



UNOLS

Radioisotope Contamination Awareness Program

Best Practices for avoiding contamination

Science

Updated 26Feb13

Purpose



UNOLS vessels support enhanced radioisotope science as well as natural abundance science that can easily be contaminated by enhanced radioisotopes.



While the NRC regulations ensure radioisotope levels are kept below levels that are a risk to health and safety, the UNOLS vessels must go beyond these levels to keep the ships clean for ALL science.



Contamination

- ▶ is a potential *health hazard* to yourself and others on the ship
- ▶ could *ruin* further scientific work (especially natural abundance isotope work) on the ship
- ▶ radioisotopes can unintentionally be carried outside the designated working area through:
 - spills
 - foot traffic and
 - hand transfer



Natural Abundance Science

Natural Abundance scientists study ^{14}C and ^3H that naturally occur in the environment.

Natural ^{14}C is a powerful tracer of the carbon cycle used to date material. It is present at very low levels, *1 part per trillion (ppt)*.

How small is 1ppt?

1 ppt would be like looking for 1 grain of dark brown sand in 5 truckloads of tan sand!



Stock solutions for primary productivity measurements represent the **equivalent of 5-10 truckloads of dark brown sand!**



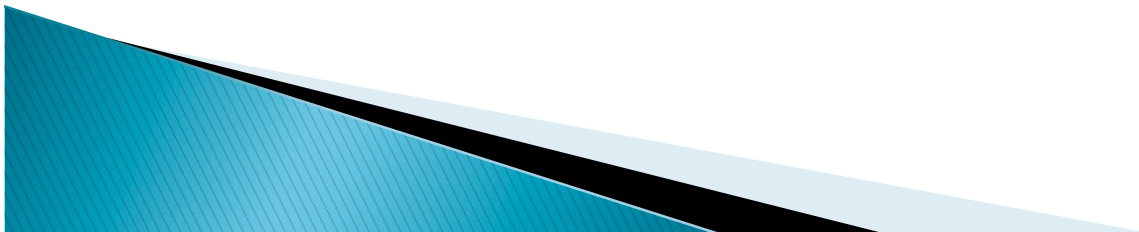
Natural Abundance Science

So what could a little enhanced radioisotope do to a Natural Abundance sample?

- ▶ 40 nanoliters of (40×10^{-6} ml) of stock enhanced isotope solution will make a modern sample appear to be 10,000 years YOUNGER! (i.e. born in the year 12,000 AD)

Bottom line:

A little contamination goes a LONG LONG way!



Natural Abundance Science



^{14}C and ^3H are not the only problem!

Deuterium and enrichment work with stable isotopes such as ^{13}C , ^{15}N and other common elements present a persistent problem for two reasons:

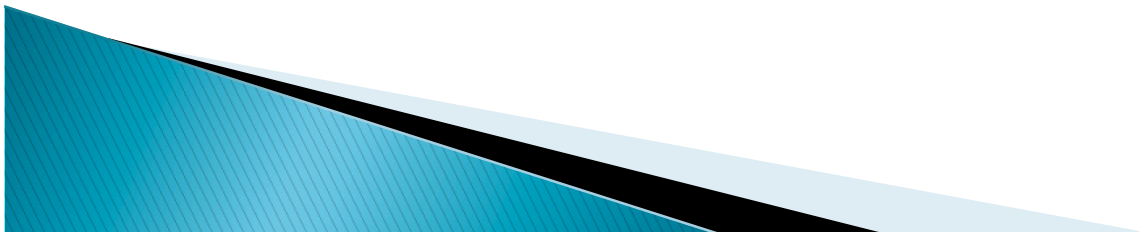
- 1) Researchers collect samples for the measurement of natural levels of stable isotopes
- 2) Many of the compounds enriched with stable isotopes are prepared in labs that also prepare compounds enriched in ^{14}C .

Thus, materials enriched in ^{13}C can present a scientific research hazard to natural level studies of both ^{13}C and ^{14}C .



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

How do we avoid it?

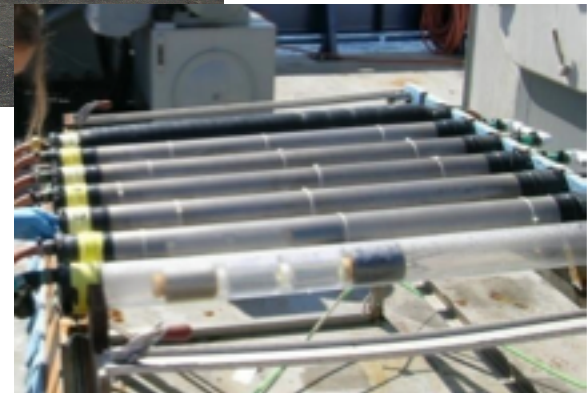


Avoiding Contamination

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!

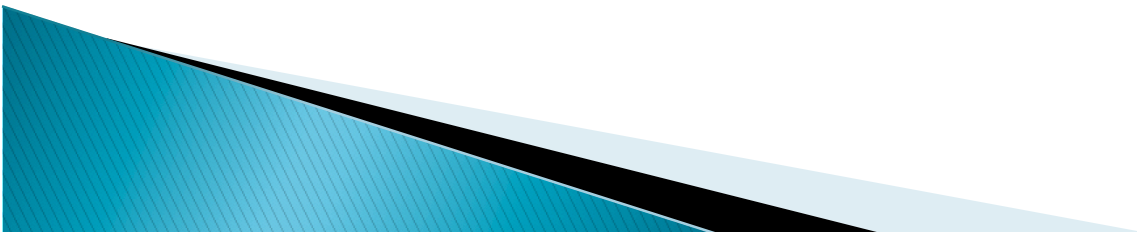


Avoiding Contamination

So much to do, so little time

- ▶ Don't be in a rush!
- ▶ Ship-time is precious but cutting corners with radioisotope use practices will only lead to more work in the long run.
- ▶ It takes longer to clean-up a spill than to prevent one in the first place.

Slow and steady wins the race.



Avoiding Contamination

The moving laboratory

The ship is in constant motion making
EVERYTHING more difficult.

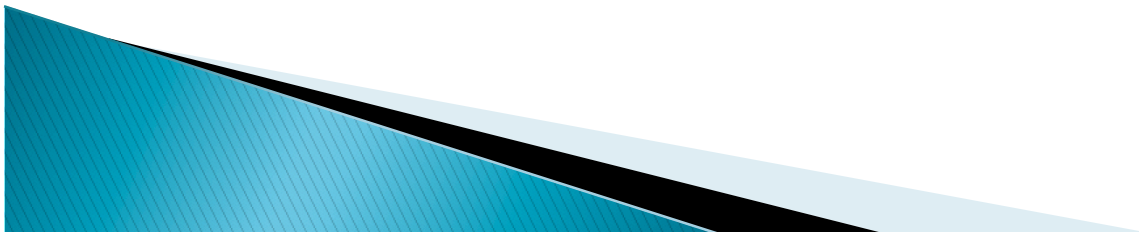
Handle the
isotopes
appropriately for
the conditions,
always expect the
weather to turn for
the worse!



Avoiding Contamination

Isotope Handling

- ▶ Keep stock isotope solutions in secondary containment.
- ▶ Isotopes transported outside the radvan to authorized locations should be kept in secondary containment at all times.
- ▶ Keep loads manageable—more small trips is safer than one large load



Avoiding Contamination

Practice Good Rad Hygeine

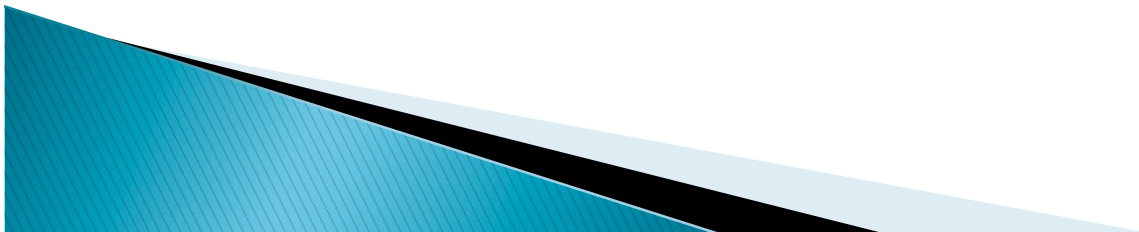
- ▶ Use Proper Personal Protective Equipment (PPE)
- ▶ Change gloves frequently
- ▶ Have dedicated Radvan shoes or use protective “booties” over shoes
- ▶ Change Benchkote frequently



Avoiding Contamination

Practice Good Rad Hygeine

- ▶ Store personal items (calculators, music players, etc) in a clean area
- ▶ Remove gloves before handling personal items
- ▶ Remove all PPE (gloves, labcoat, booties, etc), PRIOR to departing the radvan.



Avoiding Contamination

Posting/Labeling

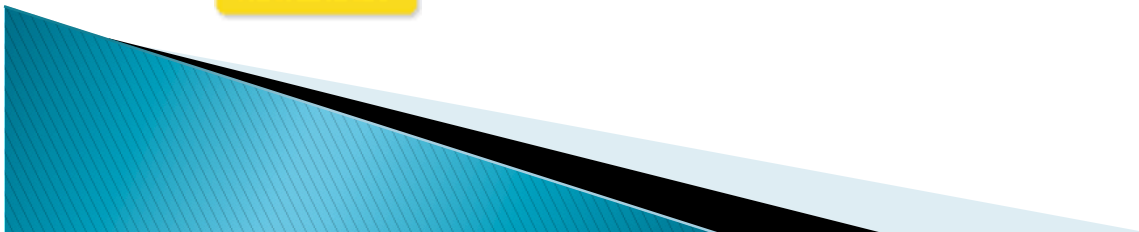
Anything that comes in contact with enhanced radioisotopes must be labeled.

This includes:

- ▶ Equipment used for experiments
- ▶ All refrigerators and freezers
- ▶ All containers, tubes, racks, pipettes



Labeling should not be removed until after the items are decontaminated.



Monitoring for Contamination

Monitoring – How?

The radioisotopes used on UNOLS ships can be monitored using:

- ▶ The Liquid Scintillation Counter (LSC):
 - ▶ Swipes
 - ▶ SWABS

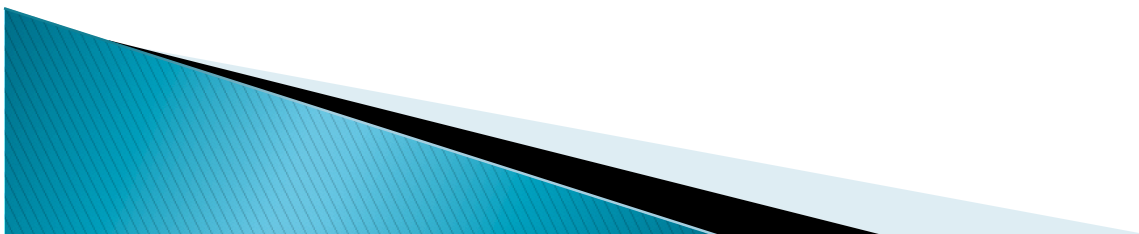


Monitoring for Contamination

Swipe Tests –

Swipe tests are normally required in the Radioisotope Use Authorization

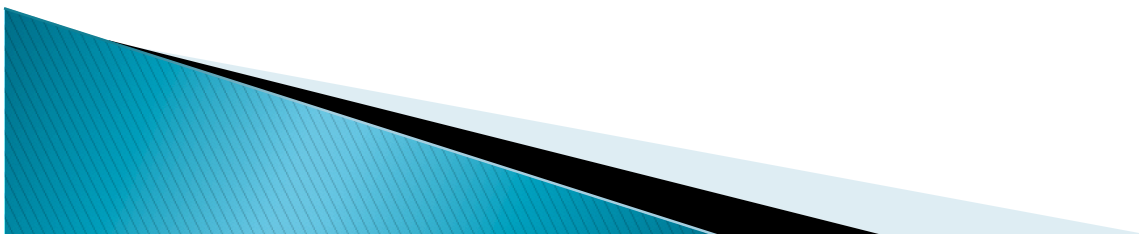
- ▶ The number and type of swipes will be outlined within the Radioisotope Use Authorization
- ▶ Copies of all Swipe reports (in the proper format) should be given to the Shipboard Person in Charge of Rads **AND** kept in the van.



Monitoring for Contamination

What is a SWAB?

- ▶ Operation SWAB was developed in 1981 by the University of Miami's Tritium Lab (UMTL) to help protect background ^{14}C and ^3H measurements from contamination.
- ▶ Samples are collected from a 1 m² area using a water/count-off (radiological soap) mixture.
- ▶ More information on the SWAB program can be found at the U of Miami SWAB website.

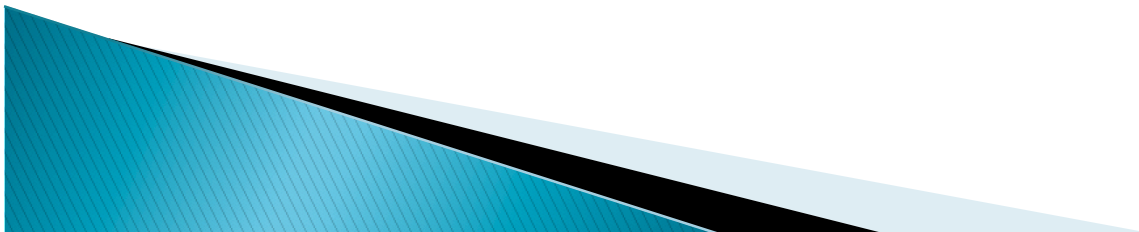


Monitoring for Contamination

SWABS – UMTL

It is recommended that a full SWAB surveys is conducted by UMTL personnel after each enhanced radioisotope cruise (not to exceed **X**/year)

A SWAB survey **MUST** be conducted at least 3 months prior to Natural Abundance work

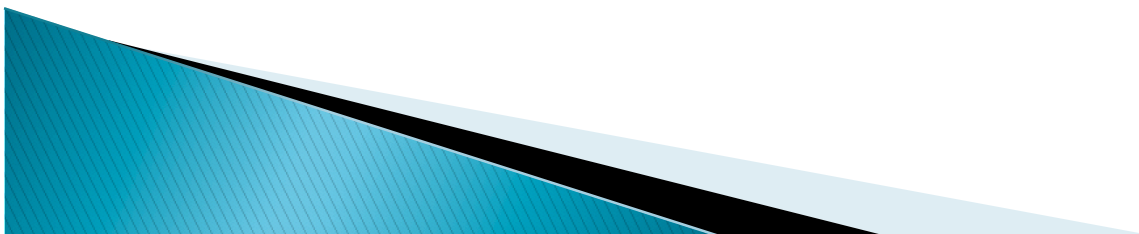


Monitoring for Contamination

SWABS – PI/Radioisotope User

It is recommended that the radioisotope user collects 2–3 SWABs within the radvan prior to departure to add reassurance that it is clean.

- ▶ Subsets of the sample can be run on the ship to get real-time results.
- ▶ It is suggested that the subsamples be counted at least 15min and that as much sample is used as possible (as recommended by the counter fluid).
- ▶ Courtesy Kits and instructions are available from the ship operator (via the SWAB program).



Avoiding Contamination

Spill Clean-up and Reporting



Everyone understands that accidents happen!

If a spill occurs,

Stop Moving – Call for help and a survey meter

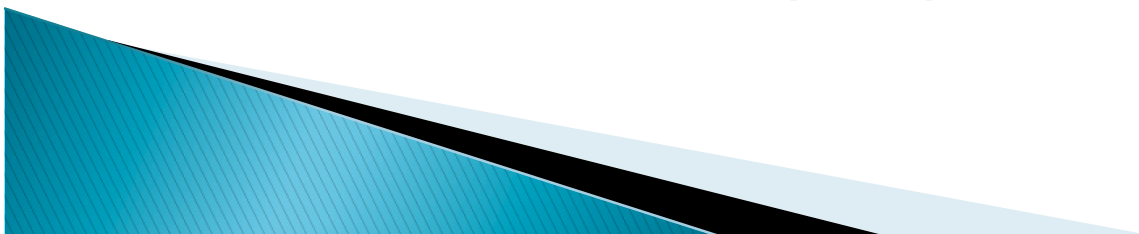
Warn others to stay out of the area

Isolate the area and spill

Minimize exposure & decontaminate



Report ALL spills to the Shipboard person in charge
of rads (this is very important for the next user!)



End of Cruise Close-out



- ▶ Radvans must be cleaned to the levels they were received
- ▶ Swipes and/or SWABS proving cleanliness must be submitted to the Shipboard Person in Charge of Radioisotopes
- ▶ Radvans must be clear of radioisotope solutions and waste

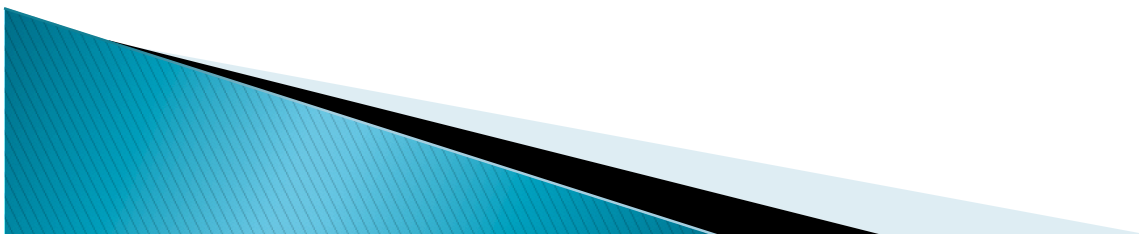
NOTE: The PI may be held **monetarily responsible** if subsequent clean-up of the radvan and ship are required.



Summary



- ▶ Vessels are multi-use
- ▶ Regulations only go as far as Health & Safety, we must go further to protect science
- ▶ A LITTLE contamination goes a long way
- ▶ Your mother is not there to clean up after you (and neither is your home institution EHS Dept!)
- ▶ It is up to each user to keep the ships clean for the next science party



Let's work together to keep
UNOLS RVs clean for everyone!

