ID 38: MARINE SEDIMENTS AS A RADIOACTIVE POLLUTION REPOSITORY IN THE WORLD

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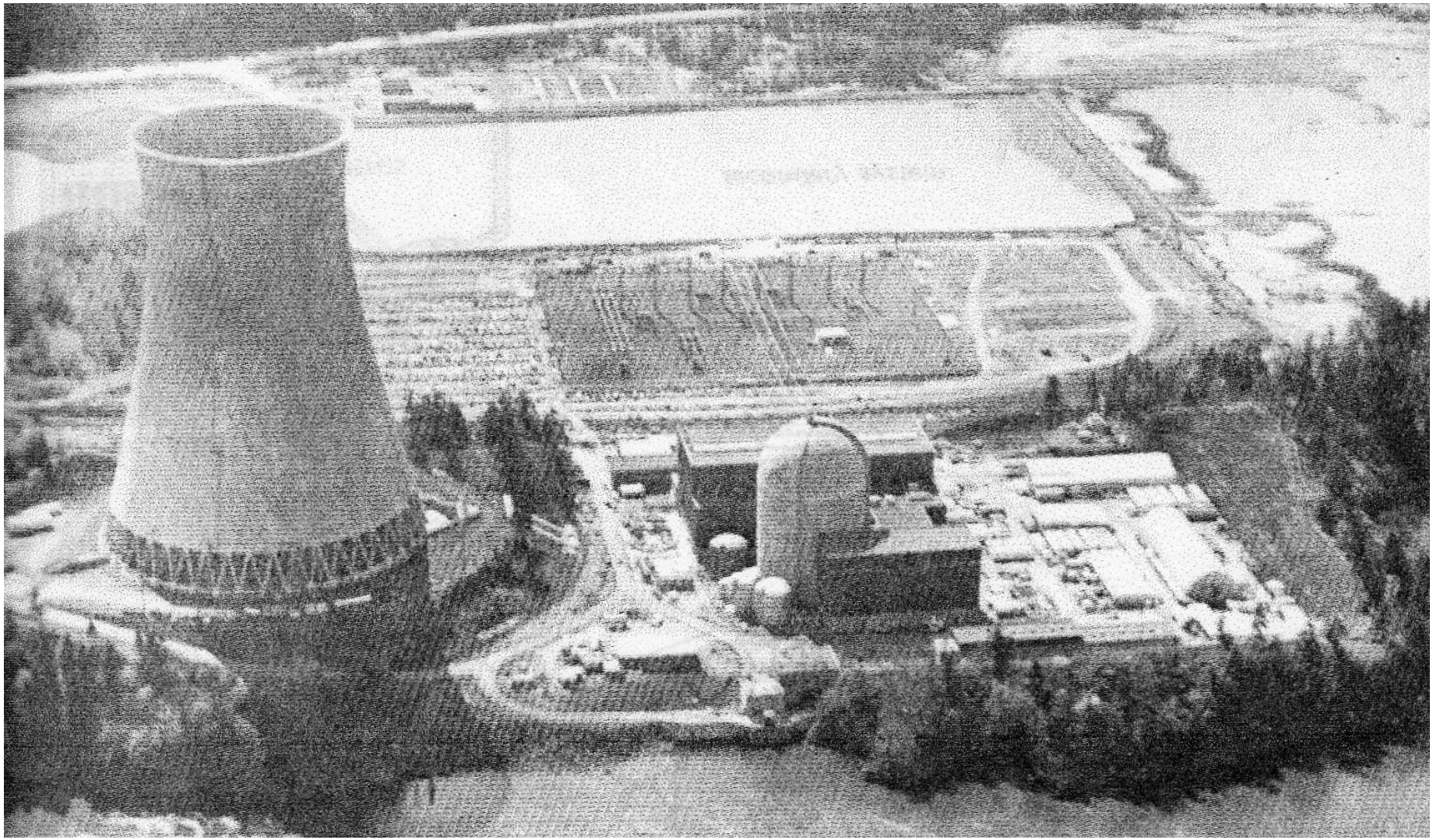
Pressurized light water coolled and moderated Nuclear Reactor PWR, working at Trojan, Alabama, USA, since 1975, 1130 MWe



The 10 worst nuclear accidents in the world

Windscale, United Kingdom, October 1957	Level 5.- - Fire in one from two nuclear reactors provokes radiation release. 518 square kilometers are contaminated. Crops and cattle must be sacrificed. 33 dead persons by cancer attributed to over dose radiation.
Ural Mountains, URSS, October 1958	Radioactive wastes explosion in a soviet nuclear weapons factory, near the city of Kyshtym. More than 10,000 persons are evacuated by authorities. No fatalities reported.
Three Mile Island, USA, March 1979	Level 7.- Partial nuclear fusion in one from two reactors caused by overheating. Radioactive water and gases are released. 140,000 persons are evacuated by authorities. This is the worst nuclear accident in the country.
Chernobyl, Ukraine, April 1986	Level 7.- Explosion of a nuclear reactor caused by overheating. Fission products spread out in atmosphere. This is the worst nuclear accident in the country, and probably in the world. Estimated fatalities are 16,000 persons.
Tokaimura, Japan, March 1997	Fire and explosion caused by a leak. At least 35 workers are contaminated.

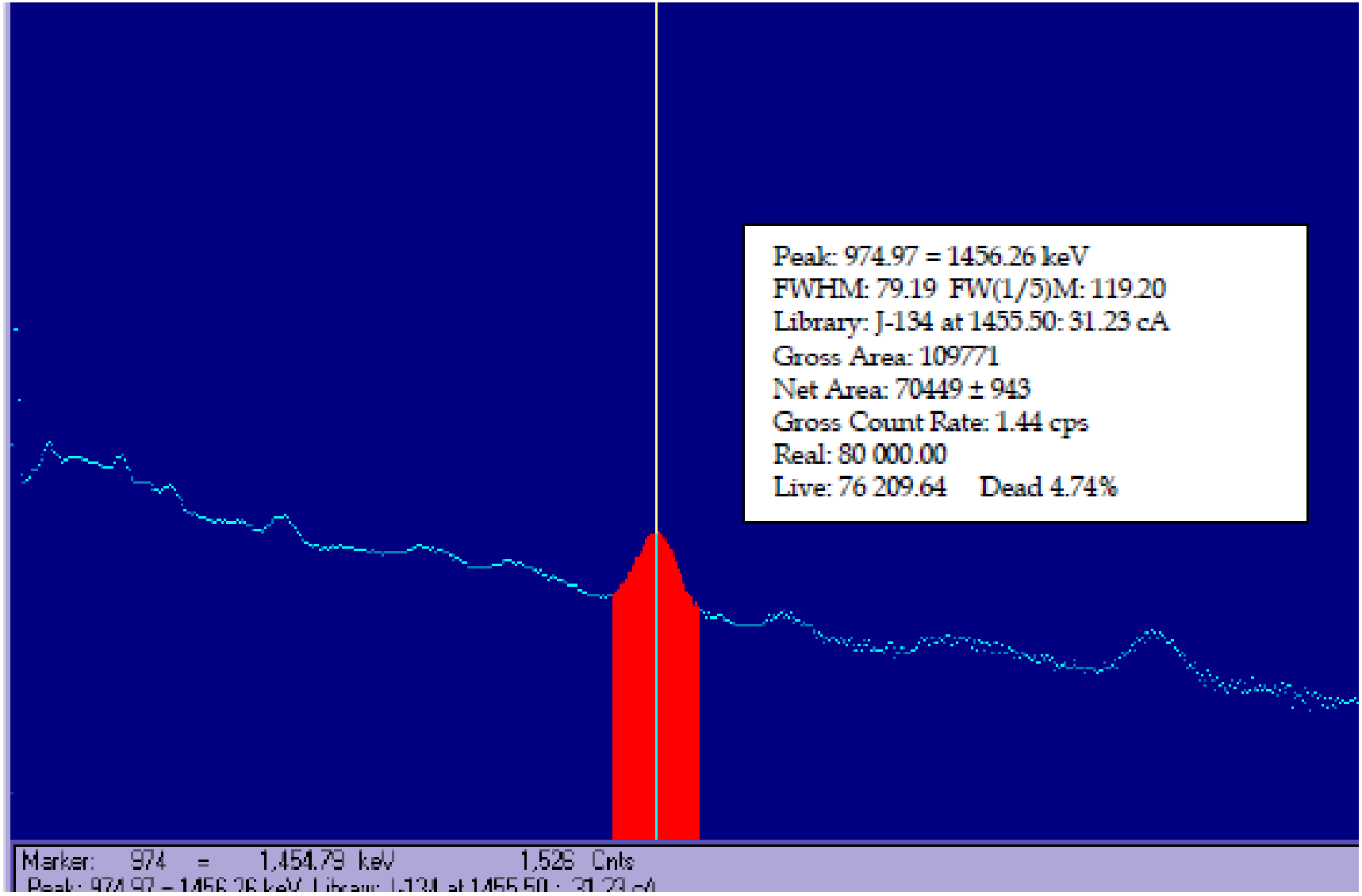
The 10 worst nuclear accidents in the world

Tokaimura, Japan, September 1999	Level 5.- Human mistake provokes out of control nuclear chain reaction in a processing uranium factory. Two fatalities reported and 50 persons received overdose radiation, while 300,000 plus residents were confined indoors.
Blayais, France, December 1999	Level 2.- Nuclear installation over flooded during one storm. Water excess interrupted automatically the operation of 4 reactors cooling water pumps. Partial melting of nuclear fuel. No fatalities reported.
Mihama, Japan, August 2004	4 fatalities and 7 burn injured workers by a leak in a nuclear plant.
Kashiwazaki, Japan, Jul 2007	Earthquake 6.8^0 Richter provokes fire, water and radioactive gases release. No fatalities reported. However, the plant is closed to verify security systems.
Fukushima, Japan, Mar 2011	Level 6.- Earthquake followed by tsunami provokes failure in cooling water pumps of reactors. Radioactive water and gas are released to atmosphere. Residents around 32 square kilometers are evacuated. No fatalities by radiation overdose reported.

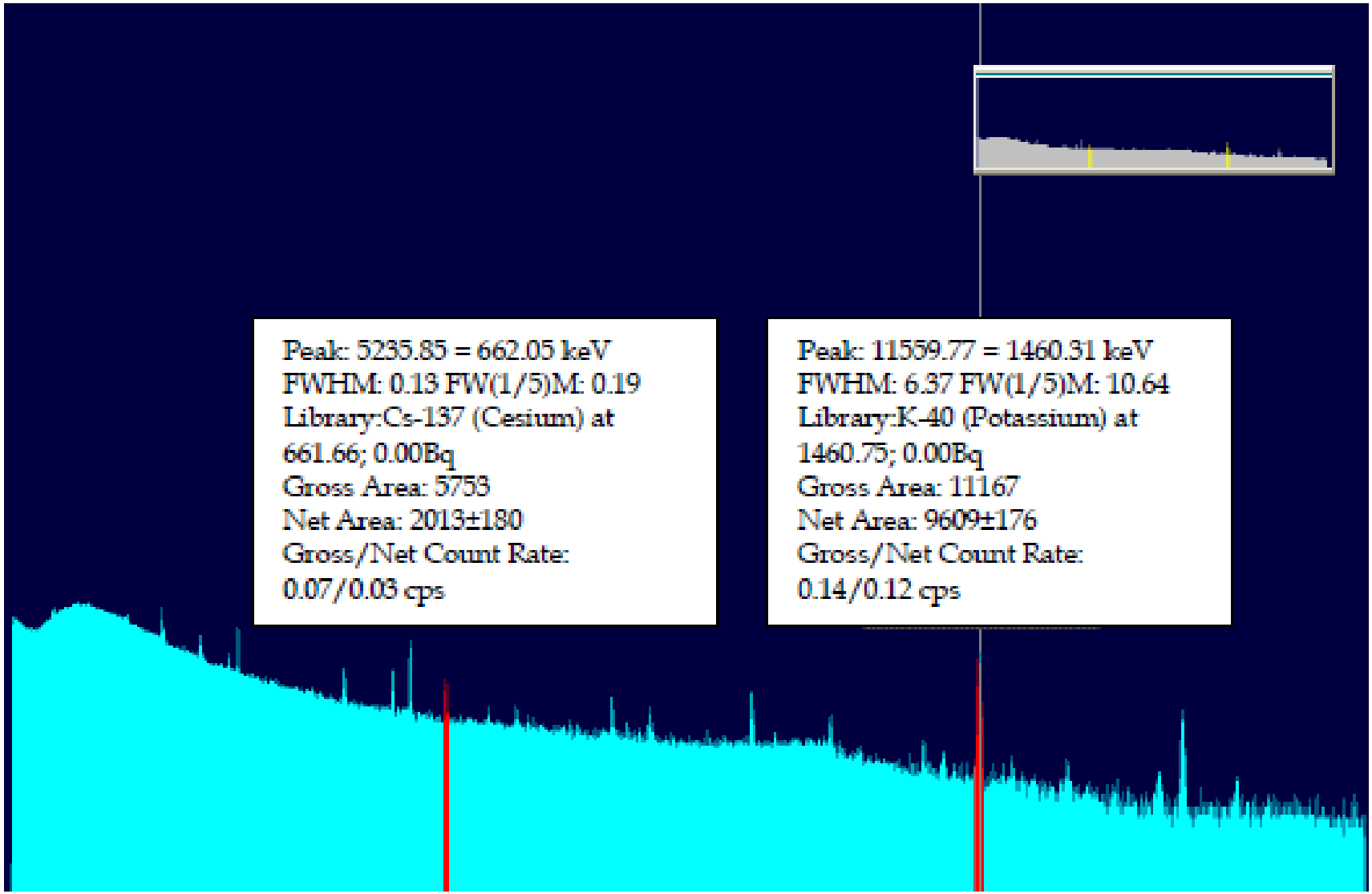
Since 1945, two war actions, and 2,000 plus nuclear explosions tests in the world.

Marinelli container with marine sediments, to detect natural ^{40}K and contaminant ^{137}Cs in NaI(Tl) and HPGe detectors

γ Spectrum of marine sediment obtained from a low background NaI(Tl) detector



γ Spectrum of marine sediment obtained with a HPGe detector



Equations used to characterize marine salts and sediments

$$K_A\left[31.19\frac{Bq}{gK}\right]=\frac{0.693\times 6.02\times 10^{23}\times 0.0118}{1.28\times 10^{9}\times 365\times 24\times 3600\times 39.1\times 100}$$

$$S\left[\frac{g}{L}\right]=\frac{W_g}{L}$$

$$A_S\left[\frac{Bq}{g\ salt}\right]=\frac{cps\ sample-cps\ background}{W_g\times Det.Eff.\times 11/100}\times 100$$

$$O_C\left[\frac{Bq}{L}\right]=A_S\left[\frac{Bq}{g}\right]\times S\left[\frac{g}{L}\right]=\frac{Bq}{L}$$

$$\%K\left[\frac{gK}{g\ salt}\times 100\right]=\frac{A_S}{31.19}\times 100$$

$$\boldsymbol{RCF\ \%=\frac{Bq^{137}Cs}{Bq^{40}K}\times 100}$$

Results obtained in 3 samples of marine salts and sediments in Mexican territorial waters

	Sea Salt Samples				Marine Sediment Samples
	Bq ^{40}K/g salt	**Bq ^{40}K/L sea water**	**g salt/L sea water**	**%K in sea salt**	$\%RCF = \frac{Bq^{137}Cs \times 100}{Bq^{40}K}$
Gulf of Mexico South East	0.276	10.1	36.7	0.88	0.89
Pacific Ocean North	0.073	2.5	34.8	0.23	0.58
Gulf of Mexico North East	0.173	7.3	42.5	0.55	0.93