



UNOLS

Radioisotope Contamination Awareness Program

Best Practices for avoiding contamination

Crew

Updated 27Feb13

Purpose

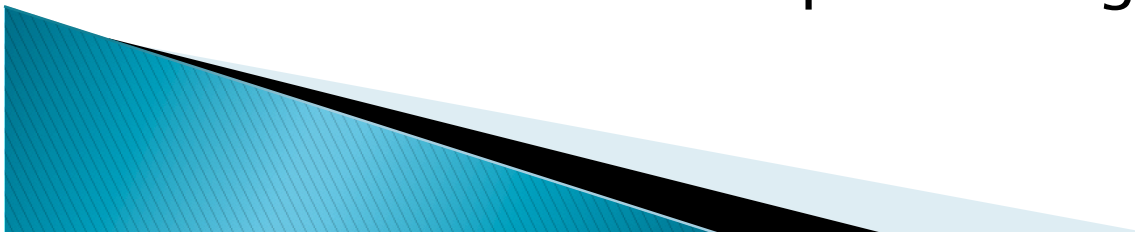


The purpose of this presentation is to inform non-radioisotope users of the problems radioisotope contamination could cause to both Health & Safety and other shipboard science.

Additionally, this will serve to increase awareness of ways to avoid contamination while working near enhanced radioisotopes.



This is NOT intended to be detailed radioisotope training.

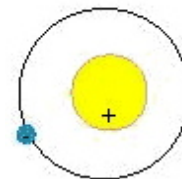


Shipboard science using Radioisotopes

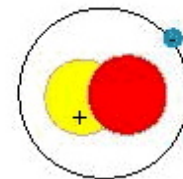
UNOLS vessels support Enhanced Radioisotope science as well as Natural Abundance science.

What's the difference?

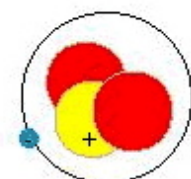
Enhanced Radioisotope science *adds* radioisotopes to the samples while Natural Abundance science measures *naturally* occurring radioisotopes.



Hydrogen (^1H)



Deuterium



Tritium (^3H)

Enhanced Isotope Science:

- ▶ Uses radioisotopes (e.g. ^{14}C , ^3H) as biological tracers
- ▶ Brings their radioisotopes onboard
- ▶ Mainly conducts their work within radvans.
- ▶ Permitted to use radioisotopes via institution and/or state regulations
- ▶ Uses much higher levels of radioisotopes than found naturally
- ▶ Uses levels of radioisotopes that could be threat to Health & Safety if not used/stored properly



Natural Abundance Science

- ▶ Measures levels of naturally occurring radioisotopes (e.g. ^{14}C , ^3H) within the environment for:
 - Natural ^{14}C is a powerful tracer of the carbon cycle used to date material (e.g. Carbon Dating)
 - Natural ^3H is used to date water (among other things!)
- ▶ Do NOT work in Radvans



Natural radioisotope levels in nature are **FAR** lower than those used in Enhanced Radioisotope experiments.



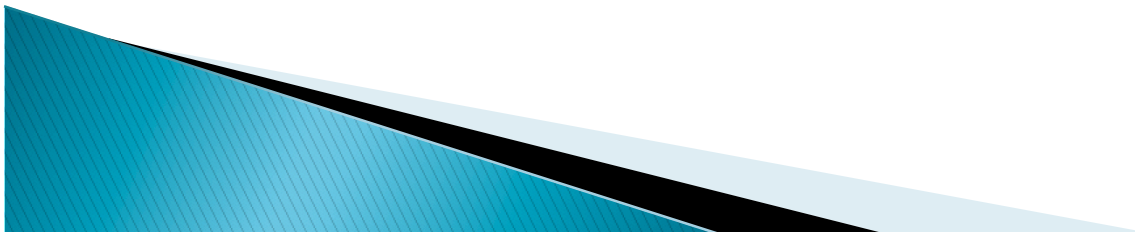
Natural Abundance Science

How low are levels of naturally occurring radioisotopes?

A regular solution of Enhanced Radioisotope solution (as used in a radvan) can make a modern sample appear to be 10,000 years YOUNGER than it really is (i.e. born in the year 12,000 AD)



It is very easy for Enhanced Isotope science to contaminate Natural Abundance science!



Natural Abundance Science

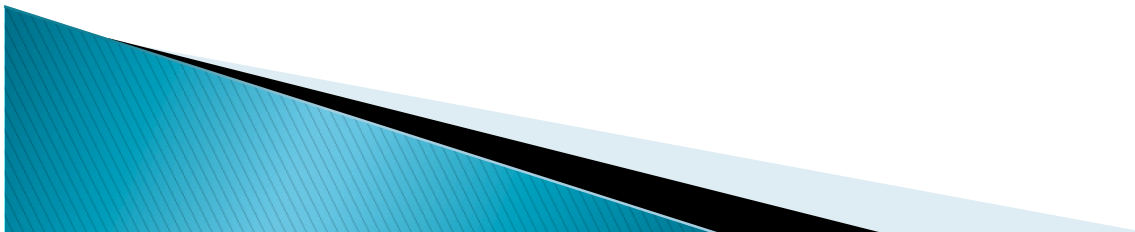
The radvans are not the only place that has radioisotopes! Many Exit signs and luminous dial divers' watches contain tritium (^3H).

- ▶ These devices can contain as much as several Ci of ^3H . This is equivalent to more than a million times the amount of ^3H contained in all the ^3H samples collected in the history of modern oceanography.
- ▶ A very small leak from one of these devices could lead to gross shipboard contamination of natural level samples for ^3H .



Contamination

- ▶ is a potential *health hazard* to yourself and others on the ship
- ▶ is unintentionally carrying radioisotopes outside the designated working area through:
 - spills
 - foot traffic and
 - hand transfer
- ▶ could *ruin* future scientific work on the ship



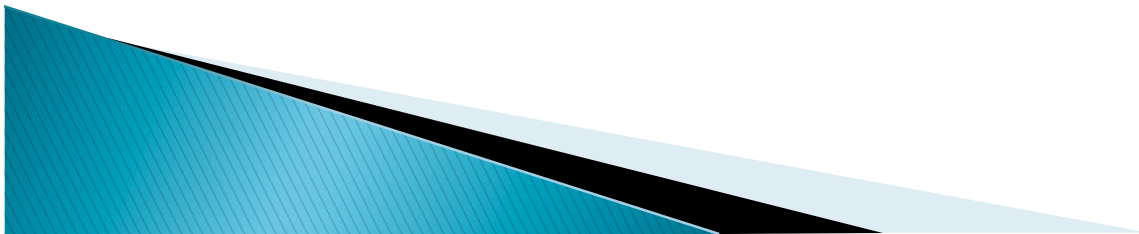
Contamination

There are two levels of radioisotope contamination:

1. That affecting Health & Safety
2. That affecting Natural Abundance work

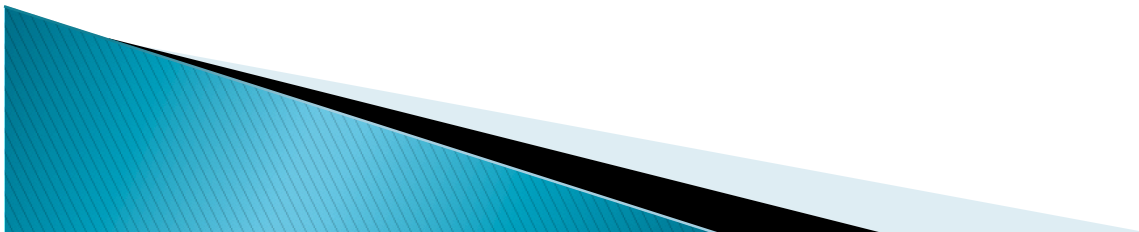
Enhanced Isotope scientists are required (through their permit) to keep the ship clean to Health & Safety standards BUT

This may not be clean enough for Natural Abundance work!



So contamination (even a minute amount) is bad on many levels.

How do we avoid it?

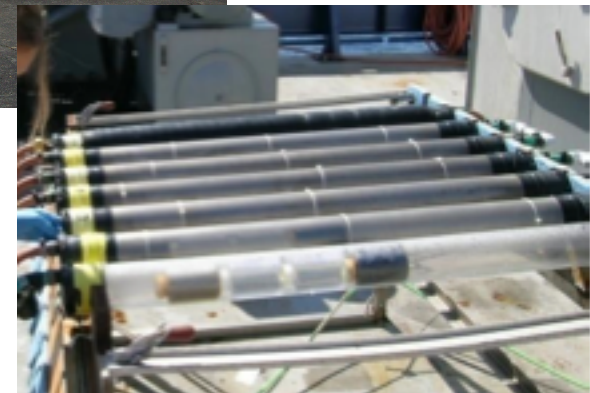


Avoiding Contamination

Radioisotope Working Areas

Radioisotope work should be conducted only in designated areas.

On UNOLS vessels this will be in the **radioisotope vans (radvans)** and, when necessary and approved, in **on-deck incubators**.



Courtesy of Scripps Institution of Oceanography

Avoiding Contamination

Radioisotope Working Areas

- ▶ Radvans are for Authorized Users only
- ▶ Non-authorized Users should **STAY OUT**, unless absolutely required
- ▶ Radvans are not for socializing
- ▶ Care should be taken in the placement of the radvan and where its fume hoods exhaust



Avoiding Contamination

Radioisotope Working Areas

- ▶ Radvans are not to be used for general (non-radioisotope) cargo
- ▶ Radvans should be locked if onboard during non-rad cruises
- ▶ ANYTHING that goes into a radvan is assumed contaminated until proper decontamination procedures are taken. This includes tools!



Monitoring for Contamination

Swipe Tests –

Enhanced Isotope scientist are required to conduct Swipe Tests to verify that their working areas remain clean. This is normally a part of their Radioisotope Use Authorization

- ▶ The number and type of swipes is outlined within the Radioisotope Use Authorization
- ▶ The Swipe test monitor to levels affecting Health & Safety
- ▶ They cannot detect levels that affect Natural Abundance work.

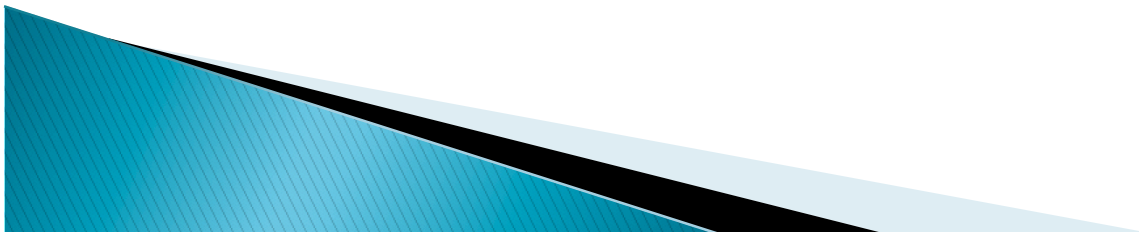
So how do we look for contamination that affect Natural Abundance work?



Monitoring for Contamination

SWAB tests

- ▶ A SWAB test is a more sensitive way to test for radioisotope contamination
- ▶ Operation SWAB is run by the University of Miami's Tritium Lab (UMTL)
- ▶ Ideally, someone from Operation SWAB would conduct a suite of SWAB tests after each cruise using Radioisotopes
- ▶ Results from SWAB tests are delivered to the institution a week or so after the tests are taken (not real-time)



Summary



- ▶ Radioisotope regulations only go as far as Health & Safety, we must go further to protect all science
- ▶ A LITTLE contamination goes a long way
- ▶ Be conscious of when radvans and radioisotopes are used onboard and practice good radioisotope hygiene
- ▶ Make sure the scientists are aware of their roles and responsibilities when it comes to:
 - Radioisotope Use and Monitoring
 - Keeping your ship clean



Some resources:

- ▶ Radioisotopes:

<http://web.princeton.edu/sites/ehs/osradtraining/coverpage.htm>

- ▶ Carbon Dating :

<http://science.howstuffworks.com/environmental/earth/geology/carbon-14.htm>

