with preservation reagent. Carefully fill water sample to brim and close lid (leave as little air at the top as possible), taking care not to touch the inside of the lid. Do not allow bottle to overflow to ensure sample contains the preservative. Invert a few times to mix.

6. Close the bottle cap tightly and seal the cap using the seal tape (provided). Cover the bottle with bubble wrap sleeve and put the rubber band around it.



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7. Label:
    a. On the bubble wrap package label, write the sample ID, date, sample volume in the chain of custody form.
    b. NOTE: Oil can cause tape to come off and Sharpie writing to blur, so be sure and write ID information in two separate locations, such as the side of the bottle and also the cap.
    c. Keep a more detailed record of sample information in a separate notebook and/or Excel spreadsheet.

8. Store all samples into the fridge to drop the temperature to about 4^oC- **keep cold but do not freeze** (this can ruin the sample for genomics analysis).

9. Prior to shipping, transfer samples into the cooler and use ice packs (provided) to keep samples cool during transportation.

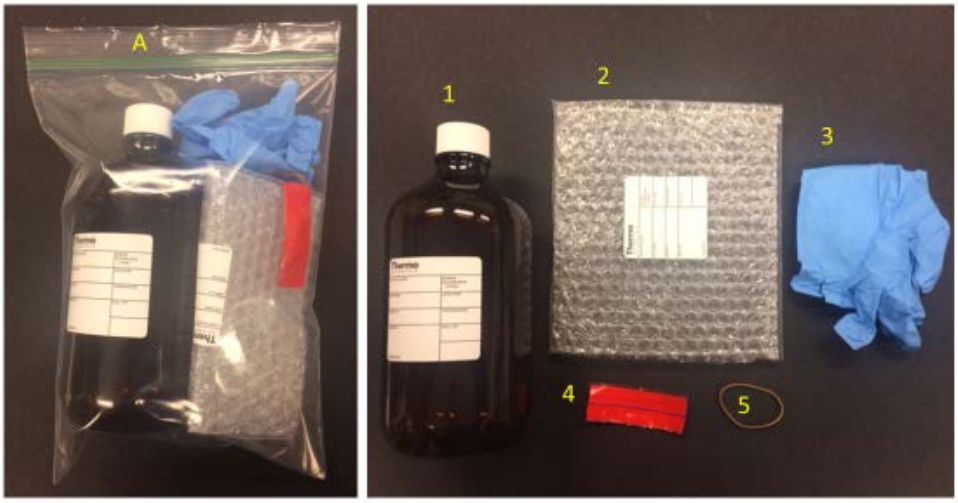
10. Ship back the cooler to lab.

2- Sampling Liquids (Produced Water) for Chemical Analysis

Packages are labeled 'Produced Water-Chemical'

Materials:

- Amber borosilicate glass bottles with PTFE-lined screw caps. Bottles are labeled Produced Water – Chemical. Labels to fill in details of samples is attached to the bottles.
- Bubble wrap sleeves
- Latex or nitrile gloves
- Seal tape
- Rubber band



Procedure for collecting liquids (produced water samples):

1. Put on clean, new latex/nitrile gloves.

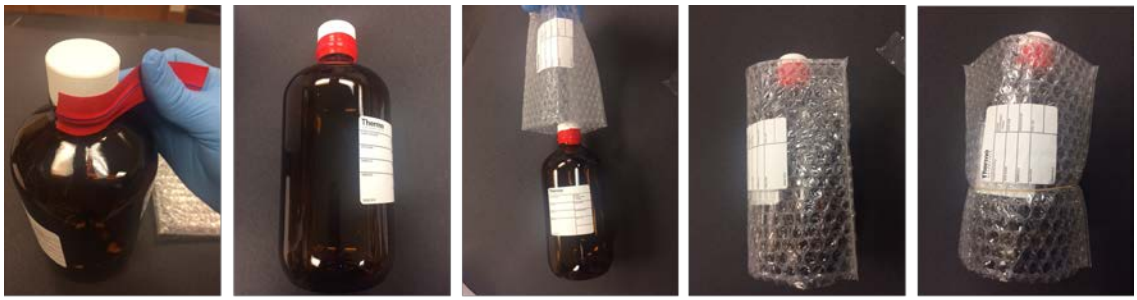
2. For each sampling point, fill 1-L glass bottles (**labeled Produced water – Chemical**) with no air gap and close lids tightly.

3. Invert each bottle six times to check for leaks.

4. Label bottle with sample ID, date, sample volume, sampling point, and temperature and pressure of flowline/unit sampled from (if applicable) in two different locations, such as the side of the bottle and also the cap.

5. Place each bottle into separate bubble wrap bag.

6. Pack inside opaque coolers (to prevent ingress of UV light) and cool with ice packs.



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7. Oil can cause tape to come off and Sharpie writing to blur, so be sure and write ID information on several locations (bottle, cap, bubble wrap bag).

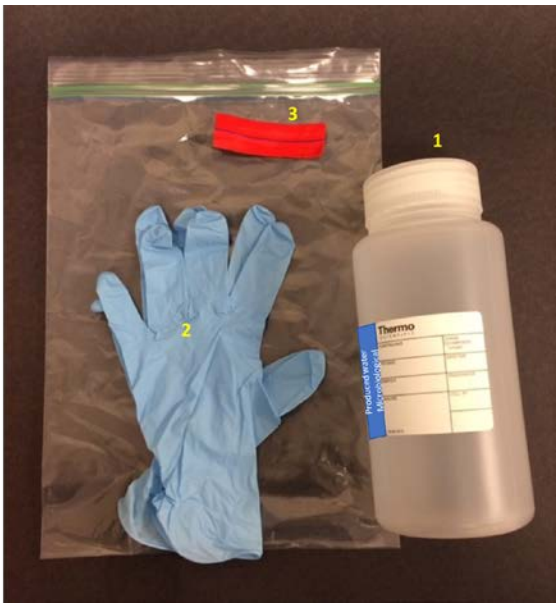
Note: If possible keep a more detailed record of sample information in a separate notebook, Excel spreadsheet and on Chain of custody forms.

3- Sampling Liquids (Produced Water) for Live Microbiological Analysis

Packages are labeled 'Produced–Water Live Microbiological'

Materials:

1 1-L Plastic bottles with wide mouth screw caps. Bottle will be labeled Produced Water – Microbiological. Labels to fill in details of samples will be attached to bottles.
2 Latex or nitrile gloves
3 Seal tape



Procedure for collecting liquids (produced water samples):

1. Put on clean, new latex/nitrile gloves.

2. For each sampling point, 1-L plastic bottle (**labeled Produced water –Microbiological**) with no air gap and close lids tightly.

3. Invert each bottle six times to check for leaks.

4. Label bottle with sample ID, date, sample volume, sampling point, and temperature and pressure of flowline/unit sampled from (if applicable) in two different locations, such as the side of the bottle and also the cap.

5. Pack inside opaque coolers (to prevent ingress of UV light) and cool with ice packs. **keep cold but do not freeze**

6. Oil can cause tape to come off and Sharpie writing to blur, so be sure and write ID information on several locations (bottle, cap, bubble wrap bag).

Note: If possible keep a more detailed record of sample information in a separate notebook, Excel spreadsheet and on Chain of custody forms.

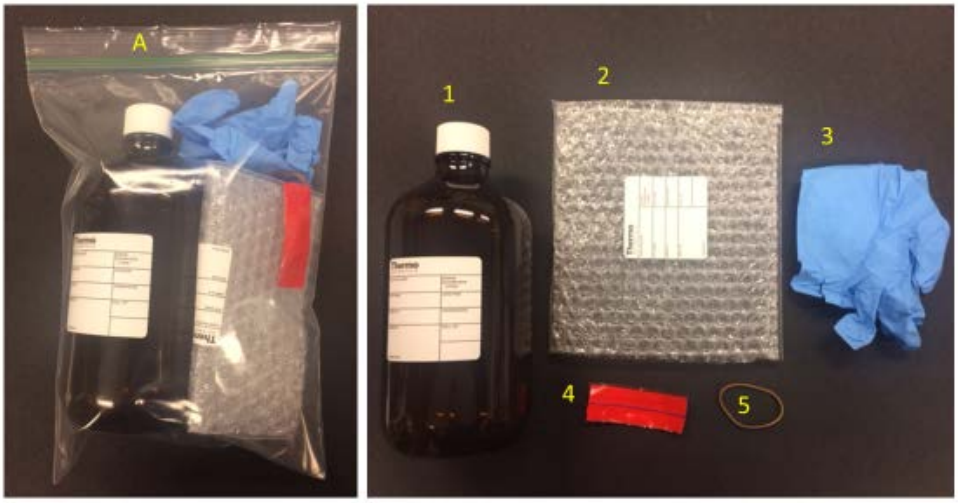
4- Sampling Crude Oil – Chemical Analysis Only

Packages will be labeled 'Chemical Analysis – Crude Oil'

- A reference oil should be collected when other oil samples are collected (see end of document)

Materials:

- One 1-L Amber borosilicate glass bottles with PTFE-lined screw caps. Bottle will be labeled Chemical Analysis – Crude Oil. Labels to fill in details of samples will be attached to bottles.
- Bubble wrap sleeves
- Latex or nitrile gloves
- Seal tape
- Rubber band



Procedure for collecting crude oil from each sampling point:

1. Put on clean, new latex/nitrile gloves.

2. Fill **<u>one</u>** 1-L glass bottles (**labeled 'Crude Oil–Chemical Analysis'**) with no air gap and close lids tightly.

3. Invert each bottle six times to check for leaks.

4. Label bottle with sample ID, date, sample volume, sampling point, and temperature and pressure of flowline/unit sampled from (if applicable) in two different locations, such as the side of the bottle and also the cap.

5. Place bottle into a bubble wrap bag.

6. Pack inside opaque coolers (to prevent ingress of UV light) and cool with ice packs to 4^{o}C / 5^{o}C temperature and transport to the lab within 24 hours.

Notes: Oil can cause tape to come off and Sharpie writing to blur, so be sure and write ID information on several locations (label on the bottle and bubble wrap bag).

- If possible keep a more detailed record of sample information in a separate notebook, Excel spreadsheet and on Chain of custody forms.

5-Reference Sample Crude Oil

A 100-mL acidified crude oil sample referred to as "reference sample" is collected.

- One precleaned 100 mL Amber borosilicate glass bottle containing HCl with PTFE-lined screw cap. Bottle will be labeled Reference Sample – Crude Oil. Label to fill in details of sample will be attached to bottle.
- Bubble wrap sleeves
- Latex or nitrile gloves
- Seal tape
- Rubber band

Procedure for collecting Reference sample crude oil:

7. Put on clean, new latex/nitrile gloves.

8. Fill **one** 1- 100L glass bottles (**labeled 'Crude Oil–Reference Sample'**) with no air gap and close lids tightly.

9. Invert each bottle 20 times to mix with HCl and check for leaks.

10. Label bottle with sample ID, date, sample volume, sampling point, and temperature and pressure of flowline/unit sampled from (if applicable) in two different locations, such as the side of the bottle and also the cap.

11. Place bottle into a bubble wrap bag.

12. Pack inside opaque coolers (to prevent ingress of UV light) and cool with ice packs to 4°C / 5°C temperature and transport to the lab within 24 hours.

Notes: Oil can cause tape to come off and Sharpie writing to blur, so be sure and write ID information on several locations (label on the bottle and bubble wrap bag).

- If possible keep a more detailed record of sample information in a separate notebook, Excel spreadsheet and on Chain of custody forms.