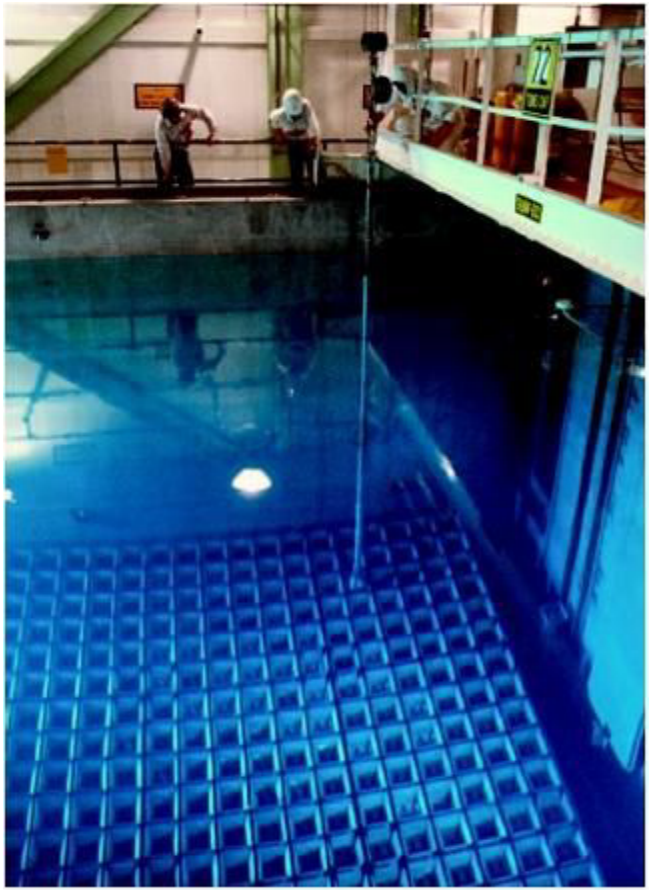
Water Is Life, Nuclear Waste Is Toxic

Environment North Annual Meeting,
Thunder Bay, Ontario

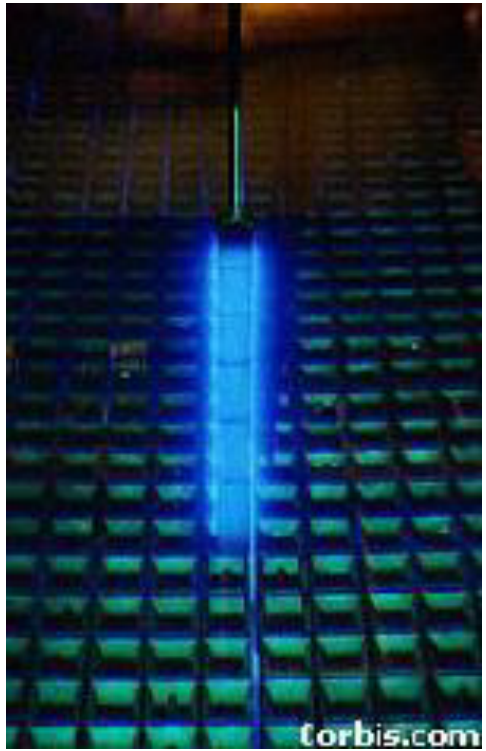
Kevin Kamps, Beyond Nuclear
April 23, 2025

Highly Radioactive Waste (Irradiated Nuclear Fuel)



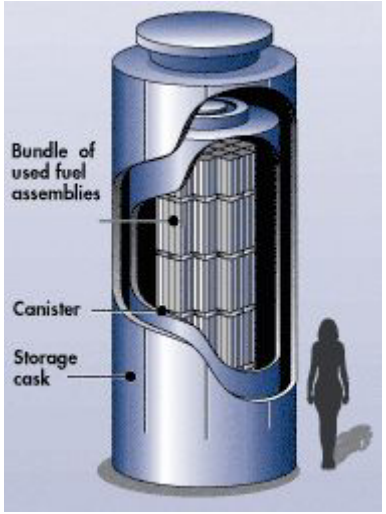
What is it? Where does it come from? (Palisades, Michigan)

Pellets, rods, assemblies



Where is it currently located? (Indoor wet storage pools)

Where is it currently located? (Outdoor dry casks)



How much is there?

U.S.A. – More than 90,000 metric tons, approaching 100,000 MT (10,000 MT on the Great Lakes shores alone)

Canada – More than 50,000 MT on the Great Lakes shores alone (Keith Matheny, “Radioactive Nuclear Waste Sits on Great Lakes shores,” *Detroit Free Press*, Oct. 19, 2018)

How much more will be generated?

In U.S., around 2,000 MT per year, from 94 still operating reactors as of Feb. 2025 (WNISR)

So-called “Small Modular Reactors,” depending on the specific design, will generate from ***2 to 30 times*** more irradiated nuclear fuel than current reactors, per unit of electricity generated, due to loss of economy of scale (Rodney Ewing, Allison Macfarlane, *et al.* – May 30, 2022, *Stanford Report*, **“Stanford-led research finds small modular reactors will exacerbate challenges of highly radioactive nuclear waste”)**

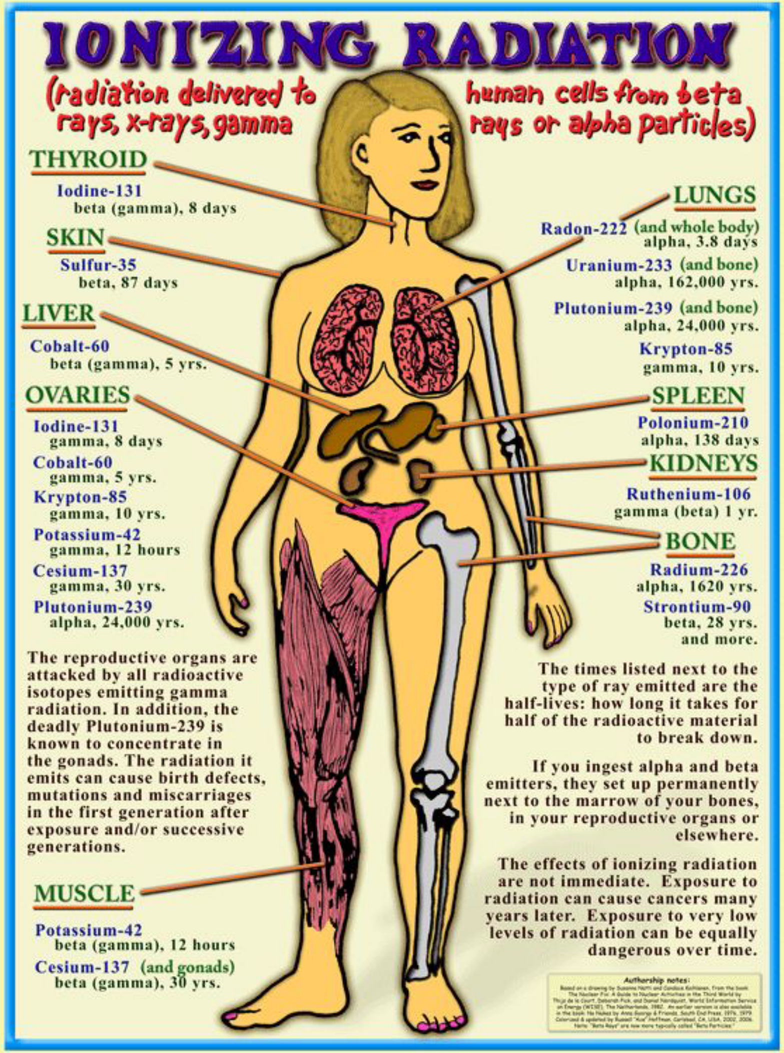
What are the hazards and risks?

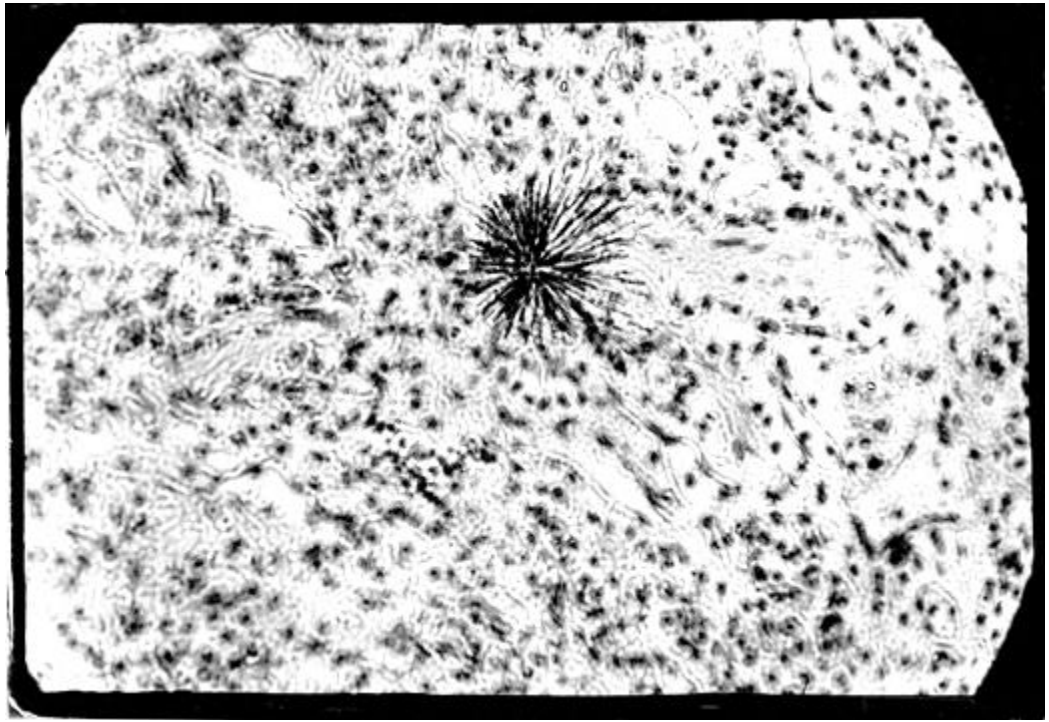
Can cause cancer, genetic damage, birth defects, and other maladies/morbidities;

Hazardous for at least a million years (NEI v EPA, 2004);

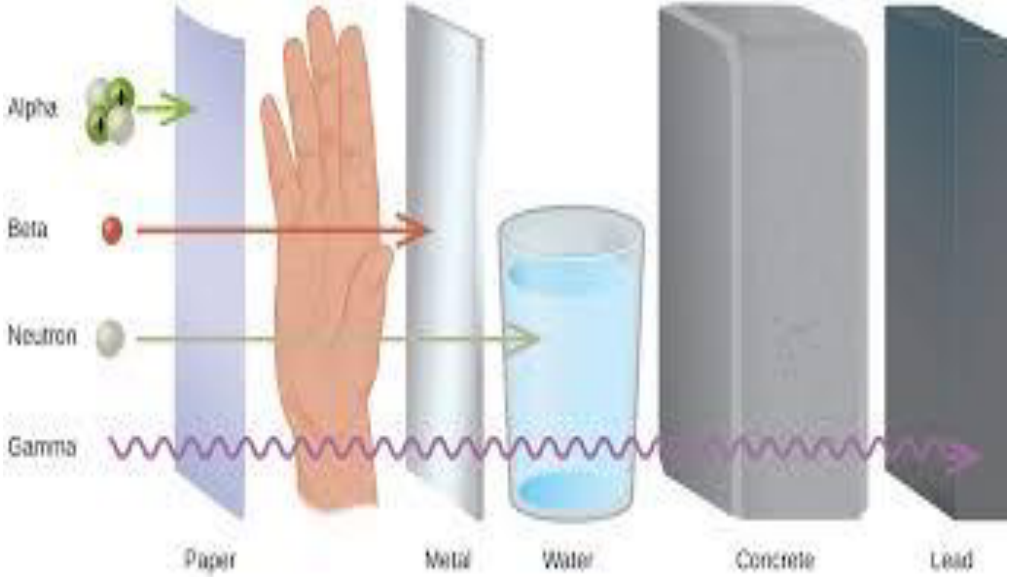
Risk of acute radiation poisoning death, from unshielded irradiated nuclear fuel, at close range/short distance, within a short time period, lasting for centuries;

Risks to water (tritium; other radionuclides' dispersion through solubility, colloidal transport, other modes; bioaccumulation/biomagnification/bioconcentration – Rosalie Bertell, IICPH)


IONIZING RADIATION
(radiation delivered to human cells from beta rays, x-rays, gamma rays or alpha particles)
THYROID
Iodine-131
beta (gamma), 8 days
SKIN
Sulfur-35
beta, 87 days
LIVER
Cobalt-60
beta (gamma), 5 yrs.
OVARIES
Iodine-131
gamma, 8 days
Cobalt-60
gamma, 5 yrs.
Krypton-85
gamma, 10 yrs.
Potassium-42
gamma, 12 hours
Cesium-137
gamma, 30 yrs.
Plutonium-239
alpha, 24,000 yrs.
The reproductive organs are attacked by all radioactive isotopes emitting gamma radiation. In addition, the deadly Plutonium-239 is known to concentrate in the gonads. The radiation it emits can cause birth defects, mutations and miscarriages in the first generation after exposure and/or successive generations.
MUSCLE
Potassium-42
beta (gamma), 12 hours
Cesium-137 (and gonads)
beta (gamma), 30 yrs.
LUNGS
Radon-222 (and whole body)
alpha, 3.8 days
Uranium-233 (and bone)
alpha, 162,000 yrs.
Plutonium-239 (and bone)
alpha, 24,000 yrs.
Krypton-85
gamma, 10 yrs.
SPLEEN
Polonium-210
alpha, 138 days
KIDNEYS
Ruthenium-106
gamma (beta) 1 yr.
BONE
Radium-226
alpha, 1620 yrs.
Strontium-90
beta, 28 yrs.
and more.
The times listed next to the type of ray emitted are the half-lives: how long it takes for half of the radioactive material to break down.
If you ingest alpha and beta emitters, they set up permanently next to the marrow of your bones, in your reproductive organs or elsewhere.
The effects of ionizing radiation are not immediate. Exposure to radiation can cause cancers many years later. Exposure to very low levels of radiation can be equally dangerous over time.
Authorship notes:



Shielding required against penetrating hazards




I DOX 100

Transportation risks

“Routine” emissions of gamma and neutron radiation (1-2 chest X-rays per hour at 2 meters = 10 milli-Rem per hour at 2 meters; 240 mR per hour at container external surface, 24-48 chest X-rays per hour);

Externally contaminated or leaking shipments (French scandal – 25-33% of all shipments to La Hague over several years in 1990s; average of 500 times “permissible” dose; one shipment 3,300 times “allowable” dose; revealed by watchdogs and journalists, including Mycle Schneider, WISE-Paris);

Mobile X-ray Machines That Can’t Be Turned Off (Lauren Olson)

Transport “accidents” (East Palestine, Ohio, Feb. 3, 2023)

Transport attacks (shoulder-fired TOW anti-tank missile)

What to do with it?

At-reactor versus Away-from-reactor storage? Storage v. disposal?

Rolling Stewardship? Hardened On-Site Storage (HOSS)?

Consolidated Interim Storage Facilities (CISFs)?

Permanent deep geologic repository disposal?

Boreholes (“Deep Isolation”)?

Reprocessing?

STOP MAKING IT!

Geologic disposal – the ups and downs

Stringent Criteria for a Highly Radioactive Waste Geologic Repository (Kevin Kamps, Beyond Nuclear, May 26, 2020)

1. Legality
2. Consent-based siting
3. Scientific suitability
4. Environmental justice
5. Regional equity
6. Mitigation of transport risks
7. Intergenerational equity
8. Non-proliferation
9. Pre-disposal reprocessing is unacceptable
10. Additional concerns that come to light must be addressed (*e.g.*, sacred sites)

Stopping dangerous/bad radioactive waste dumps: BNGS

Yucca Mountain, Nevada (Newe Sogobia, Western Shoshone)

Spiritual Leader

Corbin Harney,

Chief Raymond

Yowell

Yucca

Joe Kennedy, Ian Zabarte, youth

Private Fuel Storage at Skull Valley Goshutes, Utah

Margene Bullcreek

60 Indigenous Nations' reservations across continental U.S.

Grace Thorpe,

Sauk and Fox,

Oklahoma,

National Environmental

Coalition of Native

Americans (NECONA)

CISFs:

ISP, TX;

Holtec,

NM.

Rose

Gardner

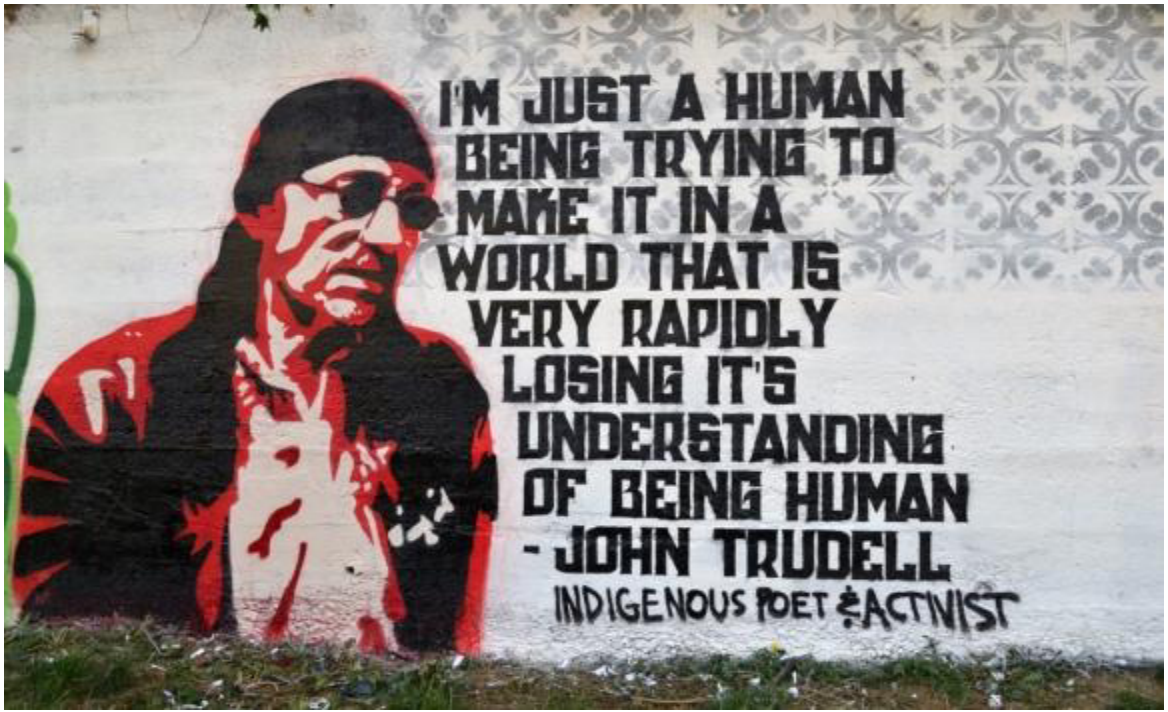
&

family

Winona “No Nukes” LaDuke, Honor the Earth

Tom Goldtooth, Indigenous Environmental Network

John Trudell



Additional victories against bad nuclear waste dumps

Gorleben, Germany;

New England, USA (Maine, New Hampshire, Vermont);

Wisconsin (Wolf River Batholith; Puritan Pluton);

Quebec's border with Vermont (shared waters);

Salt mines under Detroit, Michigan;

Russia (Vladimir Slivyak).

WE CAN WIN THESE FIGHTS!