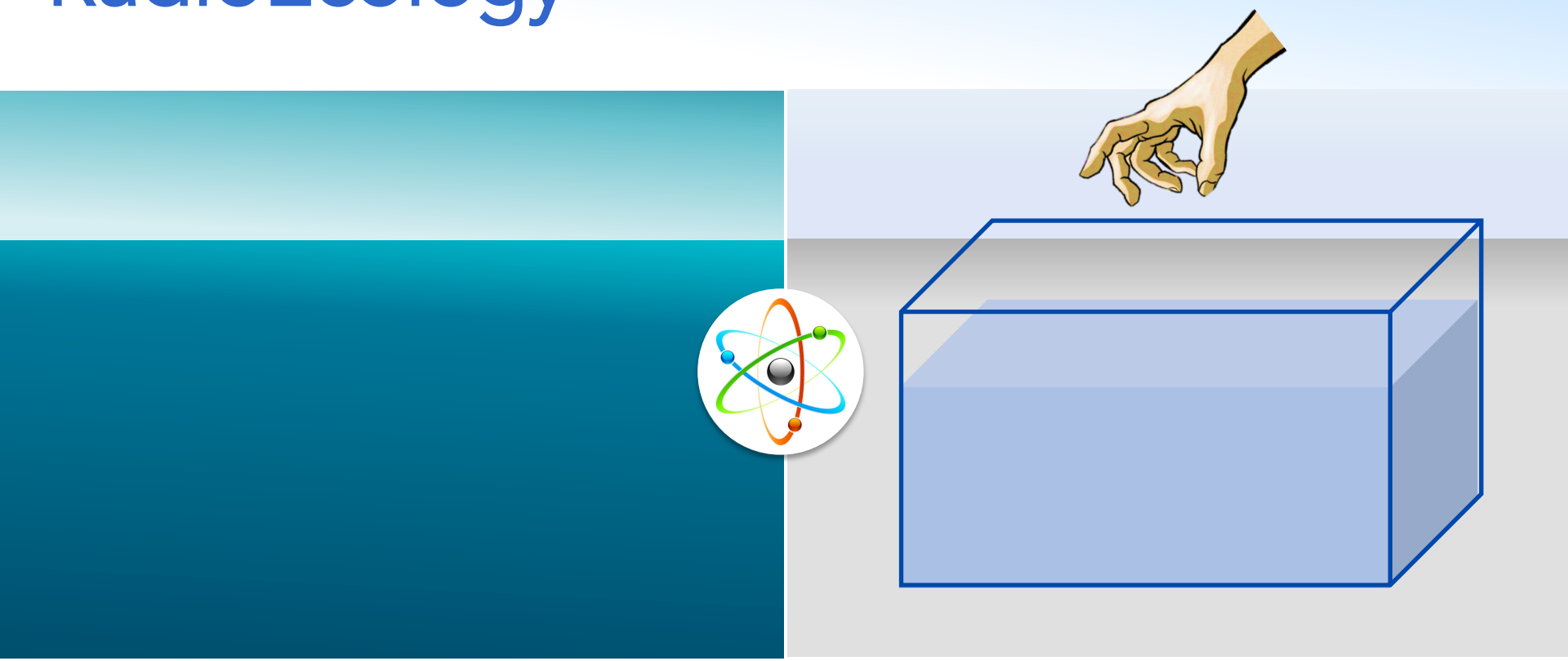
RadioEcology



Experiments using NA for understanding:

Contamination, Biology, Ecology, Risk

Mimicking or projecting environmental conditions

Calcification

Calcifying organisms

-

Physiological process

Basic quantification

or

Assessment of the fitness

Calcification

Calcifying organisms

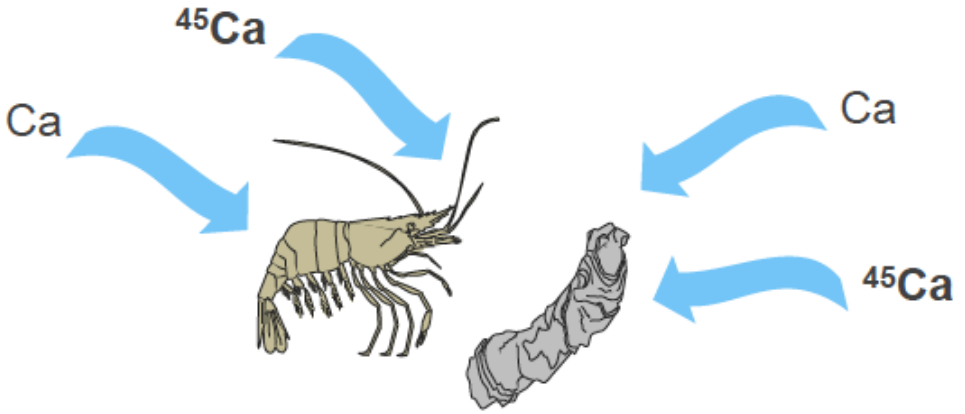
-

Physiological process

Basic quantification

or

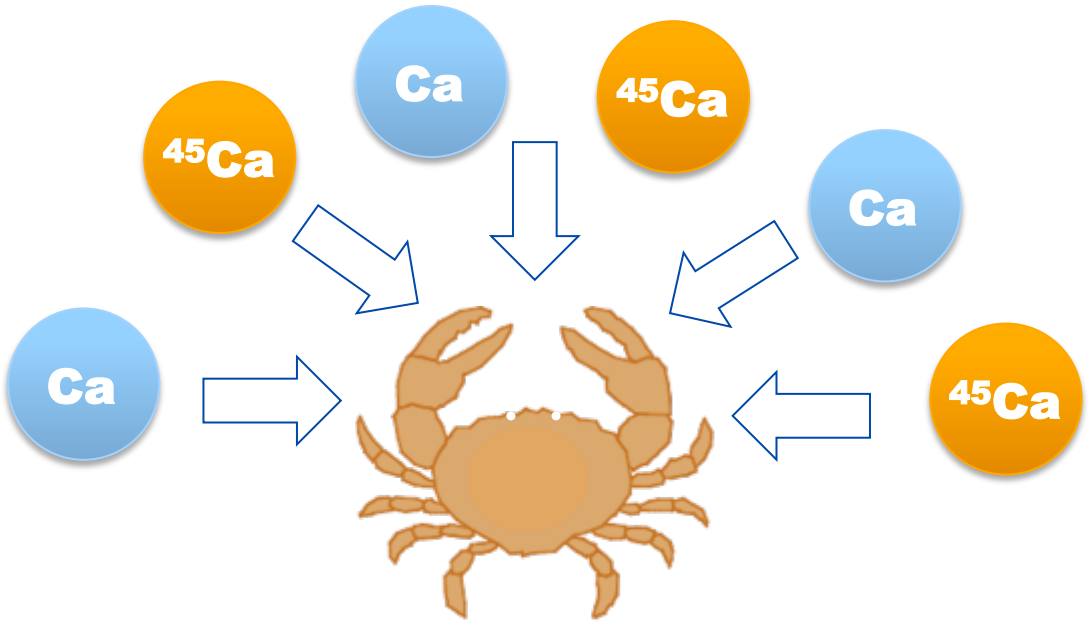
Assessment of the fitness



Impacts of ocean acidification on calcification

- **Production of commercial species**
  Shrimps, bivalves, sea urchins…
- **High-value ecosystem as coral reefs**
  High biodiversity, tourism….

Use of radiotracer (ß-emitter)

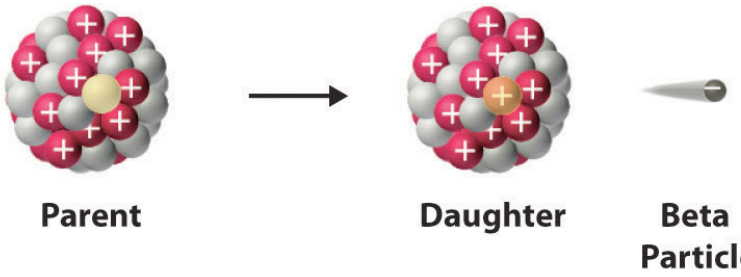


Accumulation of Calcium-45

What is beta-emitter ?

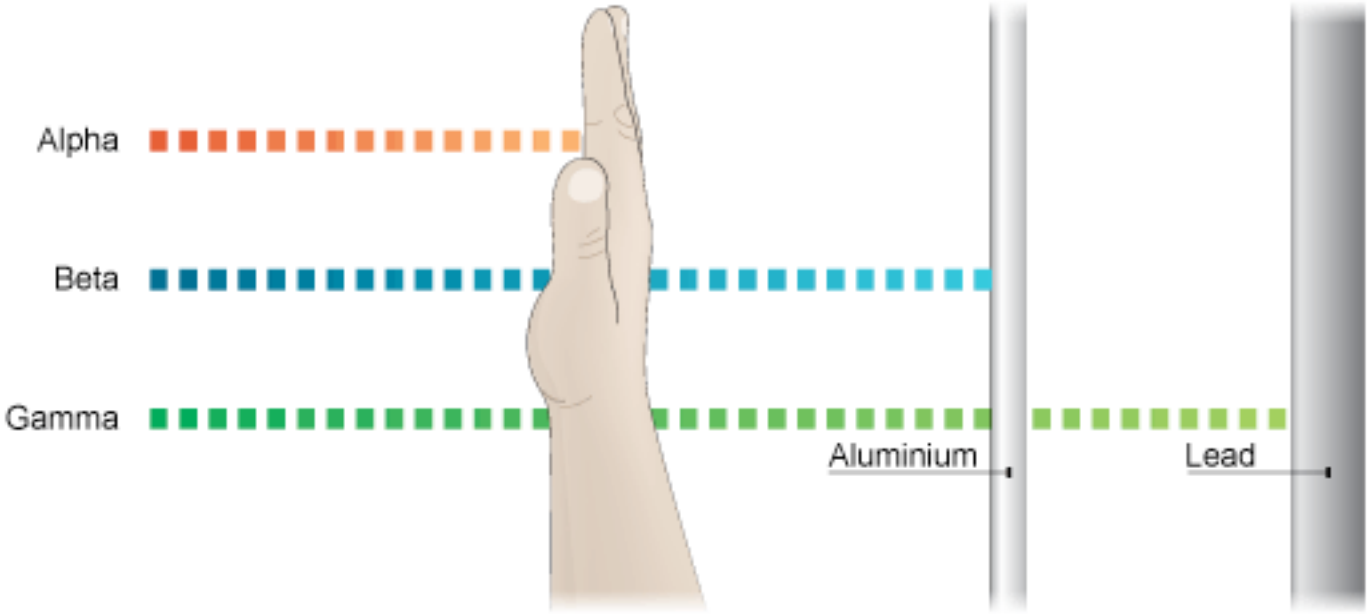
Decay Type	Radiation Emitted	Generic Equation	Model
Alpha decay	$^{4}_{2}\alpha$	$^{A}_{Z}X \longrightarrow {}^{A-4}_{Z-2}X' + {}^{4}_{2}\alpha$	Parent → Daughter + Alpha Particle
Beta decay	$^{0}_{-1}\beta$	$^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}X' + {}^{0}_{-1}\beta$	Parent → Daughter + Beta Particle
Positron emission	$^{0}_{+1}\beta$	$^{A}_{Z}X \longrightarrow {}^{A}_{Z-1}X' + {}^{0}_{+1}\beta$	Parent → Daughter + Positron
Electron capture	X rays	$^{A}_{Z}X + {}^{0}_{-1}e \longrightarrow {}^{A}_{Z-1}X' + X\ ray$	Parent + Electron → Daughter + X ray
Gamma emission	$^{0}_{0}\gamma$	$^{A}_{Z}X^{*} \xrightarrow{Relaxation} {}^{A}_{Z}X' + {}^{0}_{0}\gamma$	Parent (excited nuclear state) → Daughter + Gamma ray
Spontaneous fission	Neutrons	$^{A+B+C}_{Z+Y}X \longrightarrow {}^{A}_{Z}X' + {}^{B}_{Y}X' + C\,{}^{1}_{0}n$	Parent (unstable) → Daughters + ENERGY + Neutrons

$$^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}X' + {}^{0}_{-1}\beta$$



Characteristics

3 main emitters used in RadioEcology



Different radiation means different measurement

Liquid scintillation counters

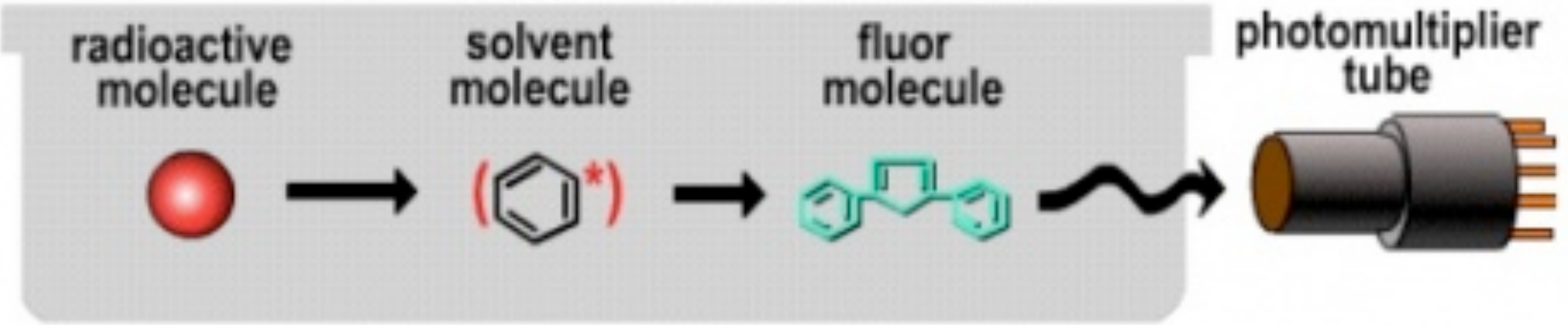
Liquid scintillation ?

Beta emitters – low penetrative power - low energy

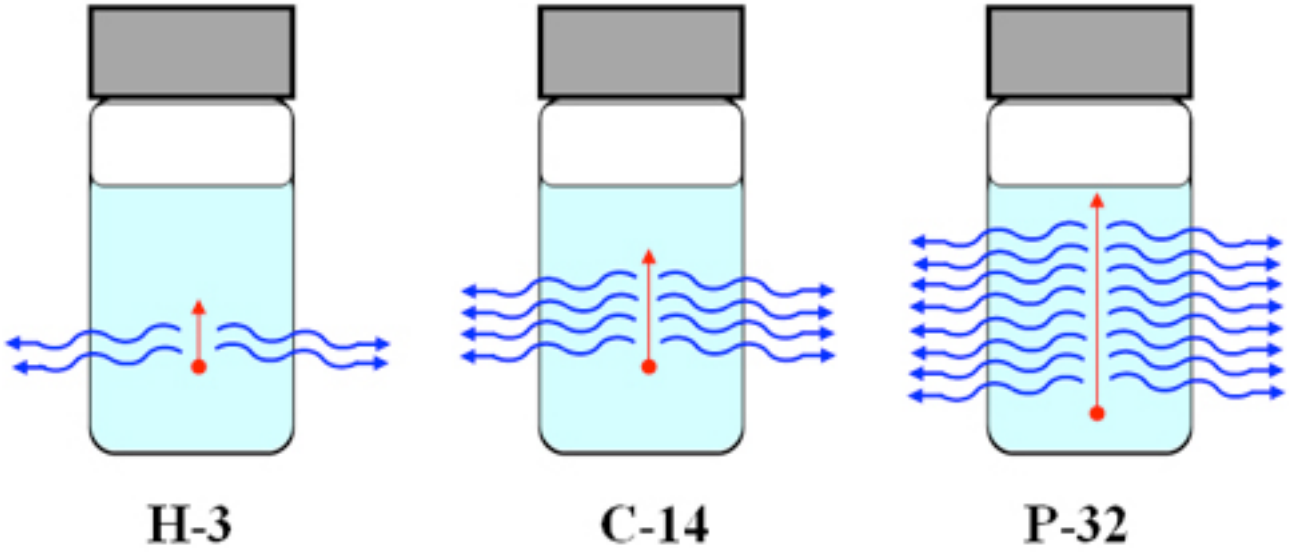
To detect radioactivity - need to be find another way

Transfer in cocktail (solvant + scintillant)

Radioactivity → Light/fluorence (photon) that you can quantify



Simplified explanation


H-3
C-14
P-32

IAEA 60 Years
Atoms for Peace and Development

Example of source commercially available

Details

Concentration	22.08 mCi/mL
Detection Method	Radiometric
Half Life	163 days
Label Position	Specifically Labeled
One Unit Contains	10 mCi
Product Brand Name	NEN Radiochemicals
Radioisotope	Ca-45
Radionuclide	^{45}Ca
Shipping Condition	Ambient
Special Ordering Information	This is a radioactive product - shipping address must have a license to receive radioactive materials.
Unit Size	10 mCi

Some advantages

- New incorporation of Calcium
  …You start at 0. no background
- From short term to long term experiment
  …minutes to weeks.
- Natural levels of the corresponding stable element can be used
- Easy methodology