

September 2010

RADIOLOGICAL TESTING AT NUCLEAR SITES

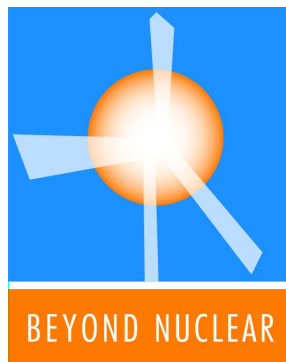
A Beyond Nuclear Guide



**How to collect samples
for radiological testing
of water.**

INSIDE

- What to test for
- Site selection
- Collecting samples
- Shipping
- Analysis



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ABOUT THE RADIOLOGICAL TESTING PROGRAM

The radiological testing program emerged in response to a need expressed by citizens in reactor communities to conduct independent and verifiable testing of potential radiological contamination in their environment. Beyond Nuclear greatly appreciates the grant from the Park Foundation that is making this project possible.



ABOUT BEYOND NUCLEAR

BEYOND NUCLEAR aims to educate and activate the public about the connections between nuclear power and nuclear weapons and the need to abandon both to safeguard our future. Beyond Nuclear advocates for an energy future that is sustainable, benign and democratic. The Beyond Nuclear team works with diverse partners and allies to provide the public, government officials, and the media with the critical information necessary to move humanity toward a world beyond nuclear.

BEYOND NUCLEAR

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Packaged samples are to be shipped to:

CRIIRAD

Commission de Recherche et d'Information Indépendantes
sur la Radioactivité
Immeuble CIME
471 Avenue Victor Hugo
26000 Valence - France

Please notify Beyond Nuclear that a shipment has been made to CRIIRAD so that Beyond Nuclear can provide CRIIRAD with the most recent licensee Annual Radioactive Effluent Release Report for the nuclear facility.

FEES AND PAYMENT

For water samples, CRIIRAD charges 186 Euros (about \$235) to analyze for tritium. (The detection limit is 3.5 Becquerel per liter which is about 100 picocuries per liter). To analyze a sample for both gross alpha and beta, the fee is 240 Euros (about \$303).

For fees on other types of measurements, please contact CRIIRAD laboratory manager, Dr. Bruno Chareyron at: bruno.chareyron@criirad.org

Please send a check or money order payable to **CRIIRAD**.

The cost of postage and shipping samples to France is also the responsibility of the requesting organization or individual.

LABORATORY TEST REPORT AND NEXT STEPS

CRIIRAD will perform the requested analyses and provide a laboratory report in English. The report will be sent by e-mail to the local organization, with a copy to Beyond Nuclear.

Thank you for your participation.

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ABOUT CRIIRAD

CRIIRAD – the Commission de Recherche et d'Information Indépendantes sur la Radioactivité (The Commission for Independent Research and Information on Radioactivity) – is an independent laboratory based in Valence, France. It is a non-governmental, non-profit organization that was formed following the 1986 Chernobyl reactor accident in Ukraine whose radiation cloud spread across much of Europe. CRIIRAD is funded by its members and through fees for its laboratory services. It works to inform people about the health risks induced by ionizing radiation and to improve their protection. To this end, CRIIRAD collects and analyzes samples of plants, air, soils, and water for radiological contamination.

CRIIRAD

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INTRODUCTION

Beyond Nuclear is working in collaboration with the CRIIRAD – *Commission de Recherche et d'Information Indépendantes sur la Radioactivité* (Commission for Independent Research and Information on Radioactivity) – and citizen groups in the United States to develop an independent radiological sampling and testing network around U.S. nuclear facilities.

In recent years, revelations have emerged at several nuclear reactor sites about extensive leaks of tritium — radioactive hydrogen — into groundwater. (See the Beyond Nuclear special report: *Leak First, Fix Later: Uncontrolled and Unmonitored Radioactive Releases from Nuclear Power Plants.*)



For example, at the Braidwood reactor in Illinois, the owner, Exelon, hid tritium leaks from the public for ten years before revealing, and then downplaying, the presence of tritium in groundwater on private and public property.

At Vermont Yankee, the owner, Entergy, initially denied the tritium leaks from buried pipes, later prompting the State Senate to vote against an operating license extension for the plant beyond March 2012.

Citizen intervention is needed to protect human and animal health and to inform residents near reactors of the health risks they face from radioactive releases and leaks.

PACKAGING SAMPLE BOTTLES FOR MAILING

Place the sample bottle in a zip-lock plastic bag. Squeeze the air out of the bag and securely seal the bag.

Place the bottle and the zip-lock bag inside of another zip-lock bag. Again squeeze the air out of that bag and securely seal it. Wrap the entire package with tape.

Place the zip-lock package in a sturdy shipping box along with packaging material, such as bubble wrap, to reduce any shock during shipping.

Make a copy of the *Chain-of-Custody Record*. Keep one and enclose the other in the shipping box (found enclosed with this handbook). Tape the box securely closed.

SHIPPING OF SAMPLE BOTTLES FOR LABORATORY TESTING

PLEASE NOTE: *The testing laboratory advises that a precautionary reading of the exterior of the sealed shipping box be taken using a radiation monitor (Geiger counter) before shipment.*

If the radiation monitor indicates a reading above background, Beyond Nuclear and the laboratory **MUST** be contacted before shipping to obtain additional instructions.

Packages that do not display a reading above background radiation can be sent as non-hazardous environmental samples of water for laboratory testing.

No carrier service will accept packages that are leaking.

Retain the receipt of the carrier service as part of the chain-of-custody record.

COLLECTING THE TEST AND REFERENCE SAMPLES

PLEASE NOTE: During Test sample preparation and collection, a ban on wrist watches with luminescent dials should be observed. These “beta lights” contain a small amount of tritium which can interfere with an accurate sample collection and laboratory analysis.



Remove the screw top cap from the bottle. Do not fill the bottle completely; leave a little room at the top.

When sampling tap water, it is recommended to let the water run for several minutes before filling the bottle.

When sampling water from a borehole or a well, it is also recommended to let the water run for several minutes.

When sampling rainwater, do not collect it from standing water on the ground. Use enough plastic dishes or rain collectors to collect a minimal

sample size of 100 ml of clean rainfall. Then pour the contents into a sample bottle.

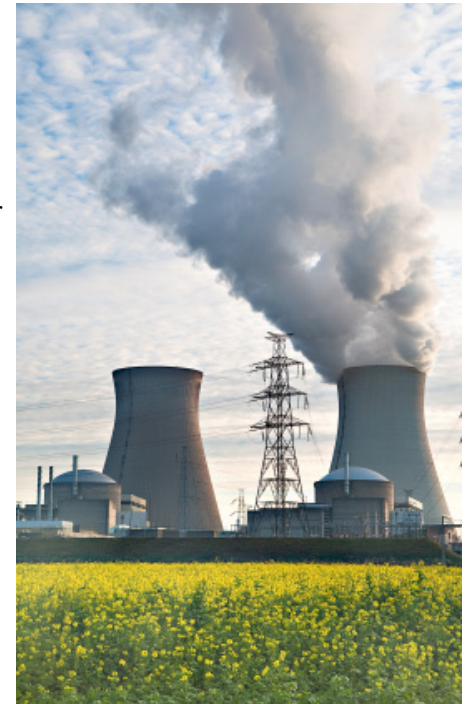
Screw the cap securely back onto the bottle to prevent leakage during transport and shipping.

Next, wipe the sample bottle dry with a paper towel.

Be sure that the appropriate information for each Test and Reference sample bottle is recorded onto the chain-of-custody form.

WHY TEST?

Nuclear power plants, both Pressurized Water Reactors (PWR) and Boiling Water Reactors (BWR), routinely emit radioactivity into the air and water through regular discharges of gaseous and liquid effluent. Routine reactor operations necessitate deliberate venting and purging of radioactive gases and particulates into the atmosphere, and the release of tritium and dissolved noble gases into the river, lake or ocean that serves as the cooling water source.



There is increasing concern among communities living downstream and downwind of nuclear facilities about the release of radioactivity to the air and water.

Nuclear power plant operators are required to file an annual report to the United States Nuclear Regulatory Commission (NRC) that calculates and quantifies these intentional and accidental radioactive releases.

The most recently available “Annual Report for Radioactive Effluent Discharge from Nuclear Power Plants” for the specific reactor that is being tested can be viewed on the NRC website at: <http://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-info.html>.

A copy of the most recent version of this annual radioactive effluent release report will be provided by Beyond Nuclear to the CRIIRAD laboratory.

WHAT TO TEST FOR

The CRIIRAD laboratory is equipped to test and measure for tritium (radioactive hydrogen) in water to determine if there are significant concentrations.



At work in the CRIIRAD laboratory.

CRIIRAD is also equipped with a gamma spectrometer that can test for a large number of other isotopes.

Gross alpha testing is performed on samples to measure alpha emitters such as americium, plutonium, uranium, radium and polonium.

Gross beta testing is performed on samples to measure beta emitters such as cobalt, strontium, iodine, cesium and technetium.

The label includes the label number, sample type, date, and the last name of the collection person. The labeling data need to correspond to the data on the chain-of-custody form. The Reference sample type must correspond to the requested Test sample type (tap water/TW, well water/WW, surface water/SW, groundwater/GW, rain water/RW).

1. The Test sample label number and the Test sample's corresponding Reference sample can be coded as follows:

Take the first four letters of the name of the nuclear facility followed by the sample number. So for example, Test sample number 1 from a location near the "South Texas" nuclear power plant would be written as **"SOUT-001"**.

The first Test sample for the Vermont Yankee nuclear power plant would be **"VERM-001"**.

The Reference or Control sample for the South Texas reactor site would be labeled **"SOUT-REF-001"** and for Vermont Yankee **"VERM-REF-001"**.

2. The labeling of Test and Reference samples must include the *type of sample* — that is, if it is well water [WW], tap water [TP], surface water [SW], rainwater [RW] or groundwater not used for drinking [GW].

So, for example, the first Test sample and corresponding Reference sample for *surface water* collected near the South Texas reactor site would be labeled as **"SOUT-001-SW"** and **"SOUT-REF-001-SW"**.

If more than one surface water Test Sample is gathered, only one corresponding Reference Sample for surface water is necessary. If a rainwater [RW] Test Sample is included, one corresponding rainwater Reference Sample [REF-RW] is needed.

The label on each sample bottle must have a complete and legible description.

- A grab sample from surface water [SW] gathered downstream from a river or lake near the nuclear facility's discharge pipe;
- Tap water [TW] from a community that receives its drinking water from a water treatment plant downstream from a nuclear facility's discharge pipe;
- Rainwater [RW] collected downwind of a nuclear facility;
- Groundwater [GW] from a bore hole not used for drinking water.

The location of the Test sample site should be recorded in the chain-of-custody record.

PREPARATION OF TEST SAMPLE BOTTLES

Beyond Nuclear will provide 100 ml and 250 ml sample bottles that can be used for collecting and shipping the water sample(s) to the CRIIRAD laboratory.

Please use the provided test sample bottles and follow instructions to ensure that the chain-of-custody can be authenticated.

LABELING OF SAMPLE BOTTLES

It is recommended that each sample be labeled *in the field* at the selection site to avoid labeling mistakes.

Use a blue or black permanent and waterproof marker (such as a Sharpie). Write directly on the plastic bottle.

Avoid using tape or paper labels which may come off.

If a sample test indicates a significant elevated reading of *gross alpha* or *gross beta*, the submission of an additional sample may be needed in order to analyze for a specific individual radioactive element.

For practical purposes, the Beyond Nuclear project is limiting the initial testing to tritium, *gross alpha* and *gross beta* radioactivity in water (surface water; groundwater; rainfall; and drinking water at the tap).

SELECTING THE SIZE OF A SAMPLE

For *tritium* testing, a collection of 100 milliliters (ml) for each Test sample Site is sufficient. An additional 100 ml Reference sample should be collected from a location that is far enough away to provide an example of the background radiation for the area.

If you are testing for *gross alpha* and *gross beta* you will need to collect a 250 ml sample bottle. Sample bottles, (pictured right) are available from Beyond Nuclear.

In either case, a minimum number of two samples are needed: one Reference sample and one Test sample from the suspected source of contamination.

A Reference sample needs to be of the same type as the Test sample (that is, river water, groundwater, rainwater, etc.) but from a different location and a more distant source (upstream, a different pond, etc.).



Example of typical sampling bottle as provided by Beyond Nuclear.

PREPARING A CHAIN-OF-CUSTODY RECORD

A *chain-of-custody record* establishes an essential, chronological paper trail for an environmental sample and its laboratory analysis.

The record includes: the person(s) responsible for collecting the Test and the Reference samples, and the date, time and location of the sample collection.

The Reference sample should be selected so that it provides a reading of background for a particular area

The record can be used later for a licensing proceeding or in court.

For further information, see the U.S. Environmental Protection Agency's *Chain-of-Custody* link: <http://www.epa.gov/apti/coc/>.

The *Chain-of-Custody Form for Environmental Sampling* is included with this booklet.

A copy of the form must be submitted with each sample.

SELECTING REFERENCE AND RADIOLOGICAL SAMPLE SITES

Prepare a detailed map of the sample collection sites.

You can use United States Geographic Service topographical maps to select and locate sample selection sites.

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You can find detailed topographical maps for purchase from the USGS Map Store at:

[http://store.usgs.gov/b2c_usgs/usgs/maplocator/\(xcm=r3standardpitrex_prd&layout=6_1_61_75&uiarea=2&type=areaDetails&care=000000009\)/.do](http://store.usgs.gov/b2c_usgs/usgs/maplocator/(xcm=r3standardpitrex_prd&layout=6_1_61_75&uiarea=2&type=areaDetails&care=000000009)/.do). You can also use the Global Positioning System to locate and record selected sites. Select a community resource person who is experienced in using GPS.

You can also prepare your own hand-drawn map to describe the location of the sampling site, accompanied by a photograph of an identifiable landmark.



The Reference sample should be taken far enough away or upstream from the nuclear power plant.

The selection of the Reference sample site is designed to provide the laboratory with a baseline sample of the background radiation level. The Reference sample should be selected so that it provides a reading of background for a particular area, but is far enough away or upstream from the nuclear power plant or another man-made radioactive source.

The selection of the Test sample site will vary. Some suggested Test sample sites include:

- Tap water from a private well water [WW] site located on the perimeter of nuclear facilities or near the radioactive effluent discharge pipe;
- Standing surface water [SW] such as from a ditch, pond, etc., that is adjacent to a nuclear facility;