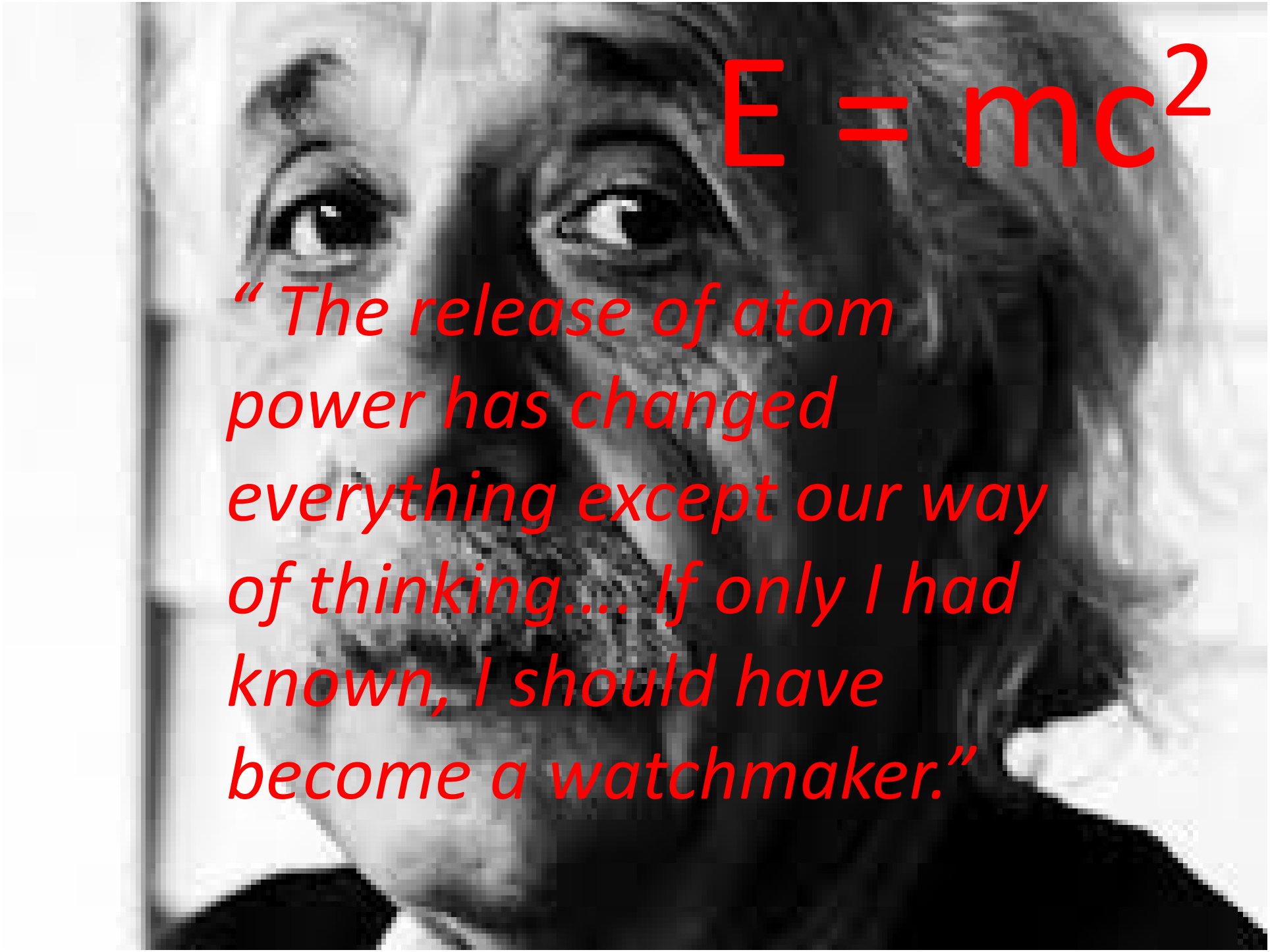
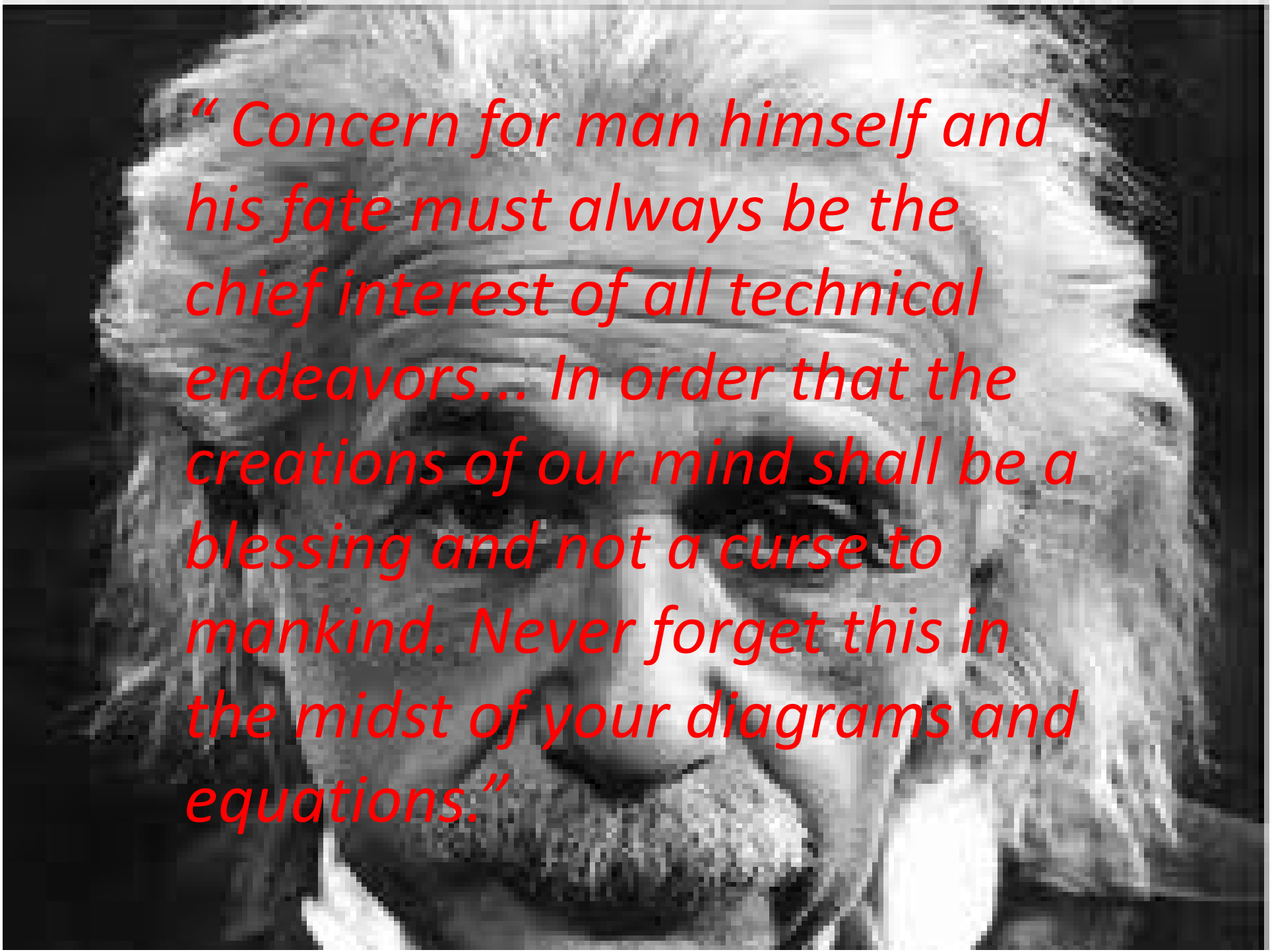

Why Not Nuclear?
The Case Against Nuclear Power


$E = mc^2$
" The release of atom power has changed everything except our way of thinking... If only I had known, I should have become a watchmaker."


“ Concern for man himself and his fate must always be the chief interest of all technical endeavors… In order that the creations of our mind shall be a blessing and not a curse to mankind. Never forget this in the midst of your diagrams and equations.”

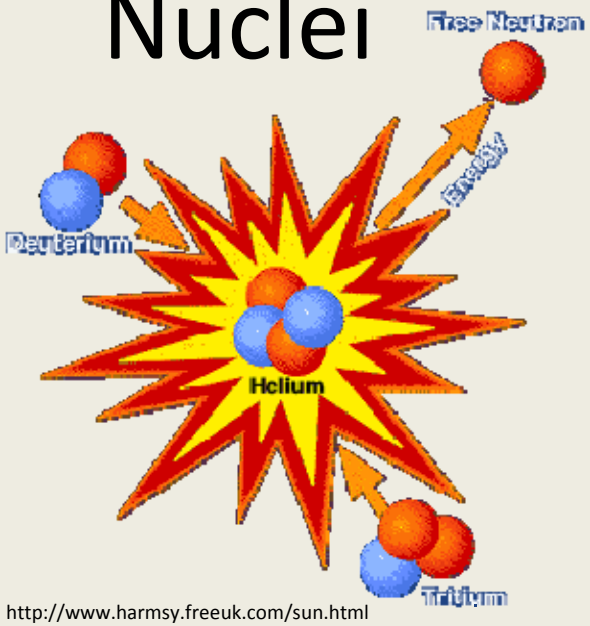
$$E = mc^2$$

Large amounts of energy are released in nuclear reactions

Heat and Radiation

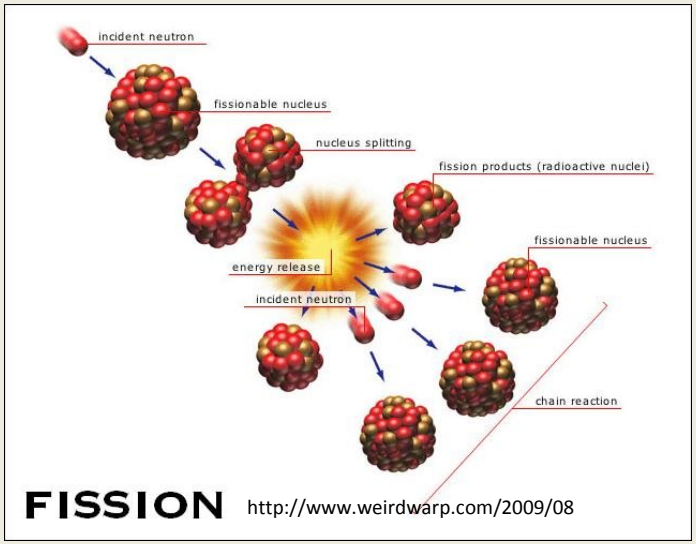
Fusion Vs. Fission

Joining of Nuclei



http://www.harmsy.freeuk.com/sun.html

Splitting of Nuclei



http://www.weirdwarp.com/2009/08

FUSION

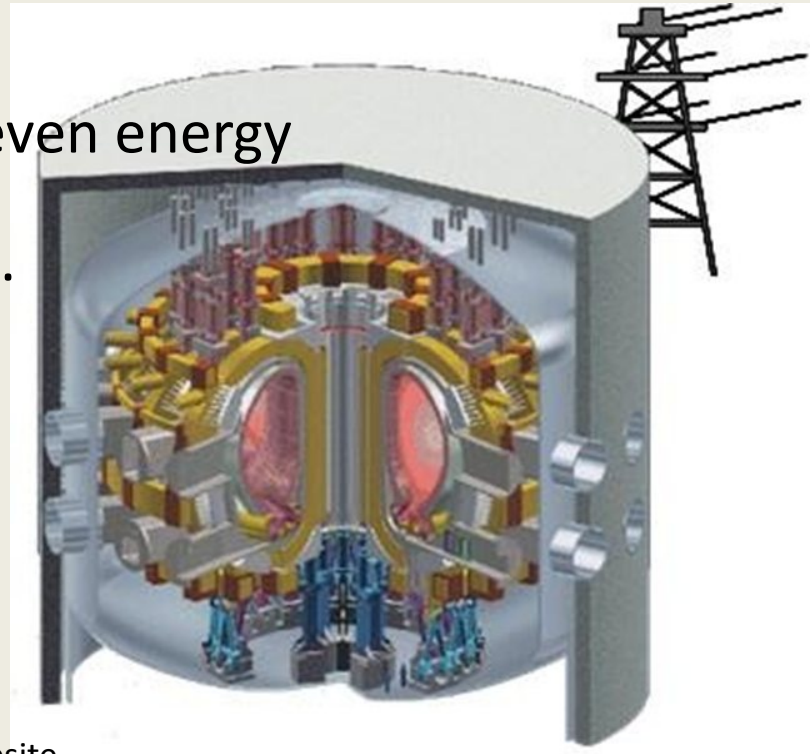
- At 100,000,000 degrees C, normal materials don't work. Containment is laser or magnetic based.

-Nearly 70 years of research: 6 minutes 30 seconds is the longest reaction achieved.

- Finally just achieved point of break-even energy

- Researchers expect success by 2050.

- Fusion is clean, but will not be practical for decades.



Source: International Thermonuclear Experimental Reactor website

FISSION

- Uranium fuel splits to form daughter particles = fission products.

- Dozens of radioactive products: Plutonium 239, Cesium 137, Strontium 90, Iodine 131, Thorium, Barium, Krypton, and many more.

- Fission products have very serious health effects.

- This is the fatal flaw of nuclear power.

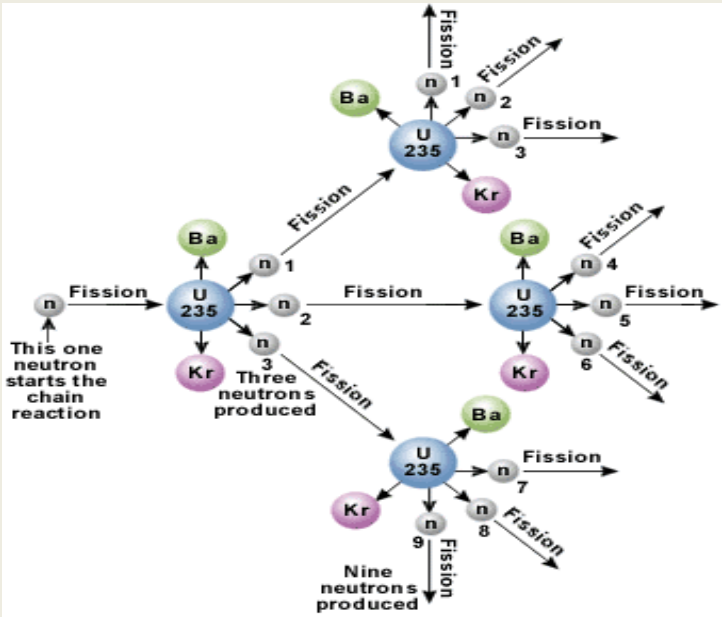


Diagram to show the chain reaction during the fission of uranium-235 with a neutron

Source: http://www.educationalelectronicsusa.com

RADIATION AND FISSION PRODUCTS HAVE MANY BAD HEALTH EFFECTS:

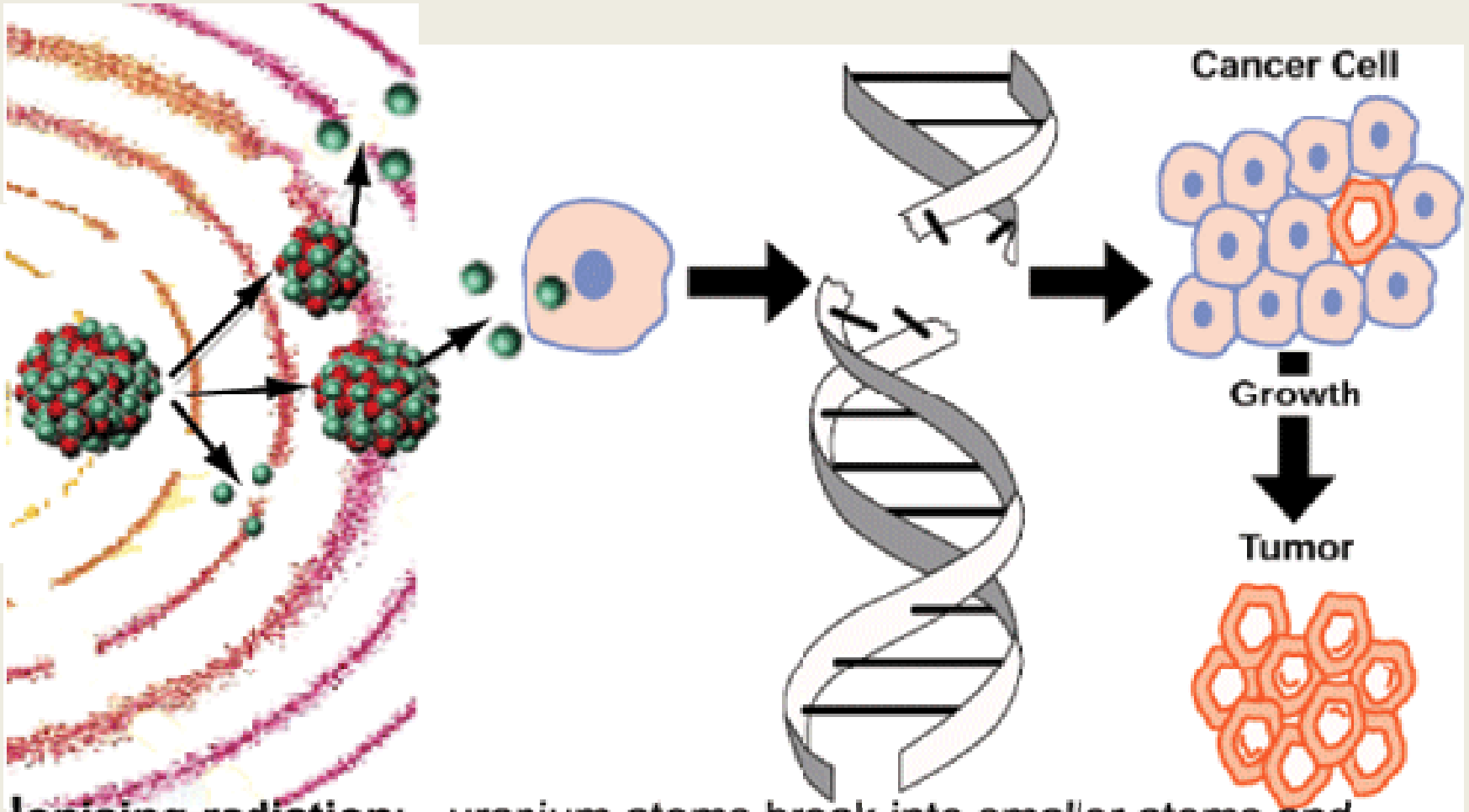
- Radiation sickness and death at high doses
- Cancers at lower doses (caused by damage to DNA)
  - Leukemia
  - Bone Cancer
  - Thyroid Cancer
  - Liver Cancer
  - Brain Cancer
  - Other Cancers

photo source: http://hometestingblog.testcountry.com/?p=12226

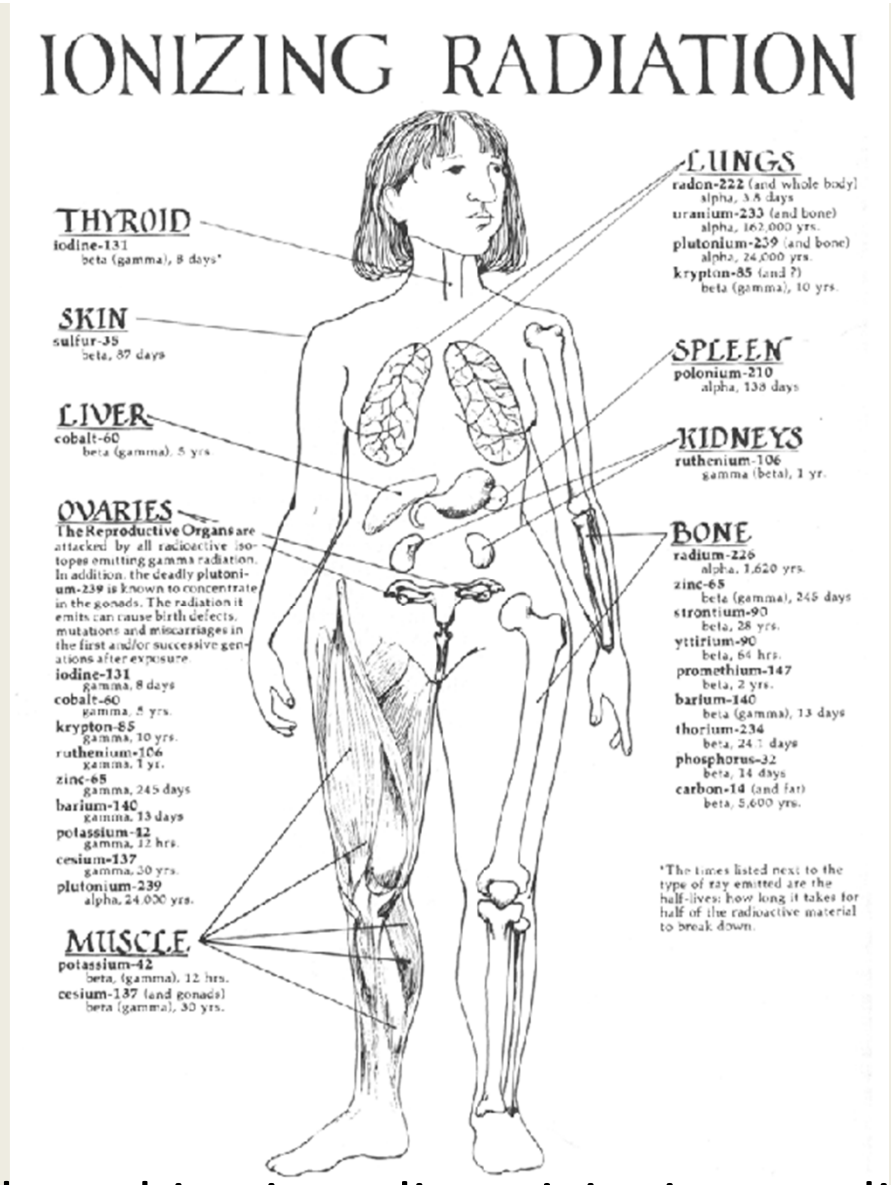
More Health Effects of Fission Products and Radioactivity

Source: glitteratis.files.wordpress.com

HOW DAMAGE OCCURS



Ionising radiation: - uranium atoms break into smaller atoms and particles, which enter a human cell, strike the nucleus, and damage the DNA, causing it to divide in an uncontrolled way - **cancer**



Eating, drinking, breathing in radioactivity is very different than getting an X-ray - lodges in body.

THREE ISOTOPES AND WHERE THEY LODGE IN THE BODY

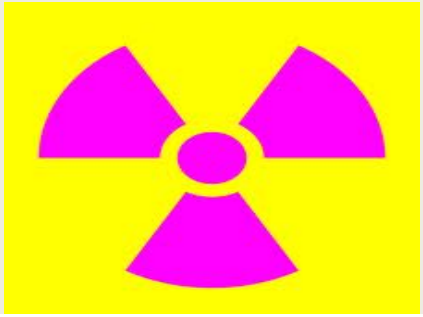
Iodine 131 – replaces normal iodine
- collects in the thyroid gland
- can cause thyroid cancer at low doses.

Strontium 90 - replaces calcium in bones
- can cause bone cancer or leukemia

Cesium 137 - replaces potassium in many tissues
- can cause a variety of cancers.

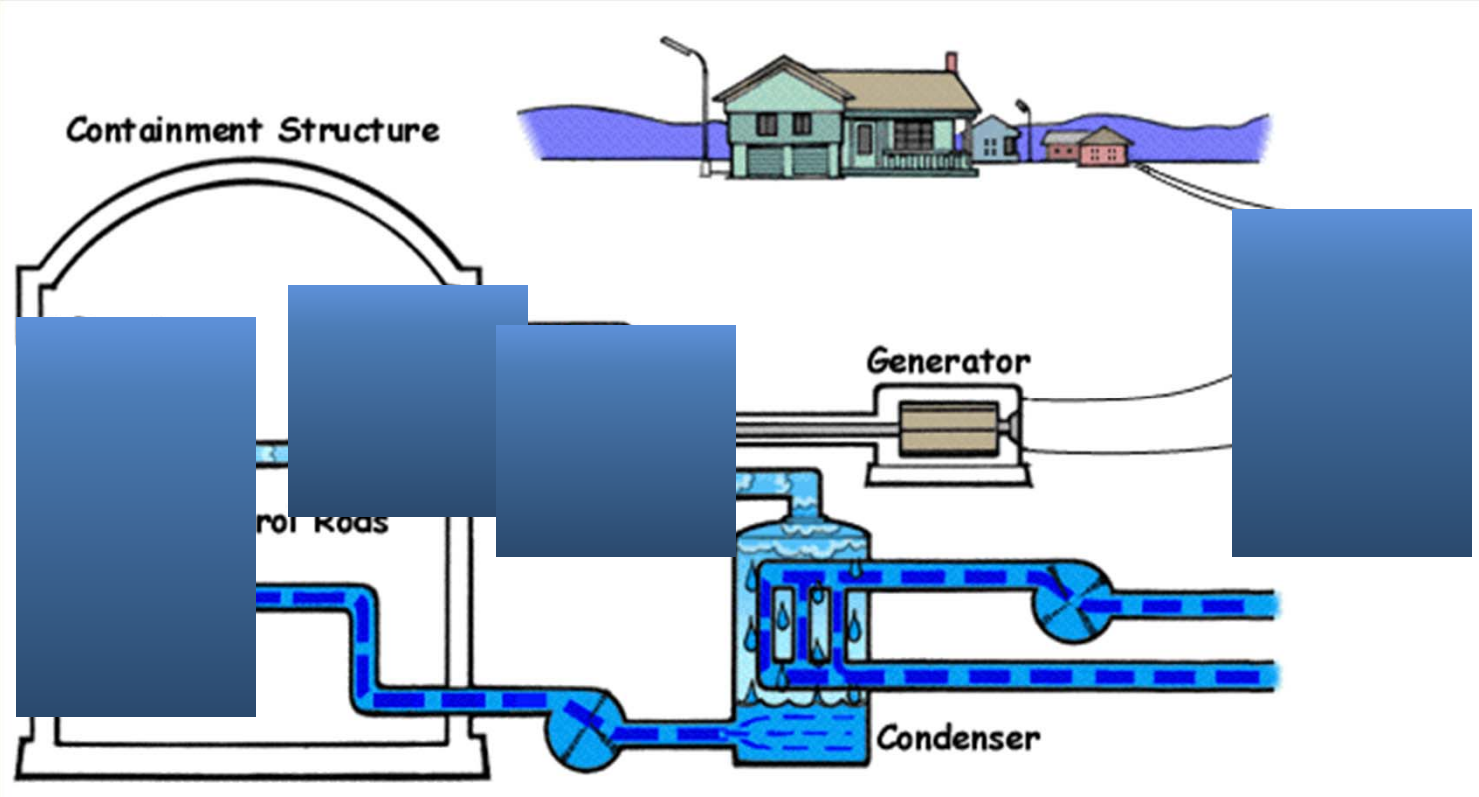
Radiation Has No Safe Dose

- Doses are cumulative, over our whole lives – they all add up, increasing risk with each new exposure.
- EPA Standards explicitly state there's no safe dose.
- Nuclear Regulatory Commission regulations reflect that there is no safe dose.
- National Academy of Sciences affirms there is no safe dose.
- *Exposure needs to be prevented, to prevent cancers and other health effects.*



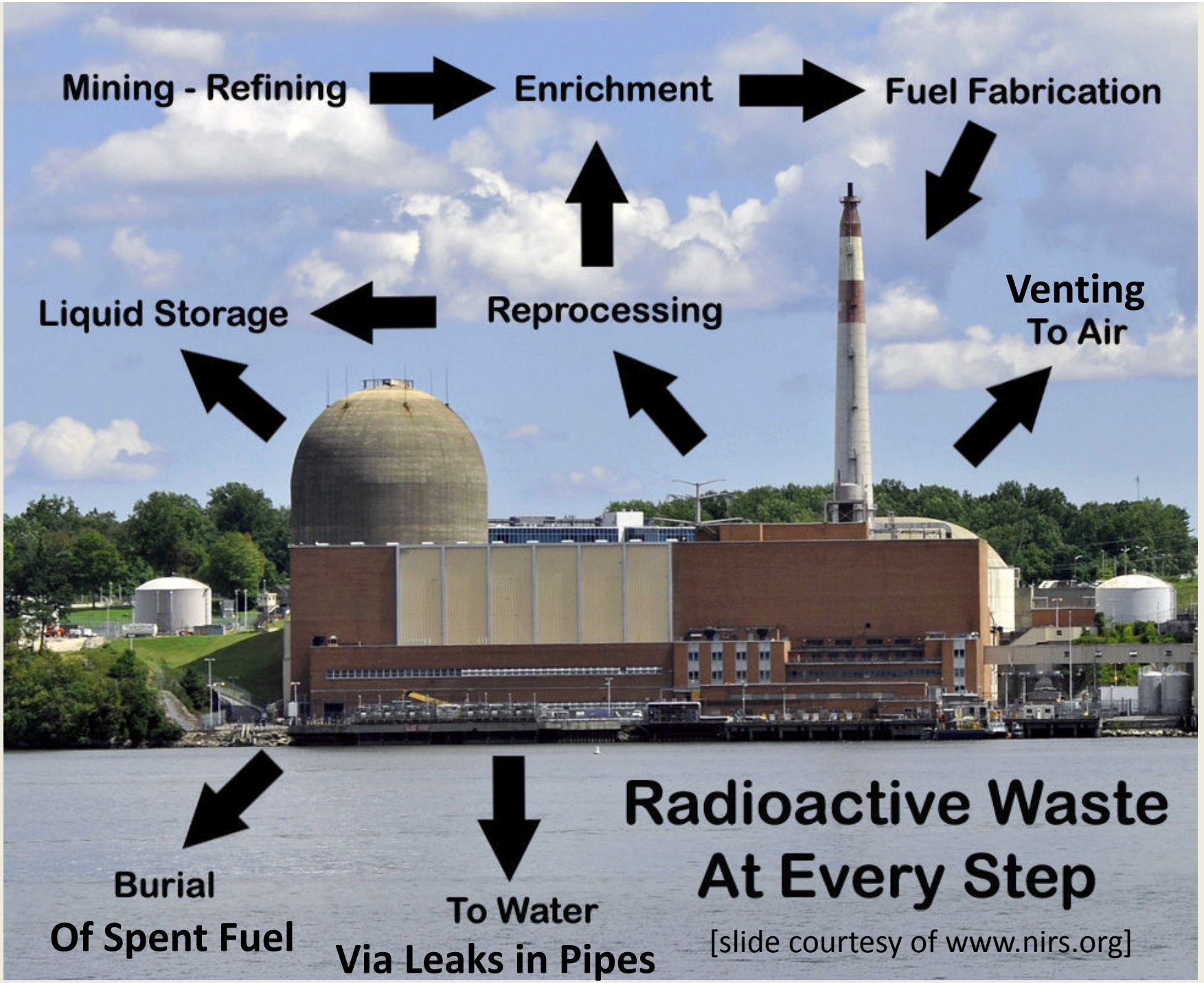
How Does it Work?

- Chain reaction in uranium fuel creates heat and waste
- Heat boils water into steam
- Steam physically spins turbine
- Turbine spins generator, creating electricity

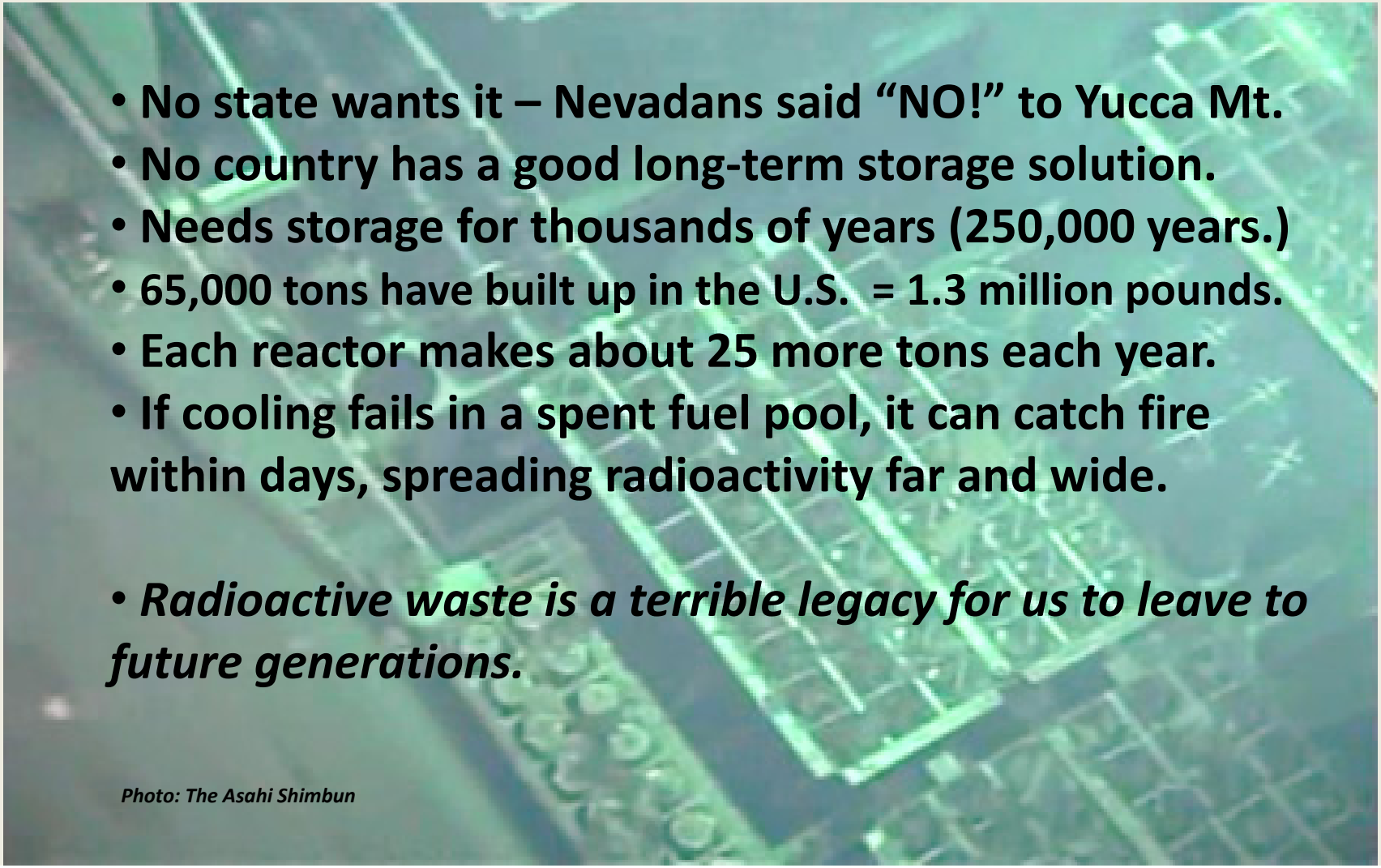


“Atomic energy is a stupid way to boil water.”

Buckminster Fuller


Mining - Refining
Enrichment
Fuel Fabrication
Venting
To Air
Reprocessing
Liquid Storage
Burial
Of Spent Fuel
To Water
Via Leaks in Pipes
Radioactive Waste
At Every Step
[slide courtesy of www.nirs.org]

Spent Fuel is the Biggest Source of Radioactive Waste



- **No state wants it – Nevadans said "NO!" to Yucca Mt.**
- **No country has a good long-term storage solution.**
- **Needs storage for thousands of years (250,000 years.)**
- **65,000 tons have built up in the U.S. = 1.3 million pounds.**
- **Each reactor makes about 25 more tons each year.**
- **If cooling fails in a spent fuel pool, it can catch fire within days, spreading radioactivity far and wide.**

- ***Radioactive waste is a terrible legacy for us to leave to future generations.***

Photo: The Asahi Shimbun

Nuclear Power - The Cost

Nuclear Power is Vastly Expensive

Photo: greenpeace.org.uk

- World's first Generation III reactor being built in Finland
- Promised for 2006; Pushed back to first power in 2015
- Promised price $4 billion - failed; Overruns to $10 billion
- Profitability called into question by Wall St Journal 2012
- Government loan guarantees mean taxpayers will pay.

Small Modular Reactors have been proposed to address the cost question.

But they still contain the fatal flaw of fission: they create radioactive fission products, that cause cancer and other illness.

The Hidden Costs of Nuclear Power

- **Waste Storage – costs fall on taxpayers, government**
- **Insurance – liability is limited - taxpayers pick up the tab**
- **Research – $147 billion spent on nuclear vs $5 billion on solar and wind over the last 50 years**
- **Over 30 subsidies in the whole fuel cycle**

- ***Subsidies cost more than the power is worth.***

[sources: thedailygreen.com union of concerned scientists]

As reported in:

The Seattle Times Saturday, July 2, 2011

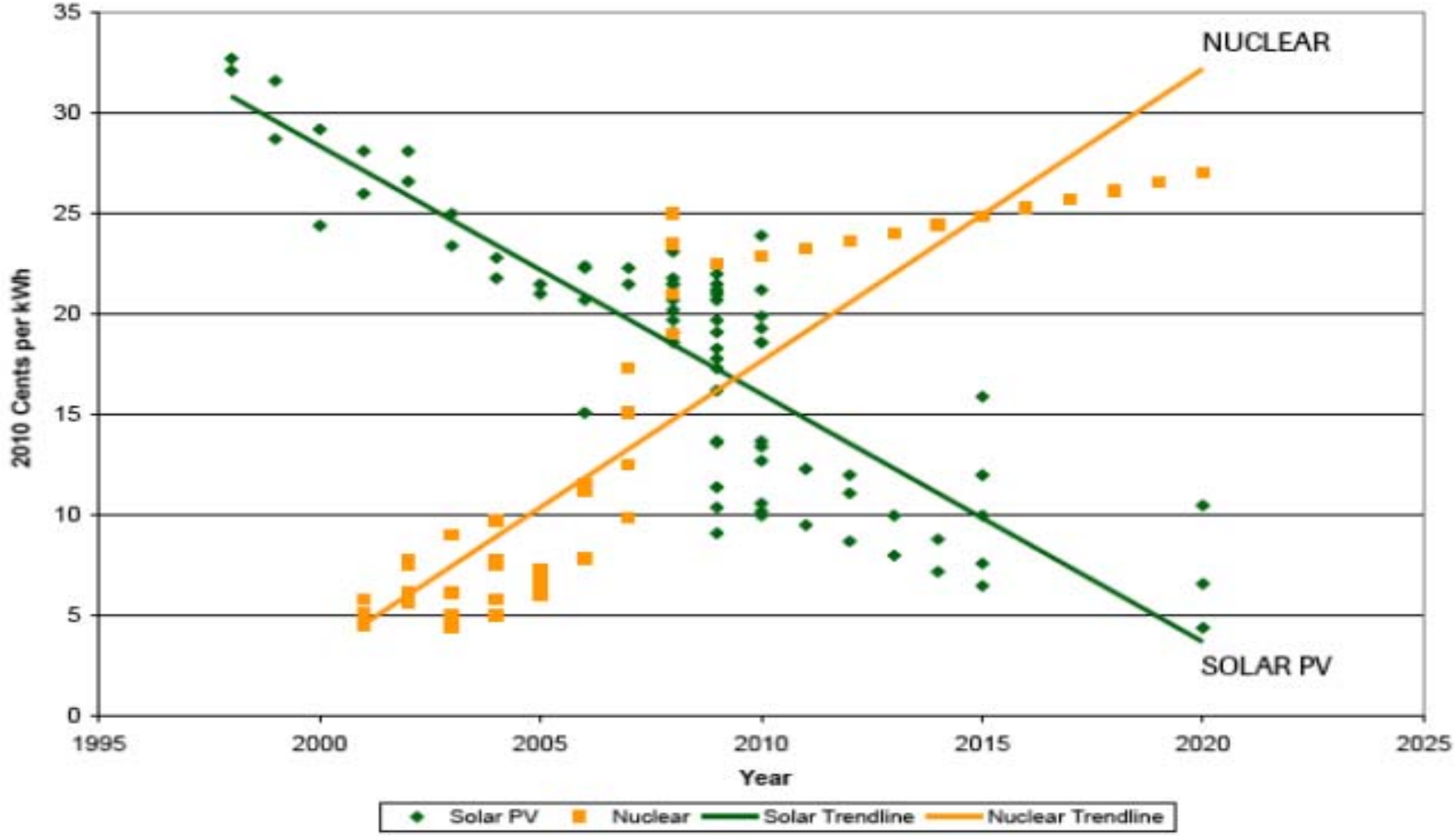
Weighing N-plant's costs, benefits

By Sandi Doughton, Seattle Times science reporter

According to a 2009 Bonneville Power Administration analysis, it *costs more to maintain and operate the Columbia Generating Station than all 31 of the hydropower plants in the Columbia Basin combined.*

Nuclear Will Get More Expensive

From Worldwatch Institute's "The World Nuclear Industry Status Report 2010-2011: Nuclear Power in a Post-Fukushima World"



In March 2011, Japan experienced the worst industrial accident in the history of the world.

source: www.fabioghioni.net

DISASTER AT FUKUSHIMA:
Tsunami and earthquake knocked out critical cooling and back-up power systems.

DISASTER AT FUKUSHIMA:
Three nuclear cores spun into uncontrolled reactions and overheating – suffering complete meltdowns, with fuel melting through steel reactor vessels.

DISASTER AT FUKUSHIMA:

Hydrogen explosions destroyed reactor buildings 1, 3, and 4.

NEW EXPLOSION AT FUKUSHIMA DAIICHI NUCLEAR REACTOR
March 13, 2011. Hydrogen explosion at Unit No. 3. *(Nippon News Network)*

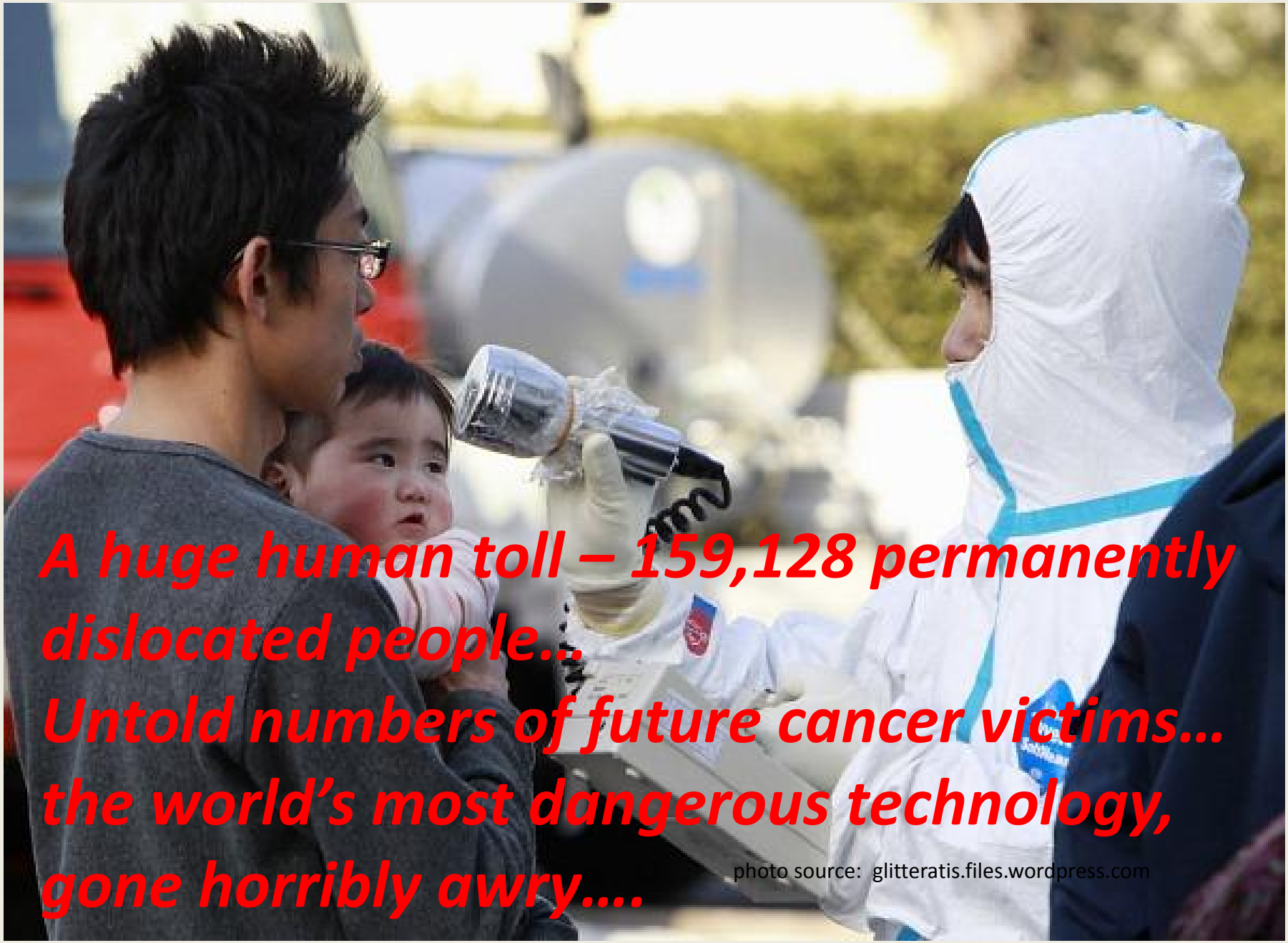
DISASTER AT FUKUSHIMA:

Photo: whowhatwhy.com

DISASTER AT FUKUSHIMA:

The cost of lost homes, businesses, farms, cities, and other property:

$250 Billion to $500 Billion and counting….


A huge human toll – 159,128 permanently dislocated people…
Untold numbers of future cancer victims…
the world's most dangerous technology, gone horribly awry….
photo source: glitteratis.files.wordpress.com

DISASTER AT FUKUSHIMA:

Columbia Generating Station at Hanford, Washington "WPPSS 2"

On the Columbia River… about 200 miles upstream from Portland… An accident there would devastate the region.

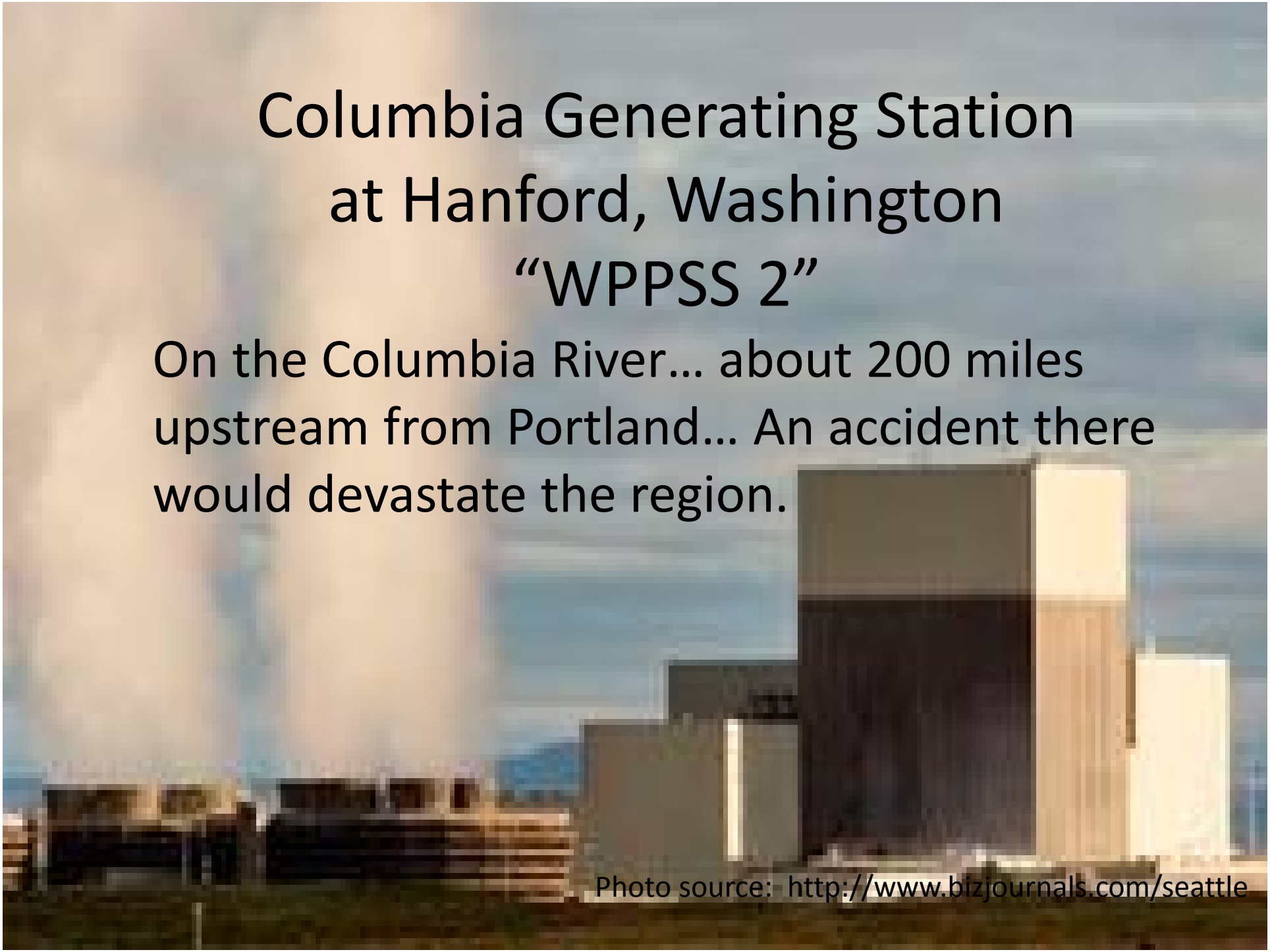


Photo source: http://www.bizjournals.com/seattle

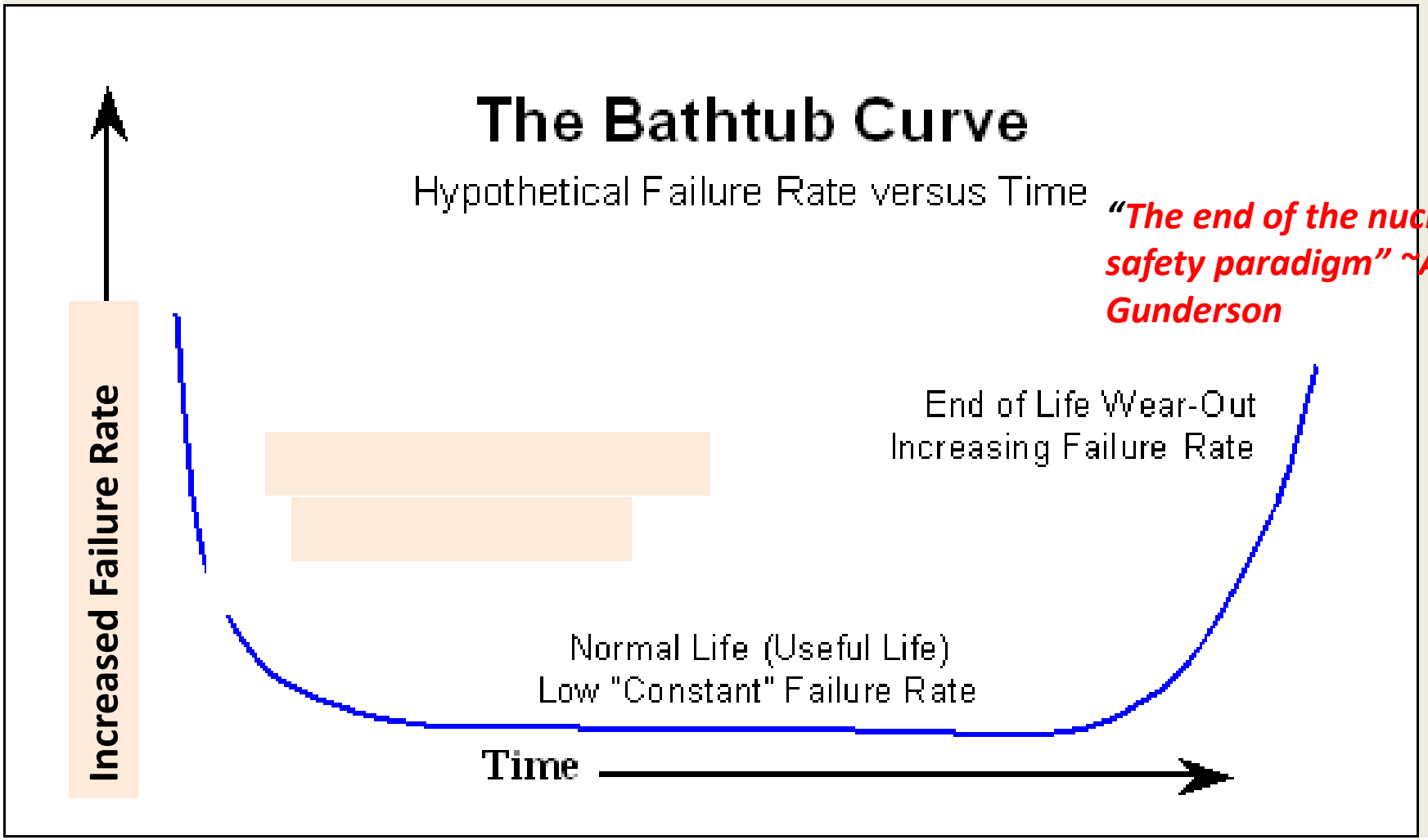
CGS's Spent Fuel Pool is elevated, like at Fukushima.

"Spent-fuel pools are <u>the most vulnerable</u> components at operating reactors,"

- Robert Alvarez, former NRC analyst and White House advisor

If lost cooling and caught fire, could spread *TEN TIMES* the radiation released at Chernobyl - which contaminated much of Europe.

CGS is an aging reactor, 29 years into a 40 year design life – an increasingly dangerous reactor.

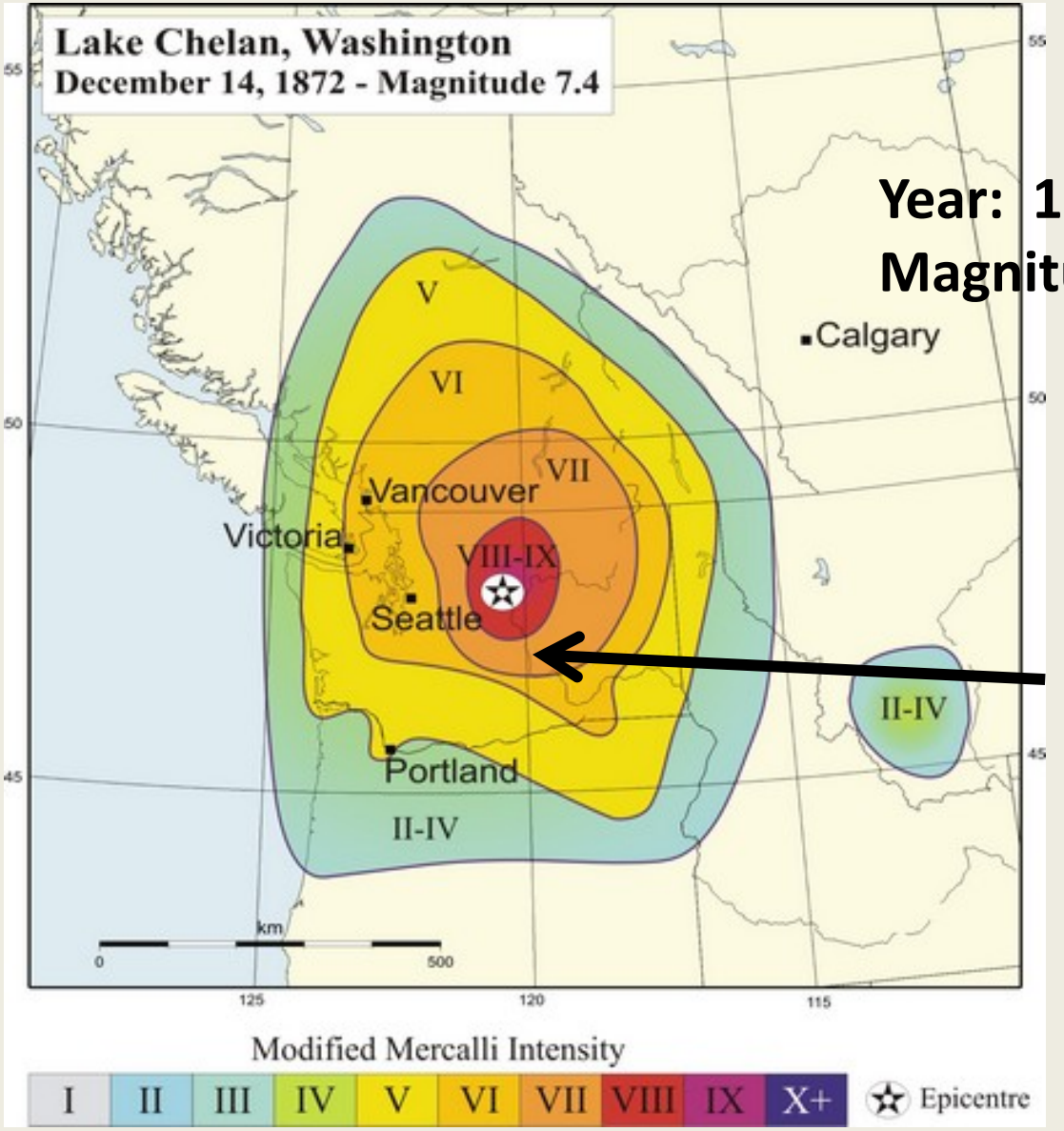


CGS Safety Problems

22 sudden forced shutdowns (SCRAMS) since 2000

NRC recently cited CGS for "miscalibrated" monitors from 2000 to 2011

Known Earthquakes Affecting Hanford Region



Year: 1872
Magnitude 7.4

Hanford

Newly-Discovered Potential Faulting Problem

Hanford lies on 11 known earthquake fault lines.

New research - those faults may be tied to the Puget Sound subduction zone – and could feel the “Big One” of the coast.

University of Washington study

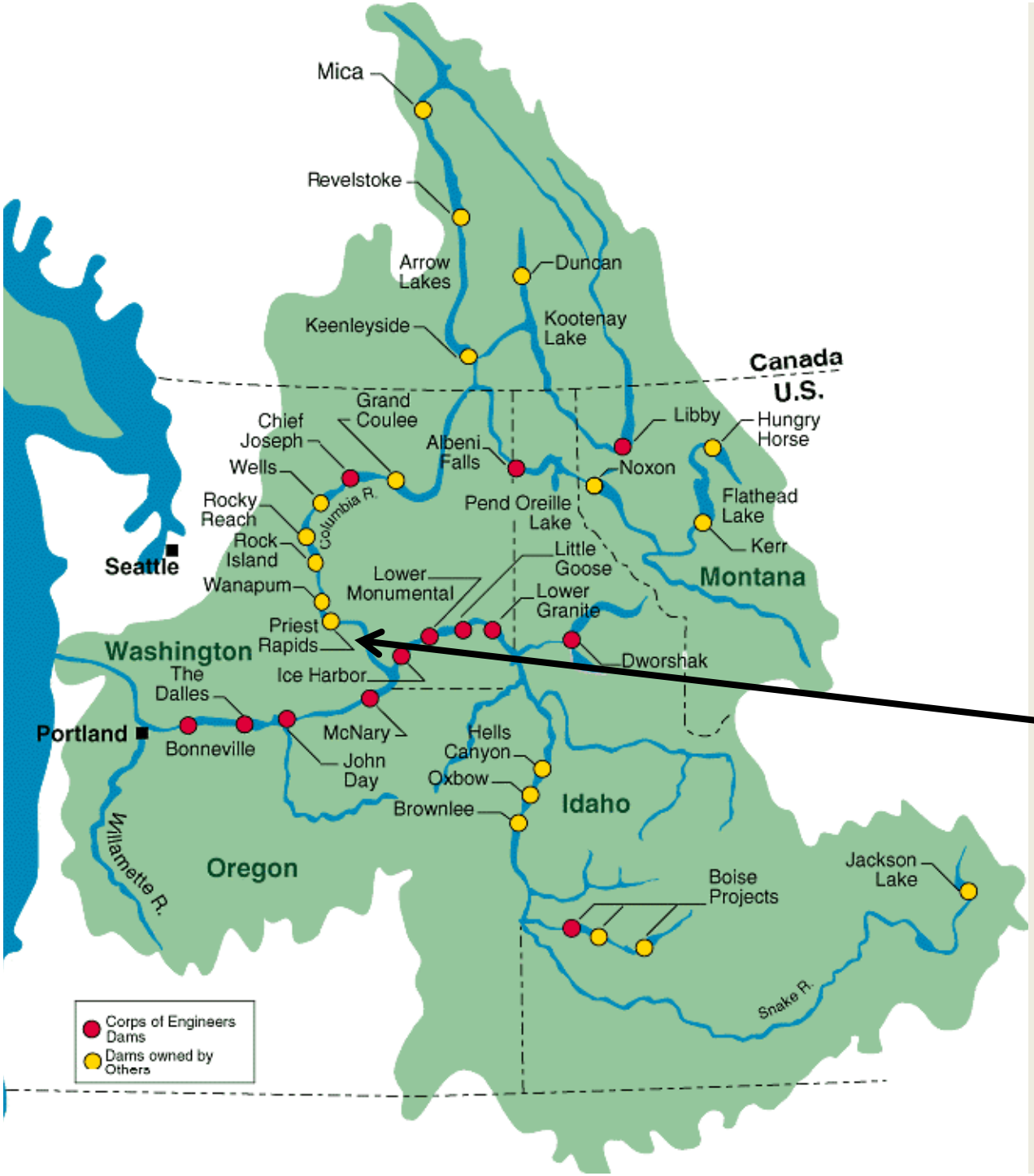
Grand Coulee Earthquake

- **1872 earthquake** had epicenter 20 miles away from Grand Coulee site. Failure of the Grand Coulee Dam is a known threat to CGS's risk of severe accident.

Teton Dam Collapse 1976

300 square miles were flooded with two towns destroyed. This type of failure could wipe out CGS's cooling, causing a meltdown.

Dams on the Columbia River



Hanford

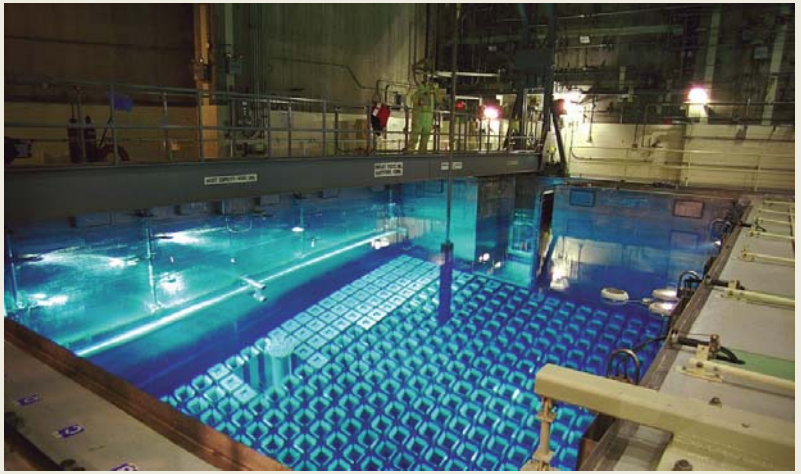
Human Acts of Destruction

A terrorist attack on CGS may have been planned by Al Qaeda in 2002

Jan 31, 2002: STEVE YOUNG, CNN CORRESPONDENT: **(A) warning went just a week ago from the Nuclear Regulatory Commission in Washington. It was sent to the 65 licensed power plant operators which run 103 nuclear power plants across the nation. The FBI paid a visit to at least one of those plants, the Columbia Generating Station, the only nuclear power plant in Washington state, and possibly other plants we don't know.**

Radioactive Waste

- High Level



- Low Level

- All dirty and dangerous!

The Consequences of Meltdown or Accident are Unacceptable

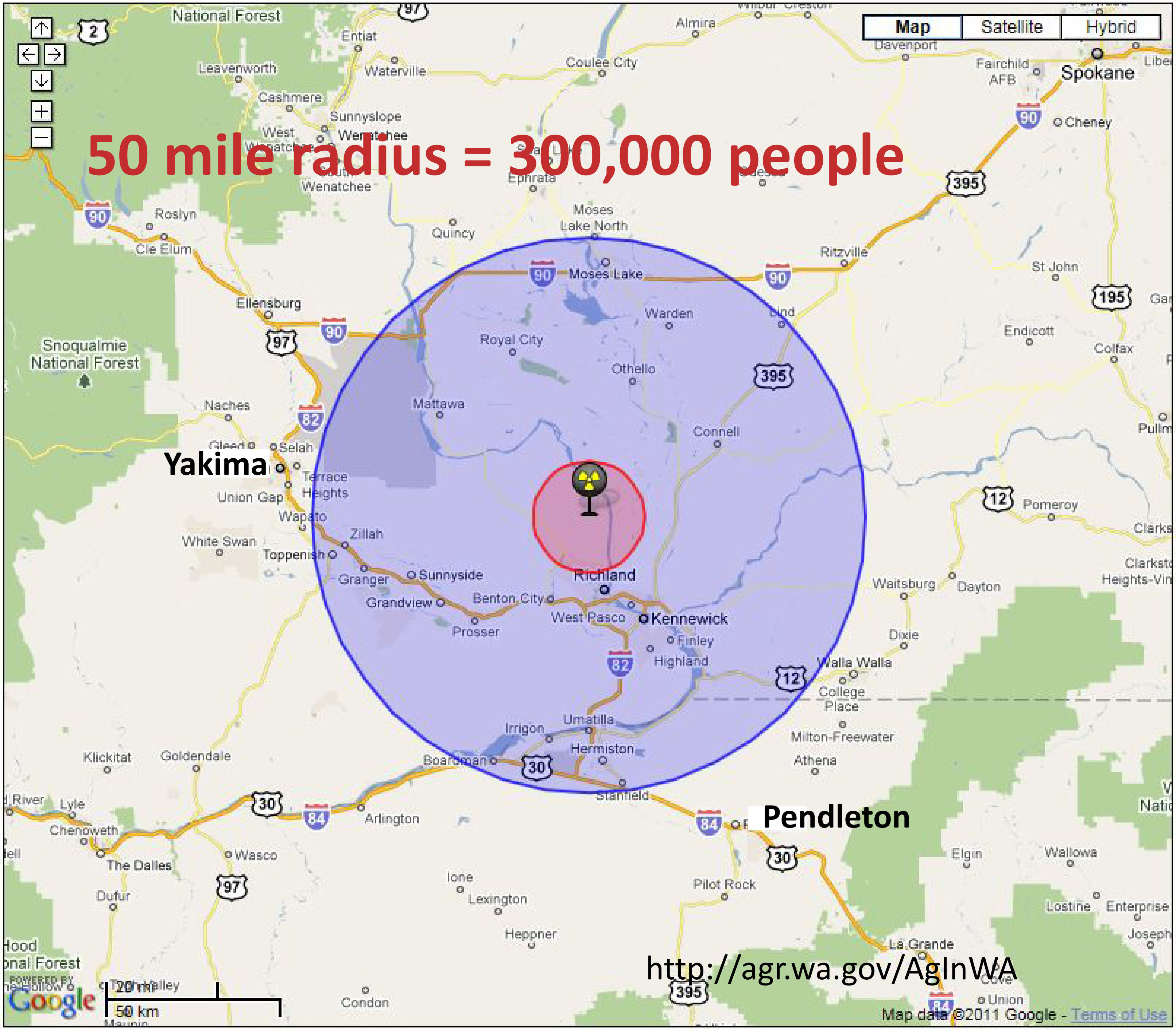
Devastation of the Columbia River as we know it

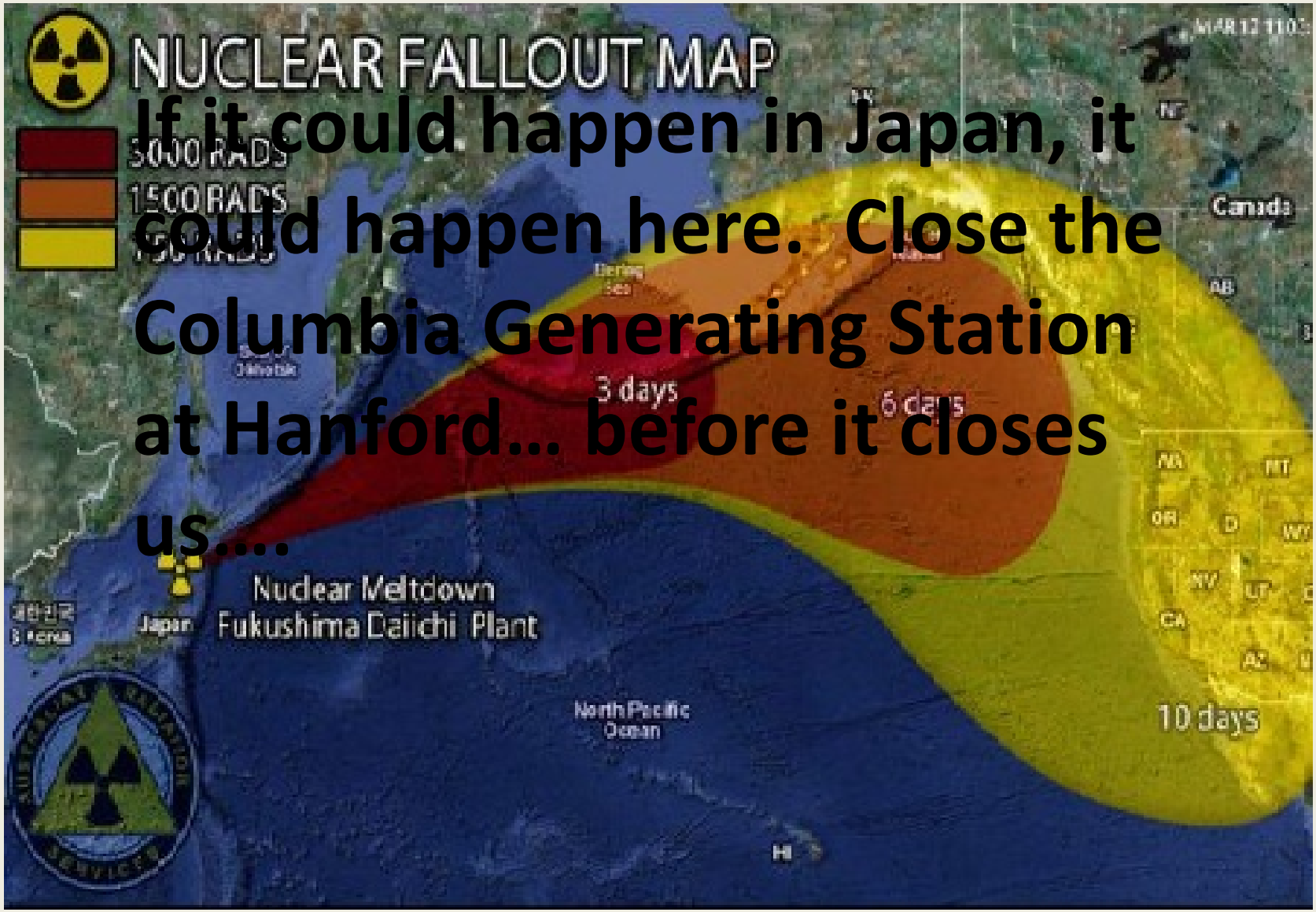
Contamination of food and water on a large scale

Displacement of large groups of residents, some permanently

Major economic impact on industries and farms

Hundreds of square miles of land made uninhabitable


50 mile radius = 300,000 people
Yakima
Pendleton
http://agr.wa.gov/AgInWA
Map
Satellite
Hybrid
National Forest
Entiat
Leavenworth
Waterville
Cashmere
Sunnyslope
Wenatchee
Coulee City
Almira
Davenport
Fairchild AFB
Spokane
Cheney
Ephrata
Roslyn
Cle Elum
Quincy
Moses Lake North
Moses Lake
Ritzville
St John
Ellensburg
Warden
Lind
Endicott
Colfax
Royal City
Othello
Snoqualmie National Forest
Naches
Mattawa
Connell
Selah
Terrace Heights
Union Gap
Wapato
Zillah
White Swan
Toppenish
Pomeroy
Granger
Sunnyside
Richland
Waitsburg
Dayton
Grandview
Benton City
Prosser
West Pasco
Kennewick
Finley
Highland
Dixie
Walla Walla
College Place
Milton-Freewater
Irrigon
Umatilla
Hermiston
Athena
Boardman
Stanfield
Klickitat
Goldendale
Lyle
Chenoweth
Arlington
The Dalles
Wasco
Dufur
Ione
Lexington
Heppner
Pilot Rock
Elgin
Wallowa
Lostine
Enterprise
La Grande
Union
Condon
20 mi
50 km
Map data ©2011 Google - Terms of Use



source: www.fabioghioni.net

Time to take action.

Time to take local action.

Contact these people, and tell them to close the CGS nuclear reactor on the Columbia River, before it closes us.

Mike O'Brien, (Chair of the Energy and Environment Committee)
Seattle City Council
PO Box 34025
Seattle, WA 98124-4025
206-684-8800
mike.obrien@seattle.gov

Jorge Carrasco, Superintendent
Seattle City Light
PO Box 34023
Seattle, WA 98124-4023
206-684-3200
jorge.carrasco@seattle.gov

Learn more at:

shutdowncgs.wordpress.com

The Nuclear Free Northwest Coalition

To give this presentation, contact:

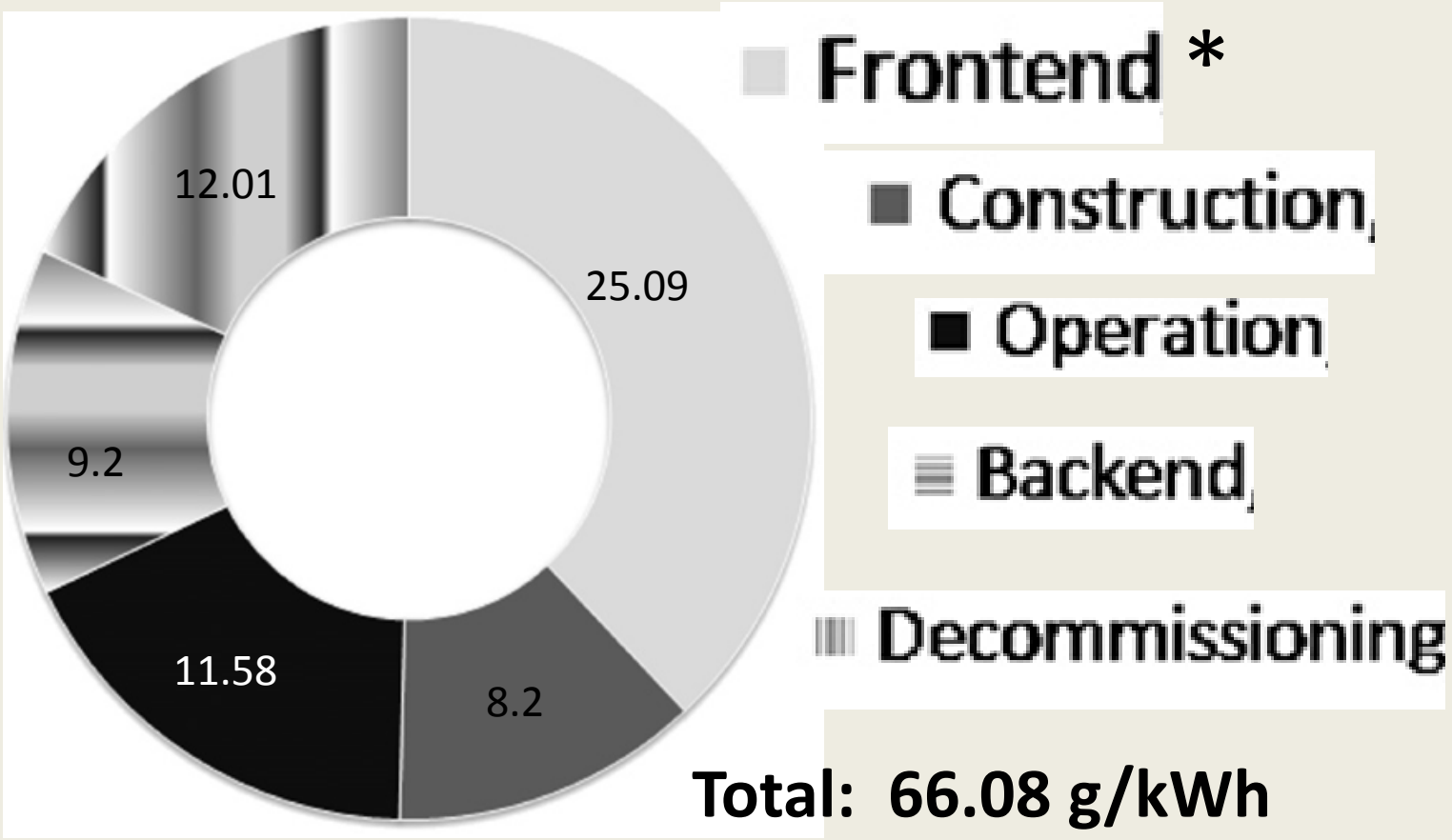
David Hill
davidcitizen@msn.com
503-230-0522

To contribute to this presentation:
www.gofundme.com/why-not-nuclear

www.davidhillconsulting.com
2013

Nuclear power is *NOT* carbon-free!

Carbon Emitted per Kilowatt



Total: 66.08 g/kWh

*Uranium mining