Part 1. Strategic Changes for ANS

Part 2. Nuclear, It's Criminalization, and LNT

American Nuclear Society

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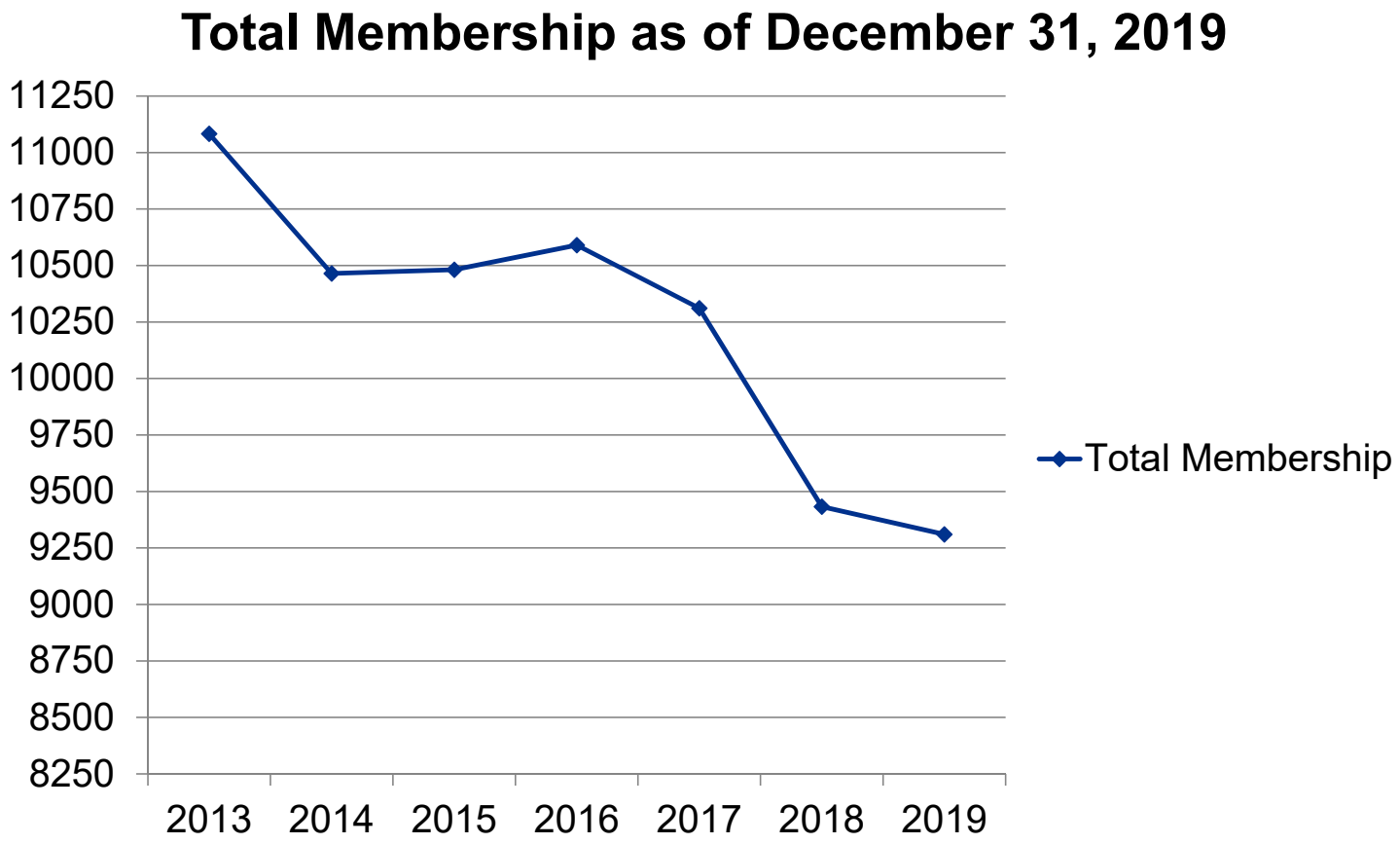
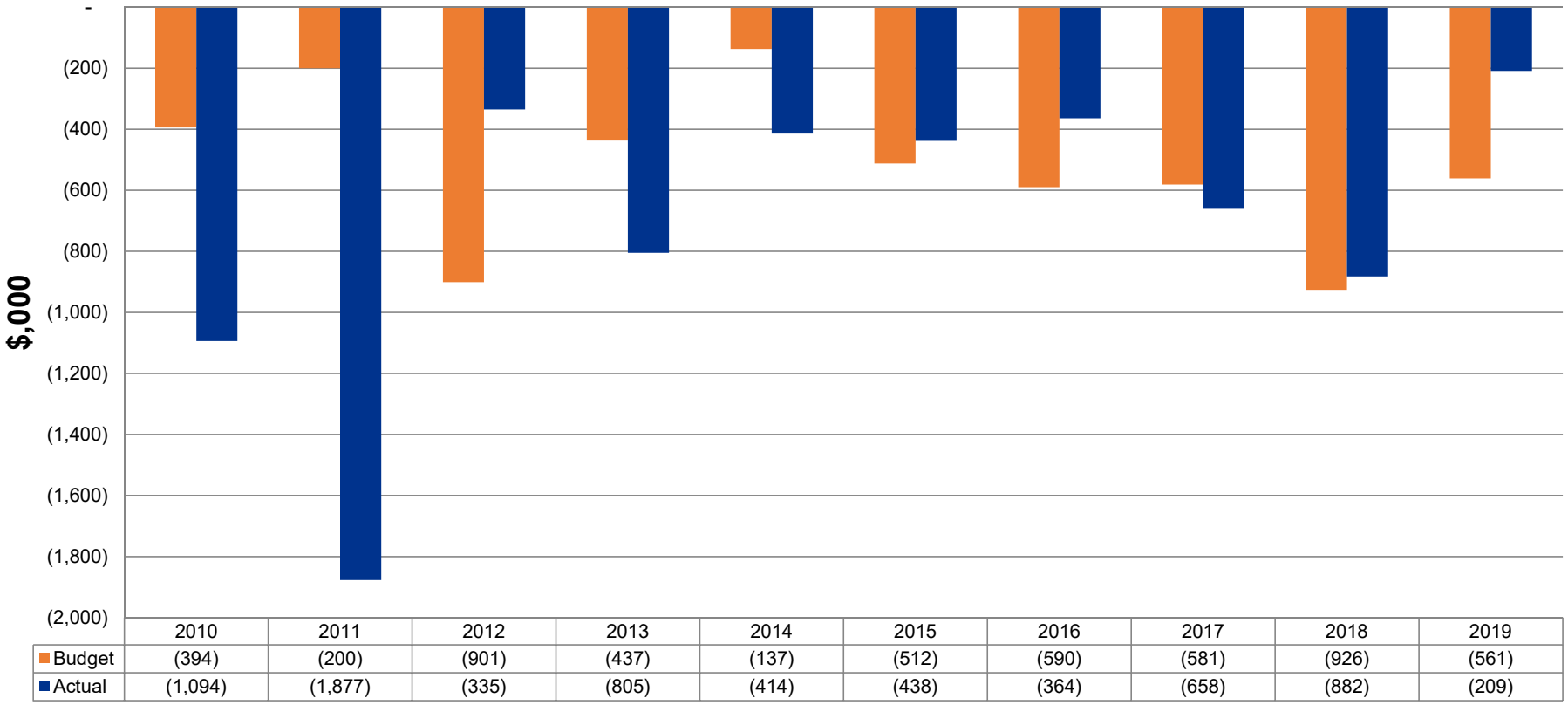
Part 1. ANS Change Plan 2020

- Continuing downward trend in membership and upward trend in budget deficit demanded change

Membership Trends - Overall



Operating Deficits



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Budget	(394)	(200)	(901)	(437)	(137)	(512)	(590)	(581)	(926)	(561)
Actual	(1,094)	(1,877)	(335)	(805)	(414)	(438)	(364)	(658)	(882)	(209)

ANS Change Plan 2020

- Continuing downward trend in membership and upward trend in budget deficit demanded change
- Change Plan 2020 developed by group of past Presidents and Board members
- Board passed Change Plan in June 2019 and Implementation Plan in November 2019
- Overall objectives
  - More strategic fundraising and targeted spending to serve members
  - Stabilize and grow membership numbers
  - Improve member benefits (e.g. new member service center)
- New Executive Director/CEO, Craig Piercy, hired late 2019
  - HQ operational review January-February
  - Reorganization/IT upgrades

2020 Annual Meeting

- COVID-19 pandemic required cancellation of in-person meeting (including hotel contract cancellation penalty)
- Had to go virtual or go dark
- Heroic staff put together completely virtual, very successful meeting
  - More than 2300 registrants!
  - Would have generated revenue, but for hotel contract cancellation fee
  - Numerous institutions asked how we did it after the fact (e.g. HPS)
- Plenary and technical sessions recorded for later viewing by registrants
- Kudos to staff, who did all of this after an emotional reorganization and while working remotely due to COVID!

Going forward . . .

Inward facing (members and societal function)

Dual mode (in-person/virtual) meeting organization

Continuing implementation of Change Plan 2020

Outward facing (members and the public)

Changing the way nuclear is viewed, starting by changing the way we, as members, *think about nuclear*

Part 2. Nuclear: Why the Resistance?

Nuclear energy has become the cleanest, safest, most reliable and scalable source of energy on the planet.

Even in the age of Climate Alarmism, nuclear is not considered THE answer . . .

Some quotes….

NASA

Although NASA's main focus is not on energy-technology research and development, work is being done around the agency and by/with various partners and collaborators to find viable alternative sources of energy to power our needs. These sources of energy include the *wind, waves, the Sun and biofuels*.

https://climate.nasa.gov/solutions/adaptation-mitigation/

EPA

- Green Power Partnership
- Coal, oil, natural gas, nuclear are **"least beneficial"** to the environment (interesting standard)
- Solar, wind, geothermal, biogas, biomass, and low-impact hydropower are "most beneficial" to the environment

(https://www.epa.gov/greenpower/what-green-power)

And not just government

Google

Committed to buy “enough wind and solar electricity annually to account for every unit of electricity our operations consume, globally”

(https://sustainability.google/projects/announcement-100/)

Amazon

“Committed to using 100% renewable energy across our global infrastructure”

Supports 70 renewable energy projects

- Solar
- Wind

(https://sustainability.aboutamazon.com/environment/sustainable-operations/renewable-energy)

And of course

Sierra Club

Ready for 100 campaign advocates for communities to commit to “transition to 100% clean, renewable sources of energy, like wind, solar, and battery storage.”

https://www.sierraclub.org/ready-for-100

Greenpeace

Recommends, “The path forward is an immediate halt to new oil, gas, and coal development in the U.S. and a managed phase out of existing fossil fuel production consistent with safe climate limits.”

https://www.greenpeace.org/usa/reports/fossil-fuel-phaseout/

What's going on? What's behind the animosity?

Consider the environmentalist premise . . .

The natural world is good.
Changing the natural world is bad.
Humans change the natural world, so *humans are bad*.

Premise evidenced by statements such as . . .

The small-world, zero-population-growth, soft-energy-path faction of the environmental movement that emerge across the 1960s and 1970s [illegible] ... arguments "more power plants create more industry," [the Sierra Club's executive director complained], that in turn invites greater population density." (From Richard Rhodes' in Energy: A Human History, 2018)

[illegible] ... Sapiens should decide to rejoin nature, some of us can only hope for the right virus to come along.

https://www.forbes.com/sites/michaelshellenberger/2018/06/11/if-nuclear-power-is-so-safe-why-are-we-so-afraid-of-it/#3e1cd4c96385

Which stands in stark contrast to promise of nuclear

"Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine and other peaceful activities. A special purpose would be to provide abundant electrical energy in the power-starved areas of the world."

President Eisenhower, Atoms for Peace speech (1953)

https://www.forbes.com/sites/michaelshellenberger/2018/06/11/if-nuclear-power-is-so-safe-why-are-we-so-afraid-of-it/#3e1cd4c96385

But aren't humans natural, too?

- We are part of this world
- We evolved over time, along with other species
- However, different from other species, our evolution included developing the capability to reason, to think
- THAT is why we thrive
- We don't have the physical attributes to thrive and nature doesn't provide what we need to thrive
- We understand and harness nature to create benefits
- We thrive because we are able to "change nature"

“Changing nature” is what scientists and engineers do!

- Harness otherwise useless resources and change them to make them useful (Alex Epstein, industrialprogress.com)
- Extract coal/oil/natural gas and uranium to make electricity
- Wind, solar and hydropower also not possible without resource extraction
  - petroleum for wind turbines
  - rare earth elements for solar panels
  - iron for hydroturbines
- Wind and solar not viable without backup from hydro, fossil, nuclear

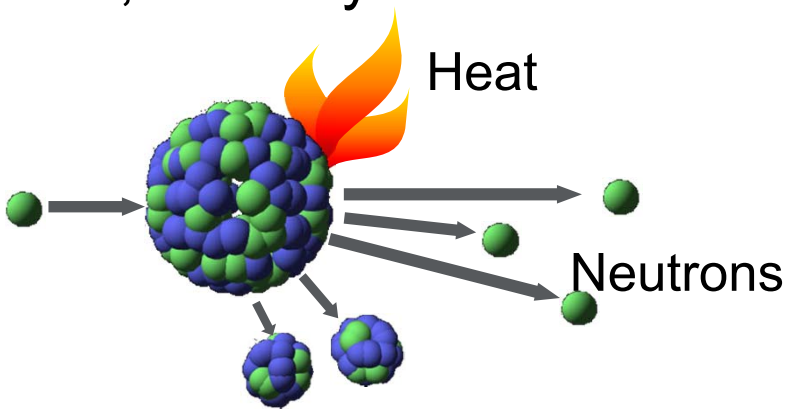
The anti-human flourishing worldview leads to . . .

Pressure to increase regulations

Associated litigation

The “criminalization of nuclear”*

- Nuclear is offensive to some because we understand and exploit the energy of the nucleus, the very foundation of all matter



(*Alex Epstein, Industrial Progress)

If Mary Lou were Empress

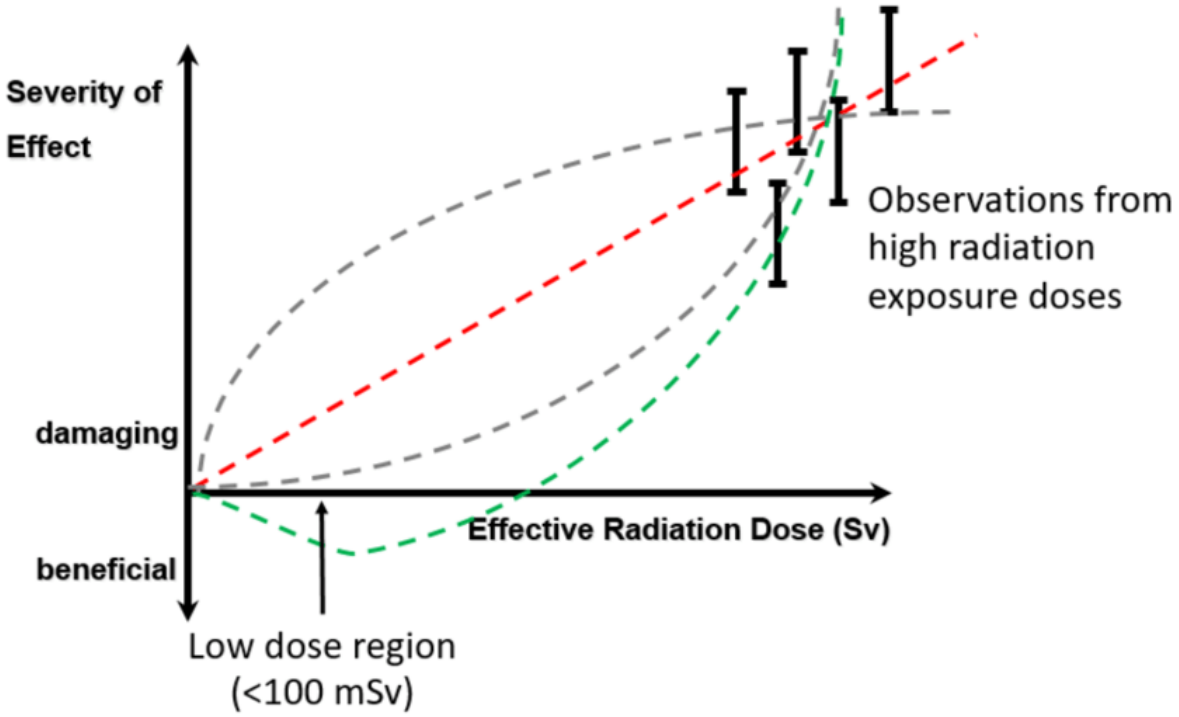
(Disclaimer: not ANS or ISU veiws) . . .

1. No more subsidies for any kind of power production
   - Get rid of “feed through tariffs” (guaranteeing above market price for renewable feed to grid)
2. Truly free energy market with consumer choice of power source and associated cost
   - Get rid of “renewable portfolio standards” (requiring some % renewable)
3. Privatize nuclear waste management
4. Make regulations commensurate with risk, rather than based on very flawed Linear No Threshold (LNT) hypothesis and ALARA

For this discussion, let's focus on LNT/ALARA

Linear No Threshold hypothesis

- 0 dose = zero risk
- Therefore 0 is the goal, because we want 0 risk (As Low As Reasonably Achievable)



- Completely unsubstantiated at low doses
- "Low-dose responses are non-linear at all levels of biological organization (molecular, cellular, tissue, organism) and suggest that LNT overestimates risk" (Tony Brooks, radiation oncologist)

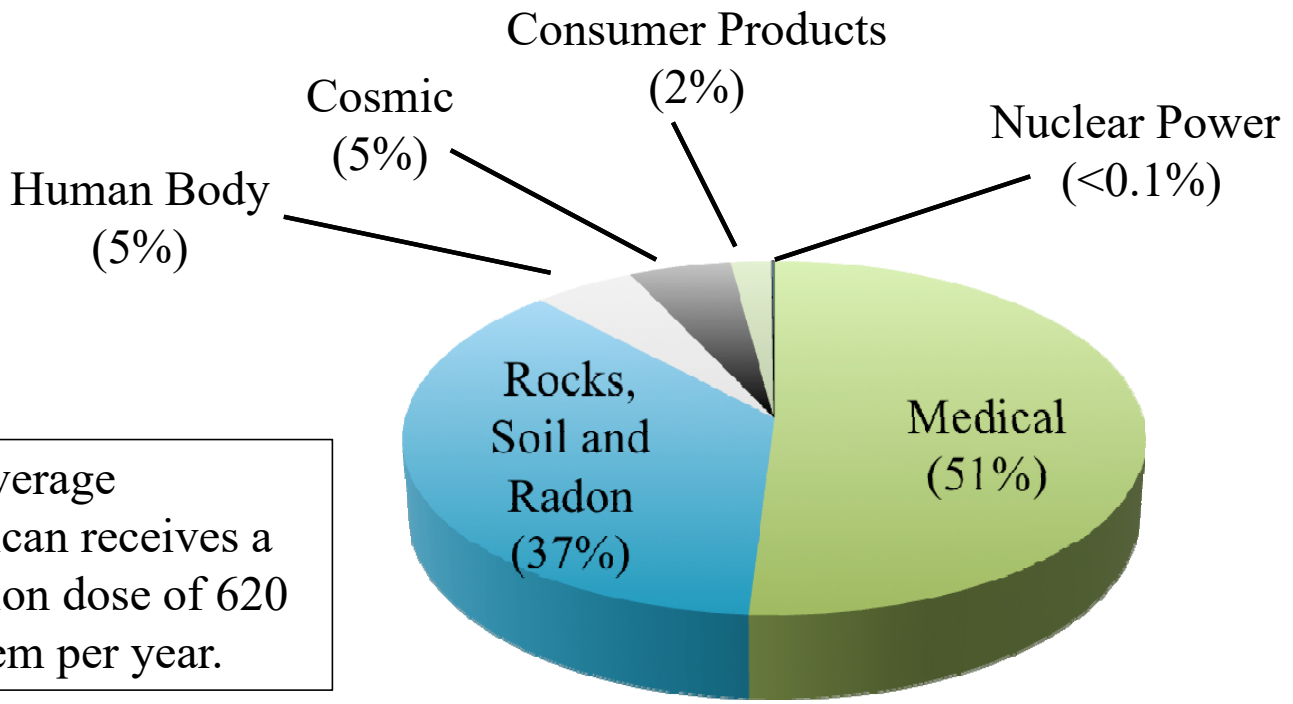
LNT/ALARA

Though scientifically unsubstantiated at all but very high doses, still forms the basis for ALL nuclear-related legislation

Increased regulation → increased cost with no added benefit

- Regulated dose limit to general public from nuclear power must be less than 100 mrem/yr
- Our average dose from natural background is ~ 300 mrem/yr, with another ~ 300 mrem/yr from medical procedures

Sources of average radiation dose in the US



The average American receives a radiation dose of 620 millirem per year.

Source: National Council on Radiation Protection and Measurement Report 160 (2006)

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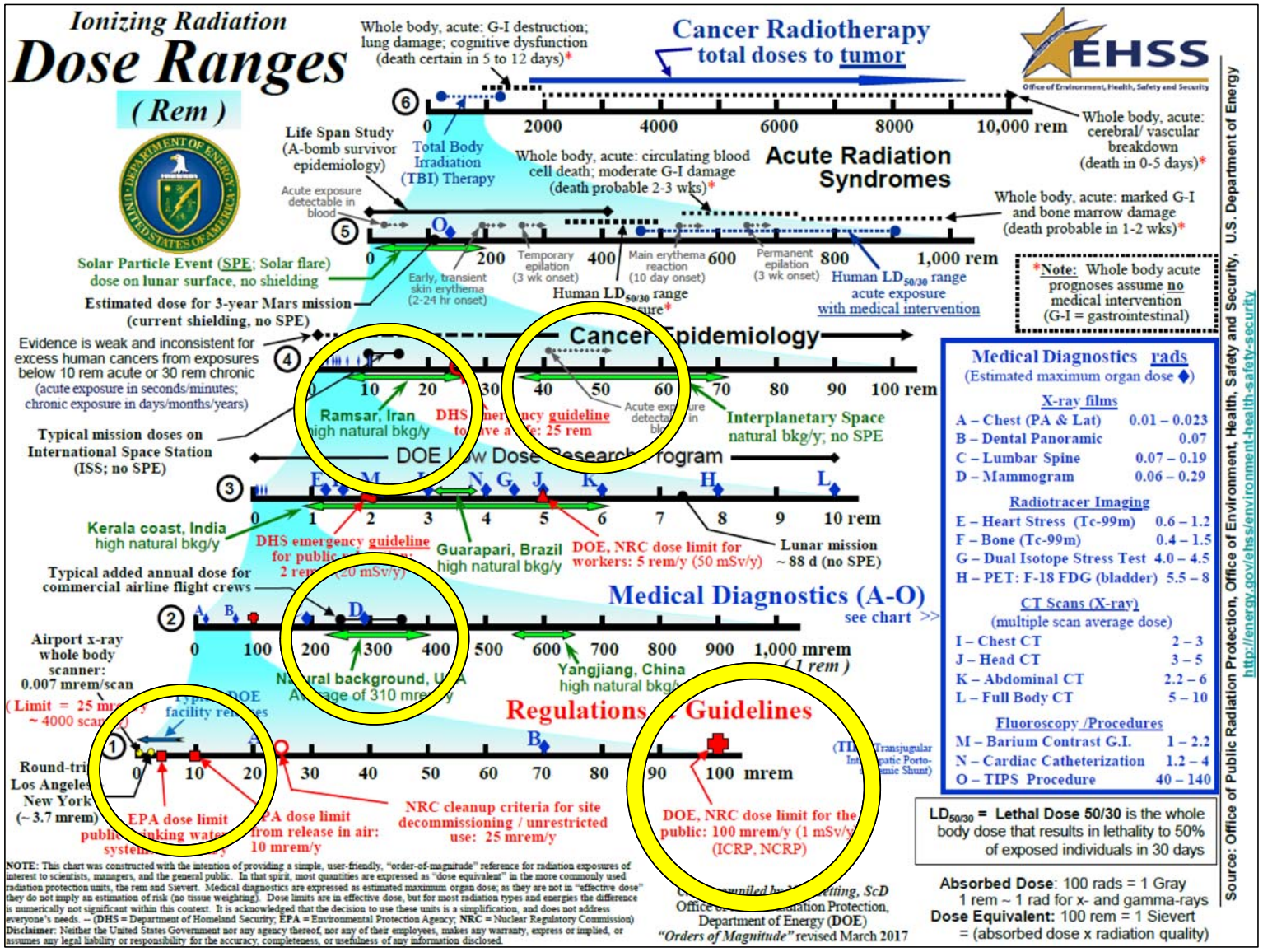
- According to Health Physics Society, average person's cancer risk from adding 50-100 mrem to annual radiation exposure is "not statistically different from zero"


Ionizing Radiation
Dose Ranges
(Rem)
Whole body, acute: G-I destruction; lung damage; cognitive dysfunction (death certain in 5 to 12 days)*
Cancer Radiotherapy
total doses to tumor
EHSS
Office of Environment, Health, Safety and Security
Life Span Study (A-bomb survivor epidemiology)
Total Body Irradiation (TBI) Therapy
Whole body, acute: circulating blood cell death; moderate G-I damage (death probable 2-3 wks)*
Acute Radiation Syndromes
Whole body, acute: cerebral/ vascular breakdown (death in 0-5 days)*
Whole body, acute: marked G-I and bone marrow damage (death probable in 1-2 wks)*
Acute exposure detectable in blood
Early, transient skin erythema (2-24 hr onset)
Temporary epilation (3 wk onset)
Main erythema reaction (10 day onset)
Permanent epilation (3 wk onset)
Human LD50/30 range acute exposure with medical intervention
*Note: Whole body acute prognoses assume no medical intervention (G-I = gastrointestinal)
Solar Particle Event (SPE; Solar flare) dose on lunar surface, no shielding
Estimated dose for 3-year Mars mission (current shielding, no SPE)
Evidence is weak and inconsistent for excess human cancers from exposures below 10 rem acute or 30 rem chronic (acute exposure in seconds/minutes; chronic exposure in days/months/years)
Cancer Epidemiology
Ramsar, Iran high natural bkg/y
DHS emergency guideline to save a life: 25 rem
Interplanetary Space natural bkg/y; no SPE
Typical mission doses on International Space Station (ISS; no SPE)
DOE Low Dose Research Program
Kerala coast, India high natural bkg/y
DHS emergency guideline for public 2 rem (20 mSv/y)
Guarapari, Brazil high natural bkg/y
DOE, NRC dose limit for workers: 5 rem/y (50 mSv/y)
Lunar mission ~ 88 d (no SPE)
Typical added annual dose for commercial airline flight crews
Medical Diagnostics (A-O)
see chart >>
Airport x-ray whole body scanner: 0.007 mrem/scan
(Limit = 25 mrem/y ~ 4000 scans)
Natural background, USA Average of 310 mrem/y
Yangjiang, China high natural bkg
(1 rem)
Regulations & Guidelines
Round-trip Los Angeles New York (~ 3.7 mrem)
EPA dose limit public drinking water system
EPA dose limit from release in air: 10 mrem/y
NRC cleanup criteria for site decommissioning / unrestricted use: 25 mrem/y
DOE, NRC dose limit for the public: 100 mrem/y (1 mSv/y) (ICRP, NCRP)
Medical Diagnostics rads
(Estimated maximum organ dose)
X-ray films
A – Chest (PA & Lat) 0.01 – 0.023
B – Dental Panoramic 0.07
C – Lumbar Spine 0.07 – 0.19
D – Mammogram 0.06 – 0.29
Radiotracer Imaging
E – Heart Stress (Tc-99m) 0.6 – 1.2
F – Bone (Tc-99m) 0.4 – 1.5
G – Dual Isotope Stress Test 4.0 – 4.5
H – PET: F-18 FDG (bladder) 5.5 – 8
CT Scans (X-ray)
(multiple scan average dose)
I – Chest CT 2 – 3
J – Head CT 3 – 5
K – Abdominal CT 2.2 – 6
L – Full Body CT 5 – 10
Fluoroscopy /Procedures
M – Barium Contrast G.I. 1 – 2.2
N – Cardiac Catheterization 1.2 – 4
O – TIPS Procedure 40 – 140
LD50/30 = Lethal Dose 50/30 is the whole body dose that results in lethality to 50% of exposed individuals in 30 days
Absorbed Dose: 100 rads = 1 Gray
1 rem ~ 1 rad for x- and gamma-rays
Dose Equivalent: 100 rem = 1 Sievert
= (absorbed dose x radiation quality)
Source: Office of Public Radiation Protection, Office of Environment, Health, Safety and Security, U.S. Department of Energy
http://energy.gov/ehss/environment-health-safety-security
NOTE: This chart was constructed with the intention of providing a simple, user-friendly, "order-of-magnitude" reference for radiation exposures of interest to scientists, managers, and the general public. In that spirit, most quantities are expressed as "dose equivalent" in the more commonly used radiation protection units, the rem and Sievert. Medical diagnostics are expressed as estimated maximum organ dose, as they are not in "effective dose" they do not imply an estimation of risk (no tissue weighting). Dose limits are in effective dose, but for most radiation types and energies the difference is numerically not significant within this context. It is acknowledged that the decision to use these units is a simplification, and does not address everyone's needs. -- (DHS = Department of Homeland Security; EPA = Environmental Protection Agency; NRC = Nuclear Regulatory Commission)
Disclaimer: Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed.
Department of Energy (DOE)
"Orders of Magnitude" revised March 2017

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- According to Health Physics Society, average person's cancer risk from adding 50-100 mrem to annual radiation exposure is "not statistically different from zero"
- Significant resources go into getting doses lower than natural background

Case study: Impacts of LNT-based, overly conservative dose limits

Public	Dirty Harry weapons test (1953)	Fukushima accident (2011)
Regulated dose limit (mrem/yr)	3900	100
Dose limit for considering evacuation	250,000-500,000 mrem	100 – 2000 mrem/yr
Max dose rate from event (mrem/h)	340	4.5
Projected dose from event if no evacuation (mrem/yr)	3000	1000 -5000
Dose impact	None	None
Other impact	Occasional “shelter in place” orders	Evacuation of > 100,000 people ~2300 deaths due to evacuation ~20,000 deaths due to earthquake & tsunami Significant mental/emotional strain

Bruce W. Church & Antone L. Brooks (2020): Cost of fear and radiation protection actions: Washington County, Utah and Fukushima, Japan {Comparing case histories}, International Journal of Radiation Biology, DOI: 10.1080/09553002.2020.1721595

Why the difference?

Then

- Higher dose limits for the public
- Less knowledge about effects of low dose

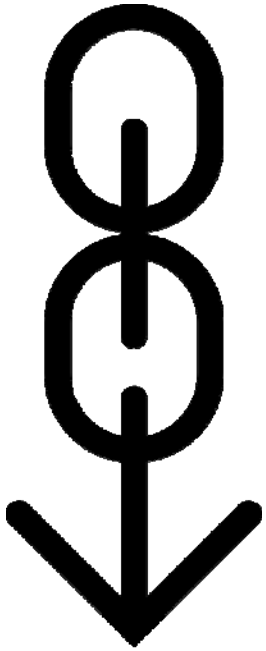
www.youtube.com/watch?v=If5msUhcOUQ

Now

- Lower dose limits for the public
- Much more knowledge about effects of low dose (Tony Brooks, Radiation Oncologist)
  - LNT is scientifically dead for low-dose risk assessment
  - Radiation is a poor mutagen and carcinogen
  - Low dose and dose rate radiation cancer risk is very small and very difficult to detect
  - Fear of low dose radiation and radiation protection kills people and is very expensive

https://www.youtube.com/watch?v=UfS53M-KqwY

LNT – an *impediment* to expansion of nuclear power and therefore inhibiting human flourishing



- Historically, human life on earth is *better than ever for many of us*
- Humans thrive when they have access to *plentiful, safe, and reliable* energy
- Nuclear excels at all of these
- Nuclear has become expensive for various reasons: *one* of them is regulation of potential radiation dose to levels well below natural background levels (adding considerable expense)
- Much of this is based upon the unsubstantiated *Linear No-Threshold Hypothesis*

What can you and I do?

- Alas, I am not the Empress
- We understand why nuclear is not favored
  - Let that understanding inform your interactions with those open to considering nuclear
- We know that LNT/ALARA is a fundamentally incorrect basis for regulating radiation dose for all but very extreme cases
  - Use your voice to communicate about the benefits of nuclear and the actual risk of radiation

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1ANS

Unity, community, and alignment among members at every level and each constituent unit of ANS

Center for Nuclear Science and Technology Information

An Initiative of the American Nuclear Society

NuclearConnect.org