

# Sachiko: A Nagasaki Bomb Survivor's Story

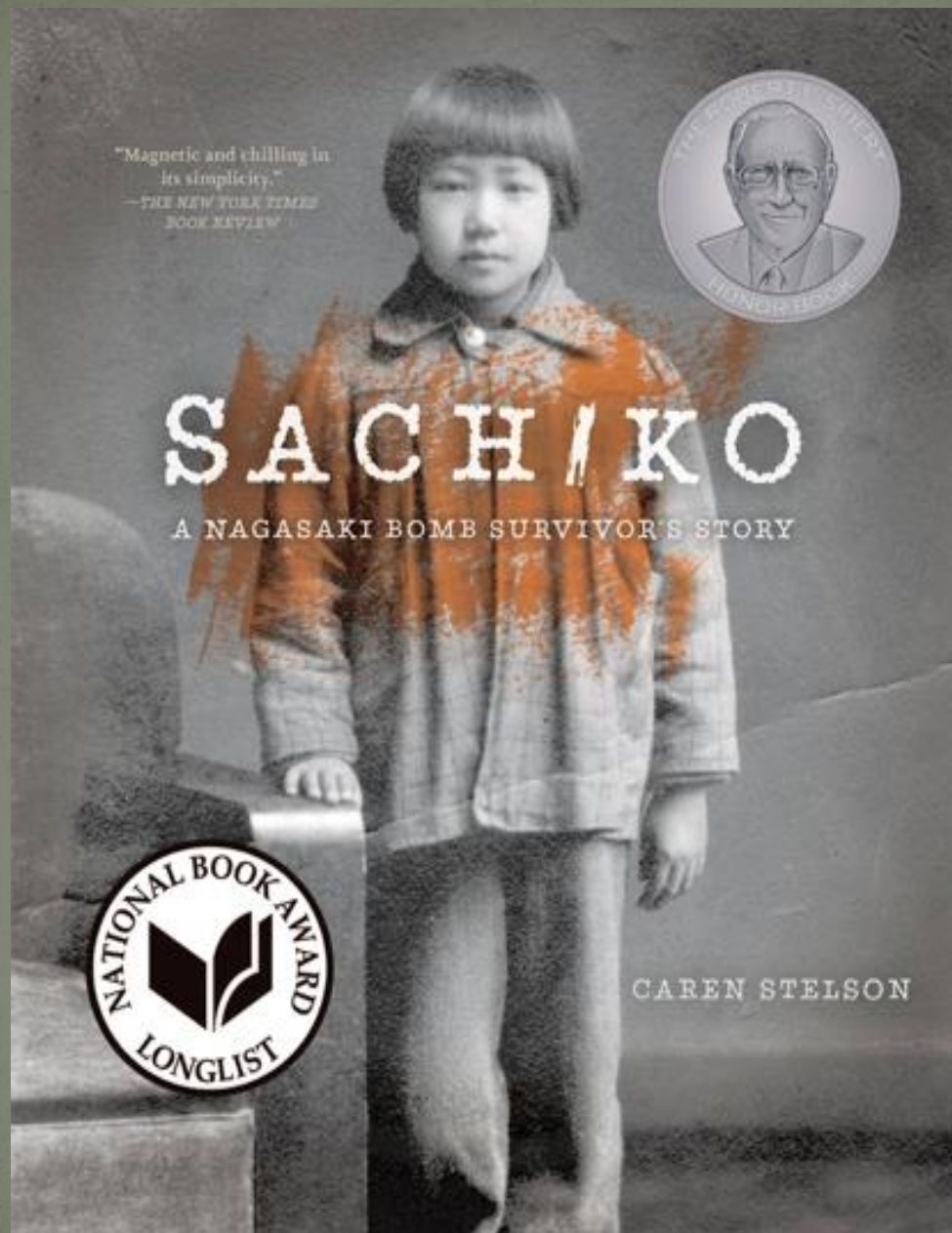
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Medical Professionals Learn About Ionizing Radiation Effects on  
Human Health and Prevention of Nuclear Disasters

In Honor of Dr. Jeff Patterson







Sachiko Yasui was 6 years old on August 9, 1945 when the U.S. detonated "Fat Man," the second atomic bomb used in combat over Nagasaki. At 11:02 am, Sachiko was playing "house" outside with friends, 900 meters from Ground Zero. She lost 23 members of her family to the bomb.

Today she is a peacemaker in Japan.



Sachiko Yasui and Caren Stelson

2010





**SURVIVAL  
UNDER  
ATOMIC ATTACK**

THE OFFICIAL U. S. GOVERNMENT BOOKLET

# Monica Vohmann, MD

- Grew up in West Germany and with peace demonstrations against stationing of nuclear weapons in the divided Germany in the mid-1980's
- Trying to understand the effects of the Chernobyl Nuclear disaster as a 15 year old in Europe
- Working with Physicians for Social Responsibility
- No training in medical school or residency on nuclear disasters and ionizing radiation exposures – how can we prevent these and how respond in case of exposures.



# Nuclear Disasters and Preparedness ???

- Nuclear war and power plant disasters cannot be “prepared for”
- AMA, Red Cross, IPPNW & others agree on Ban for Nuclear Weapons
- UN banned nuclear weapons in June of 2017
- Issues in caring for victims:
  - Radiation exposure to caregivers & first responders
  - Difficult to triage most severe injuries
  - Hospitals and medical clinics likely not usable
- South Miami Iodine supply as an example



Nagasaki had been the pinpoint of western trade when Japan was closed to the world. Nagasaki Medical School and hospital blended eastern and western medicine. The atomic blast destroyed the Nagasaki medical school and hospital, a near direct hit. First aid stations were also destroyed. Of the appr. 70 doctors in private practice in the city, twenty were dead and twenty more seriously wounded. Only 30 were available to help the mass of A-bomb victims.





This map of Japan shows the principal industrial cities which were burned out by 8-29 incendiary attacks. Figures indicate what per cent of the city was destroyed. For comparison, each city is paired with U.S. city of approximately the same size.

The U.S. firebombed with approximately 62 Japanese cities before detonating atomic bombs over Hiroshima and Nagasaki.

The Tokyo firebombing of March 9-10, 1945 by the U.S. was the single most destructive raid during WWII and the first use of napalm. Houses made of wood and paper went up in flames. More than 100,000 Japanese died, a million left homeless.





Sachiko, age 8, two years after the bombing.



An early photo of Sachiko's brothers, Ichiro and Aki..





# Nagasaki Map

There is little chance for human survival within a quarter mile, and as the wave travels farther out and weakens, it can shatter glass within half to three quarters of a mile (initial blast)

Blinding flash and heat causes burns and fires

Immediate Radiation

Fallout Radiation





# Radiation Basics

- What happens with explosion of a nuclear bomb?
  - Initial blast releases 50% of bomb's energy as pressure
  - Blinding flash emitting heat - 35% of energy
  - Prompt radiation is 5% of bomb energy
  - Long-term fallout 10% - depends on wind and rain
- Ionizing Radiation
  - energy moving through space able to break apart atoms and molecules - x-rays, unstable isotopes that decay
- Linear exposure
  - more radiation = more cancer, no threshold
  - accumulates over lifetime, no safe dose
- LD<sub>50</sub> - lethal dose in 50%, exposures of 3500 mSv+

# Radiation Basics

- Radiation is measured in many ways, can be intimidating/confusing
  - (milli) Sievert (Sv or mSv), REM
    - effective dose, measure of potential for biologic damage
  - Gray (Gy) = 100 rads
    - 1 Joule of energy deposited in 1 kg mass
    - measures amount of energy actually deposited
  - Becquerel - often used for measure in food
- Exposure vs. Dose
  - how much we are in contact with vs. how much is received or absorbed
- Absorbed dose (Gy) and effective dose (Sv)



# Radiation Basics

- REM = 10 mSv, Roentgen Equivalent Man
- Roentgen Equivalent Man measure neglects higher vulnerability in population like children, women
- Exposures:
  - 0-200 mSv potential genetic consequences
  - 200-1000 mSv temporary decrease in WBC count
  - 1000-2000 mSv Acute radiation sickness, long term decrease in WBC count
  - 3000-6000 mSv Acute radiation sickness hemorrhage
  - >3500 mSv LD 50 - death in >50%
  - >6000 mSv Eventual death in almost all cases

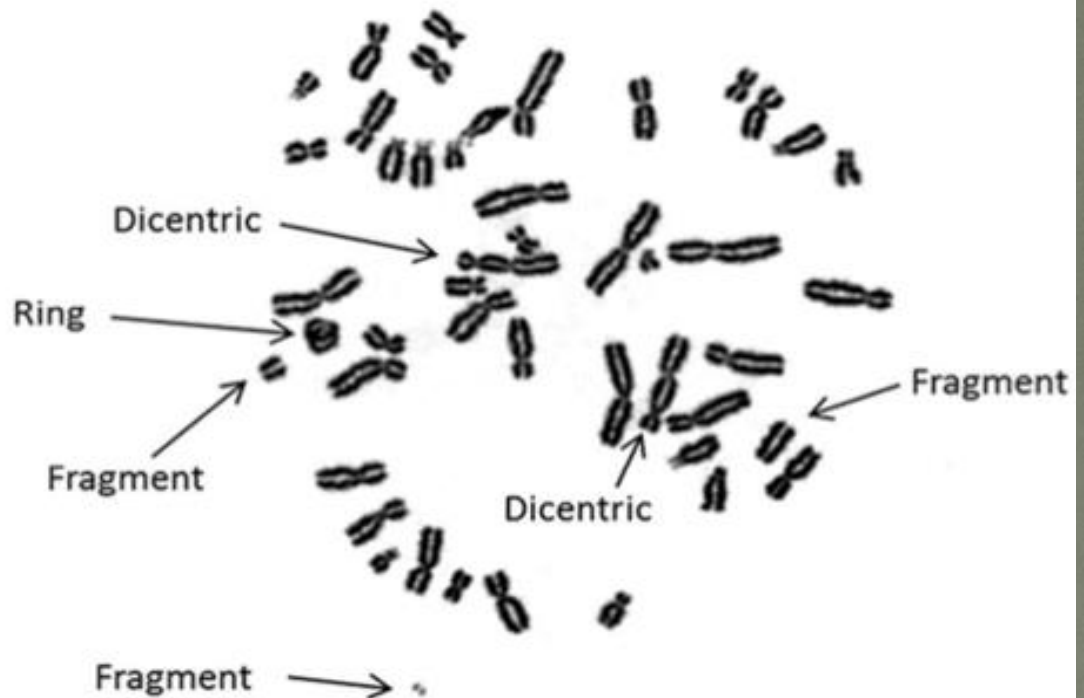
### Some examples of dose rates and doses<sup>10</sup>

Radiation dose rate	Source
<b>Per hour</b>	
12 mSv/hour	Reported value at Daiichi plant boundary (15 March)
250 mSv/hour	Reported level 100 feet above Daiichi reactor, stopping use of helicopters (18 March)
400 m Sv/hour	Reported value at the Japanese nuclear site (15 March)
<b>Per year</b>	
1 mSv/year	Maximum exposure limit for non-occupational exposures (i.e., member of the public) in the United States by a facility licensed by the Nuclear Regulatory Commission
2-3 mSv/year	Average background from natural sources
6.2 mSv/year	Average American exposure from natural <i>and</i> human caused sources according to the US Nuclear Regulatory Commission
1-10 mSv/year	Average exposure by airline flight crews
20 mSv/year	Current limit (averaged) for nuclear industry employees
50 mSv/year	Maximum occupational radiation exposure to adults working with radioactive material in United States by a facility licensed by the Nuclear Regulatory Commission
<b>Radiation dose</b>	<b>Source</b>
0.001 mSv	X Ray (extremity)
0.1 mSv	X Ray (chest)
0.4 mSv	Mammography
1.5 mSv	X Ray (spine)
2 mSv	CT Scan (head)
15 mSv	CT Scan (abdomen and pelvis)
250 mSv	US limit for police officers, firefighters and other emergency workers engaged in life-saving activity
350 mSv <i>per lifetime</i>	Criterion for relocating people after Chernobyl accident
1,000 mSv (or 1 sievert)	Radiation sickness can occur, causing nausea, vomiting, diarrhea and skin blisters
More than 6 Sv	Probable death (1000mSv/hour for 3 hours causes a 50% fatality rate and for 6 hours essentially a 100% fatality rate)

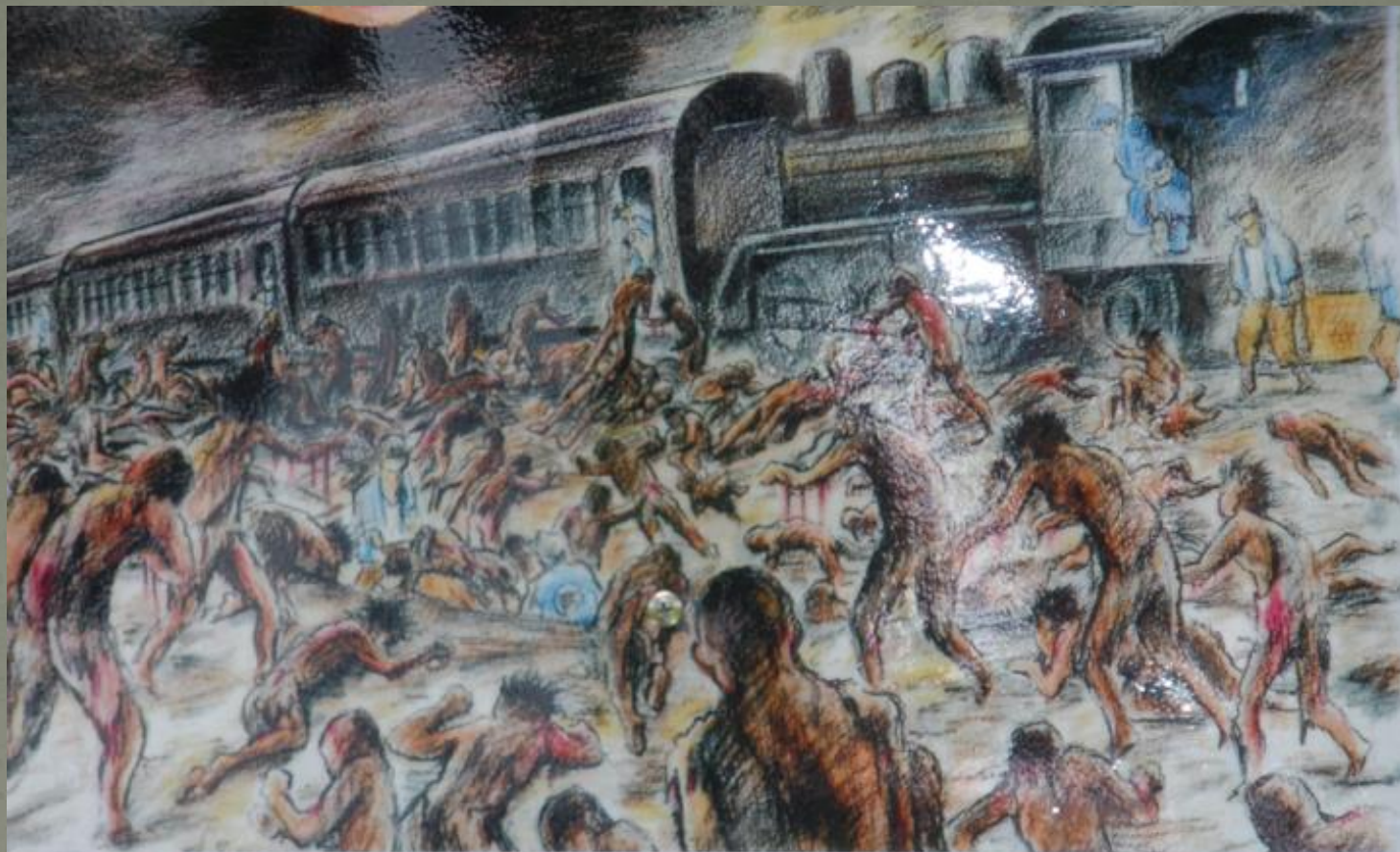


# Radiation Effects

- Harm to DNA
- Harm to tissue protein
- Broken chemical bonds
- Cell death



Chromosomal abnormalities induced by radiation as seen with a microscope



月9日。原爆で破壊された三菱兵器製作所大橋工場で、生き残った早崎猪之助(当時14歳)が  
者とともに救援列車で脱出した。その惨状は生涯忘れることができない。(画・マルモトイツミ)

Drawing of survivors seeking the rescue train to take them out of Nagasaki.



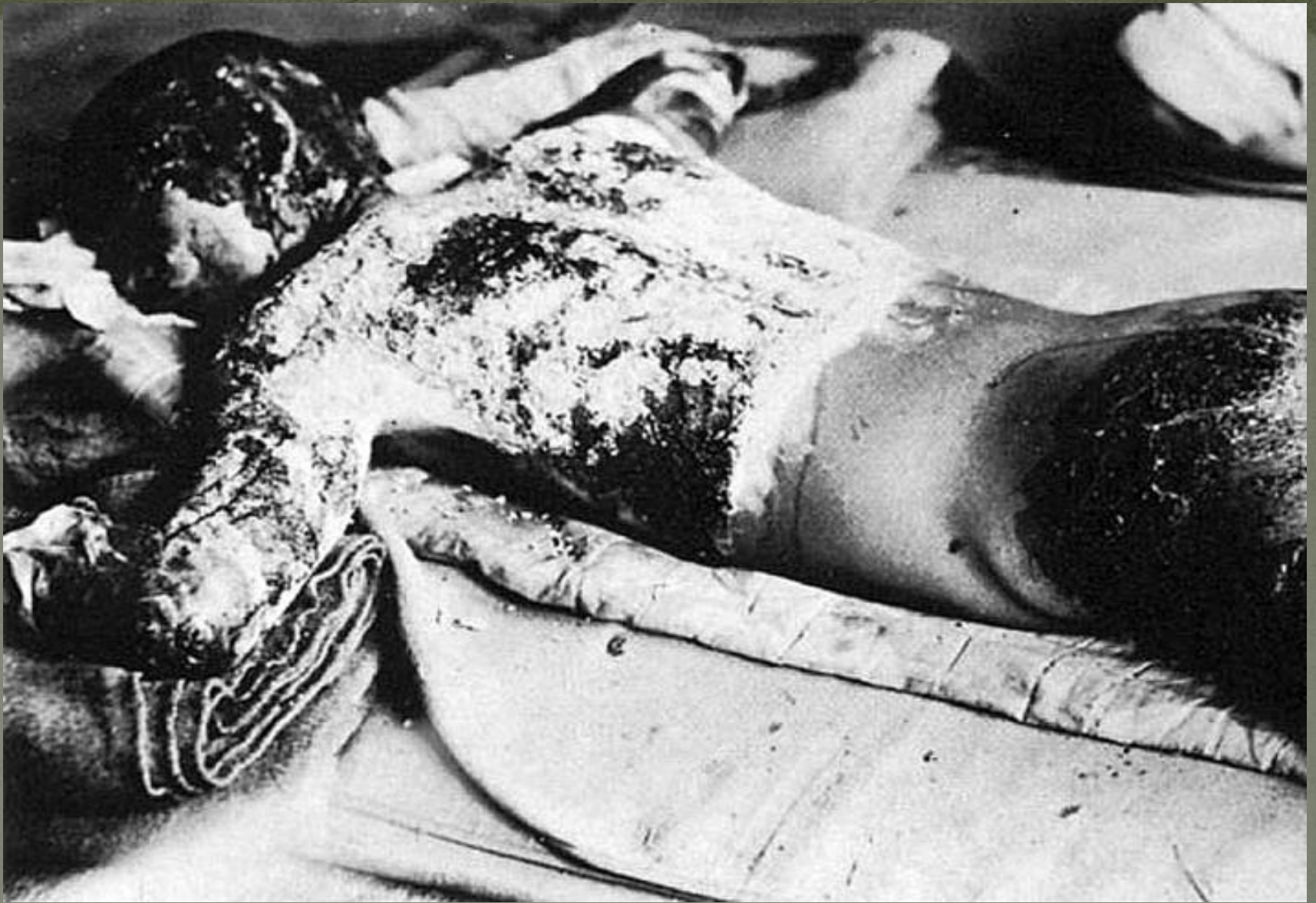
# Acute Radiation Illness

- Exposures of 100-600 REM or 1000-6000 mSv
- Death in 50% of cases at 350+ REM, 3500+ mSv
- Signs and Symptoms:
  - Nausea and vomiting, diarrhea, loss of appetite
  - Skin burns, petechiae
  - Weakness/Fatigue
  - Fainting
  - Inflammation of tissues
  - Mucosal bleeding
  - Anemia, longer term decrease in WBC
  - Hair loss

# Acute Thermal Burns

- Short term consequences of burns medically speaking
  - infection, infection, infection,
    - availability of medical care
    - decreased immunity from radiation exposure
- Disfiguring for life, scarring for life as long term





Atomic bomb victim of flash burns.



Keloid scars from burns.



Acute  
Thermal  
Burns  
Clean-up  
worker

Chernobyl  
1986



# Subacute Phase - weeks to months

- Hair loss
- bleeding gums
- painful mouth and throat sores - difficult to swallow
- Fatigue, headache
- Listlessness
- prolonged, high fever (104 F), delirium
- Anemia, low WBC, low platelet function
- Petechiae and internal bleeding
- High risk for infection
- Decreased thyroid function
- Mental health - Reorganizing life – grieving realities





Victim showing signs of subacute radiation illness, Chernobyl 1986

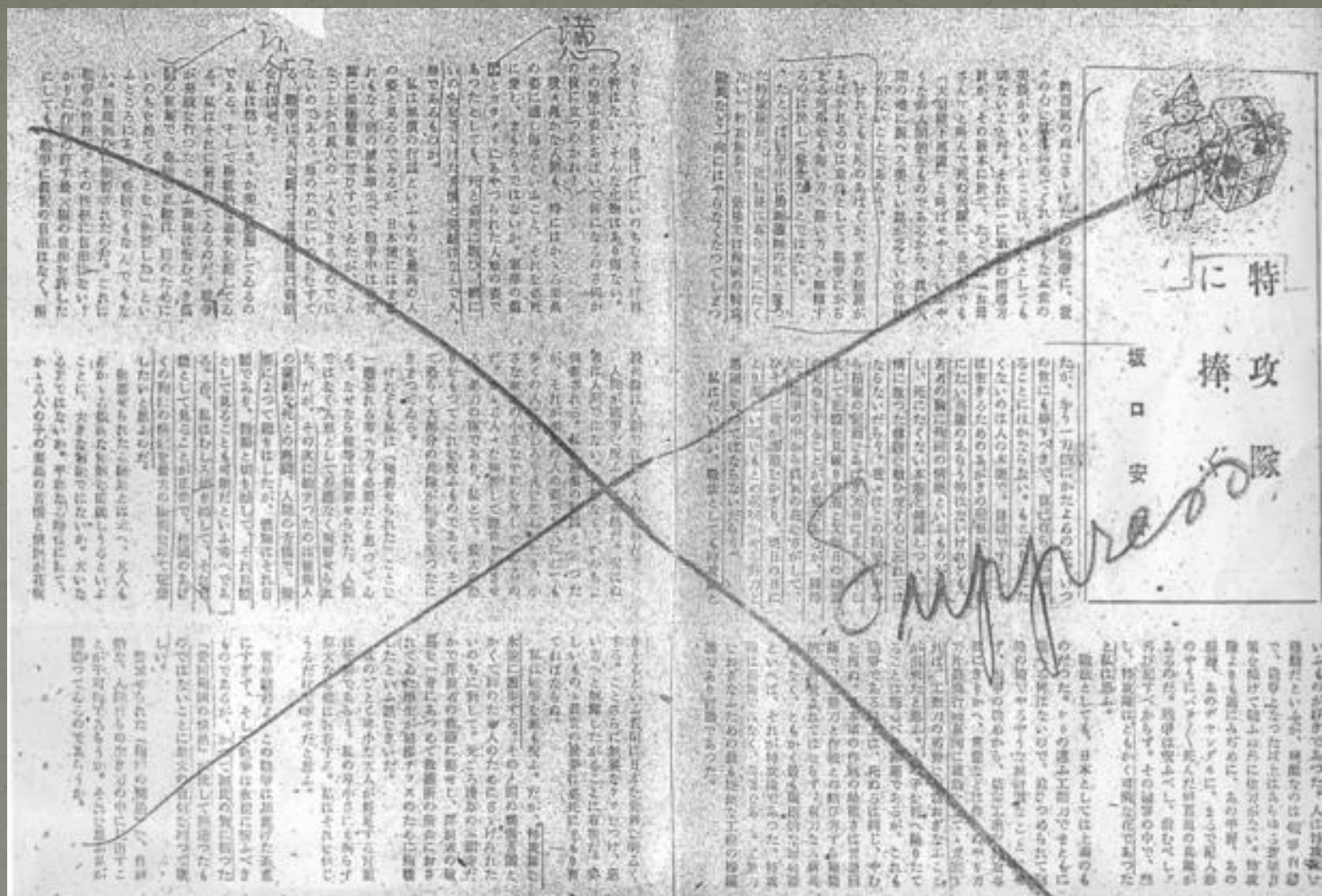
# Nuclear Disaster and Societal Impact

Radiation as the silent and unseen contamination, befouls, penetrates and pollutes, frightens in unique ways, dread lingers on and on (relocating 500,000 people impacted by environmental contamination that persists for at least tens of thousands of years).





Hiroshima and Nagasaki children who were evacuated to the countryside returned home as orphans. Few social services were available for them in postwar Japan..



Censorship of information about the atomic bombing was enforced. No one could even include the word "atomic bomb" in publications. Atomic bomb victims could not speak freely about what had happened to them.





Both American and Japanese doctors working with the Atomic Bomb Casualty Commission in Hiroshima and Nagasaki collected data on bomb victims without offering treatment.

# Contradicting *Facts* – Chernobyl and Fukushima

- Gov't run medical clinics near Fukushima
- Patient complaints - non-gov't “clinics”





# Fukushima March 2011

- 160,000 can never move back
- Communities and families have been ripped apart
  - Men stayed to work to support family
  - Women took children as far away from contaminated areas - did not believe gov't & TEPCO
- People were moved to temporary housing - which probably won't be temporary
- Temporary workers - easy prey for high exposures





# Fukushima March 2011

## Social Disasters

- Discrimination/fear of “contaminated” Fukushima ♀
- Children experiencing ↓ activity [?] ↑ Wt, developing fear of nature
- ↑ Mental illness, alcohol abuse, physical ailments, ex. DVT owing to inactivity on the rise among tens of thousands of Fukushima evacuees still living in temporary housing units.
- Displaced, Abandoned Elders
- Distrust of health experts.

# Radiation Basics II

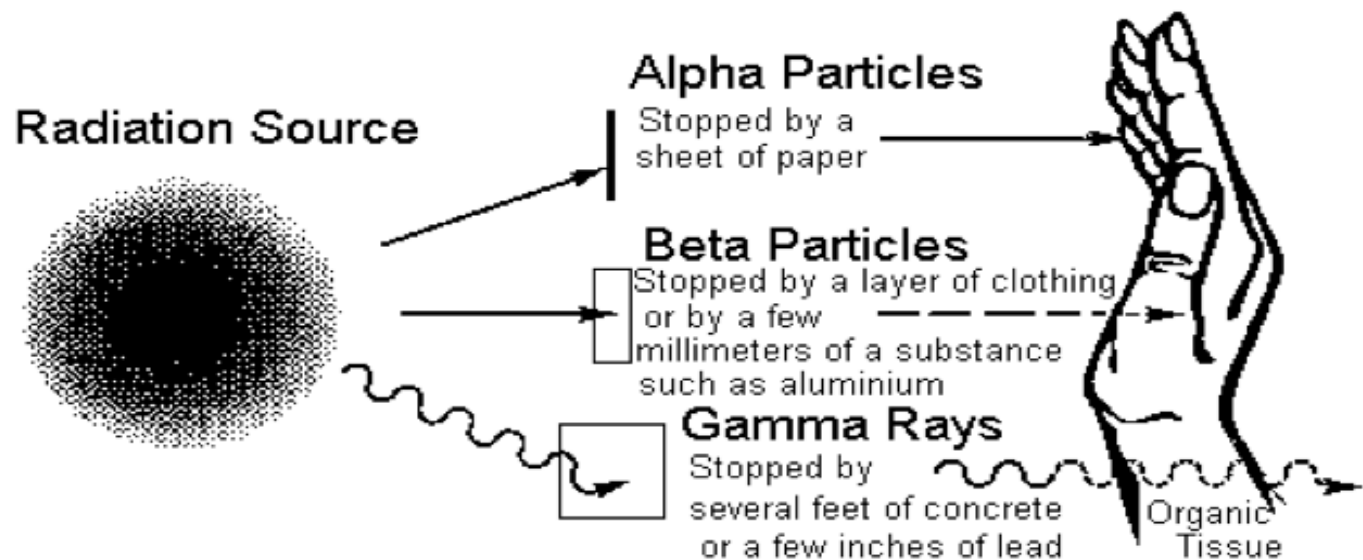
- Radiation induced cancer is indistinguishable from “naturally” induced cancer
- A single radiation exposure is sufficient to increase cancer incidence years later
- There is no safe dose of radiation
  - who decides what is acceptable beyond naturally occurring, regulatory standards
  - Uncontrolled experiment on non-consenting population
- Mistrust of medical establishment and government given censorship, ABCC and “play down” experiences
- Cataracts, heart disease, HTN, thyroid disease



# Radiation Basics II

Ionizing radiation is energy moving through space able to break apart atoms and molecules

## Ionizing Radiation Types



# Radiation Basics II

- Isotopes
  - variation on an element that is unstable and will release radiation as it decays, damages tissues
  - half-life matters - remains in environment until 10 half lives have passed
- Iodine 131
  - when ingested or inhaled goes to thyroid gland
  - half life of 8 days
  - beta and gamma emitter - thyroid cancer
- Plutonium 239
  - alpha emitter, present in Fukushima
  - lungs and if to blood - kidneys
  - half life 24,000 years



# Radiation Basics II

- Cesium 137
  - gets into food supply - plants and animals we eat
  - half-life 30 years
  - distributes widely in body - acts like potassium
  - kidney, liver, heart, solid tumors
- Strontium 90
  - gives off beta radiation
  - half-life of 29 years
  - acts like calcium - teeth and bones
  - causes bone cancer, leukemia and soft tissue cancers around bones.
- Exposures to these isotopes in fallout radiation is determined by how high in the air they were dispersed, wind and rain patterns.

# Nuclear Disasters

Atomic Bombings Hiroshima and Nagasaki 1945

Marshall Islands Hydrogen Bomb Test March 1954

Chernobyl Reactor Meltdown and Fire April 26, 1986

Fukushima 3 Core Meltdown March 11, 2011

1952 Chalk River, Ontario

- Partial core meltdown

1957 Windscale, England

- Graphite reactor fire contaminated 200 square miles

1975 Browns Ferry, Alabama

- Plant caught fire

1976 Lubmin, East Germany

- Near core meltdown

1979 Three Mile Island, Pennsylvania

- Close to total core meltdown.

1999 Tokai Mura, Japan

- Nuclear fuel plant released high levels of radioactive gas

2002 Davis Besse, Ohio

- Reactor head hole; within a few months of meltdown, containment failure

**NRC:** Has reported 4 dozen "abnormal occurrences" to Congress since 1986; 18 nuclear "events" to IAEA since 1992.

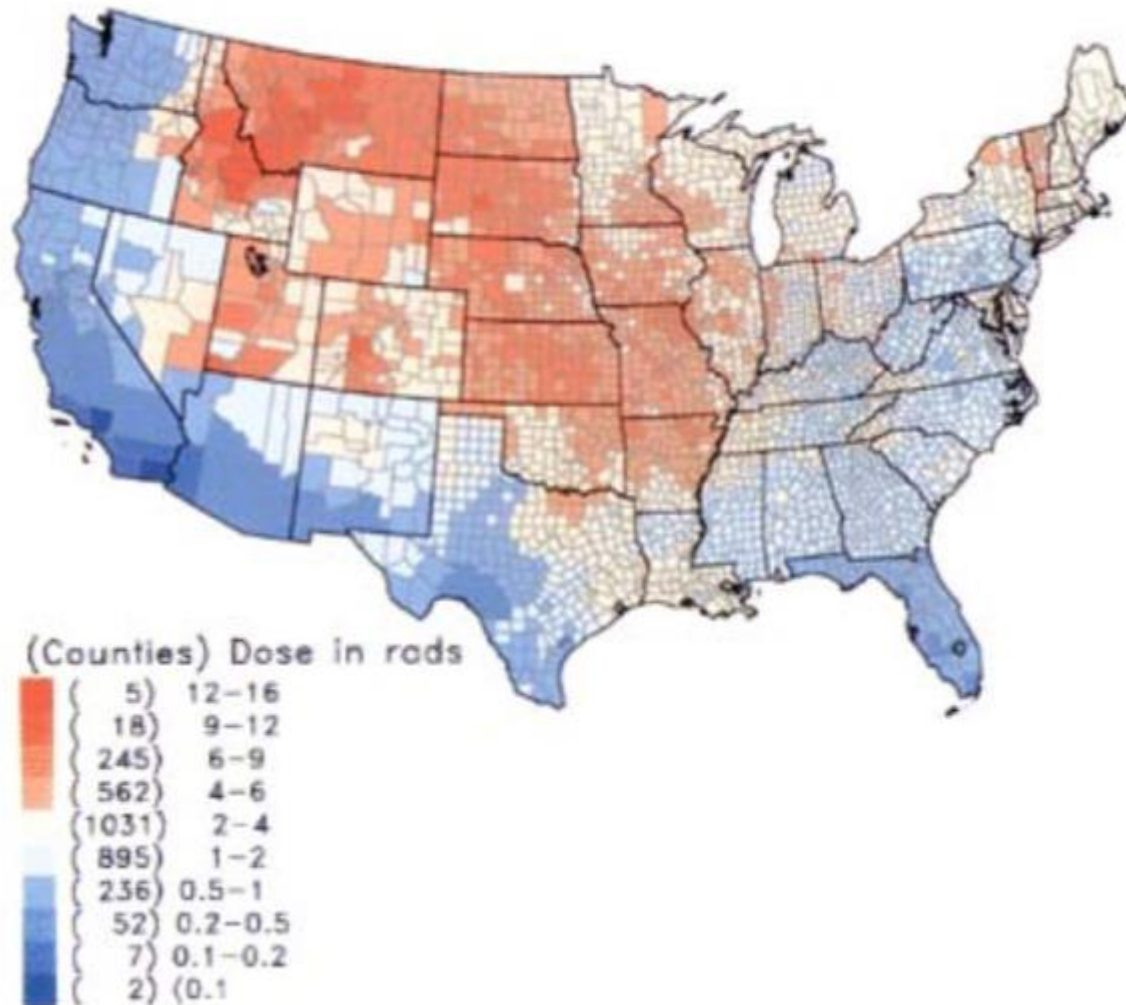


# Nuclear Evacuation Zones

'nū-klē-ər power plants  
in the contiguous United States

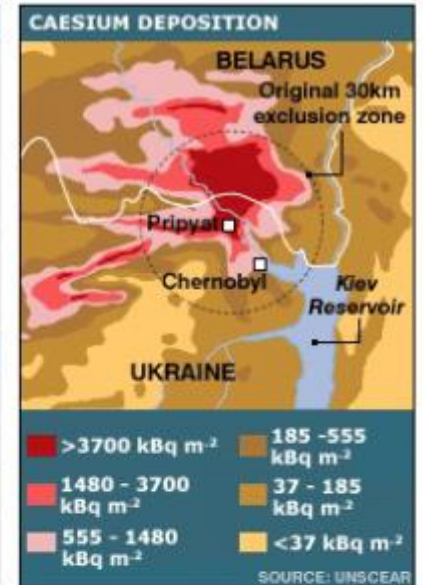
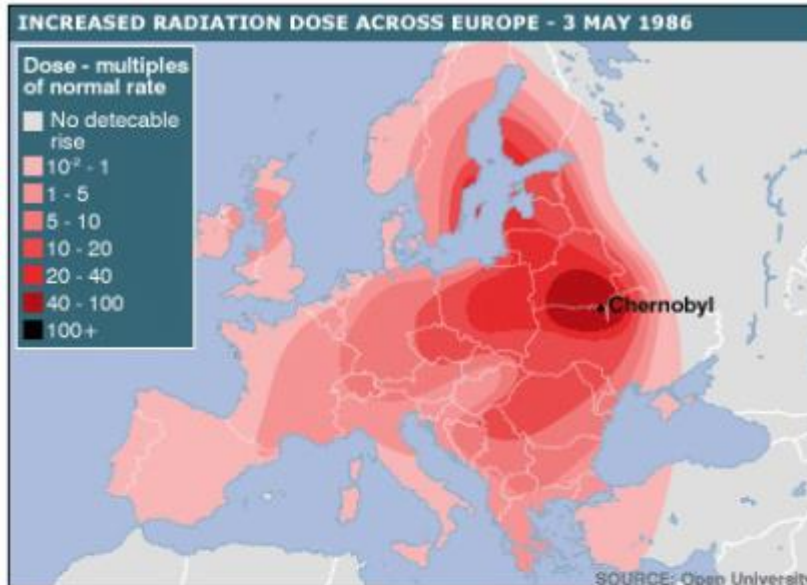
## State and County Exposure Levels

Per capita thyroid doses resulting from all exposure routes from all tests





# Chernobyl Fallout maps from the BBC



The disaster released at least 100 times more radiation than the atom bombs dropped on Nagasaki and Hiroshima.

Much of the fallout was deposited close to Chernobyl, in parts of Belarus, Ukraine and Russia. More than 350,000 people resettled away from these areas, but about 5.5 million remain.

Contamination with caesium and strontium is of particular concern, as it will be present in the soil for many years.

After the accident traces of radioactive deposits were found in nearly every country in the northern hemisphere.

But wind direction and uneven rainfall left some areas more contaminated than their immediate neighbours.

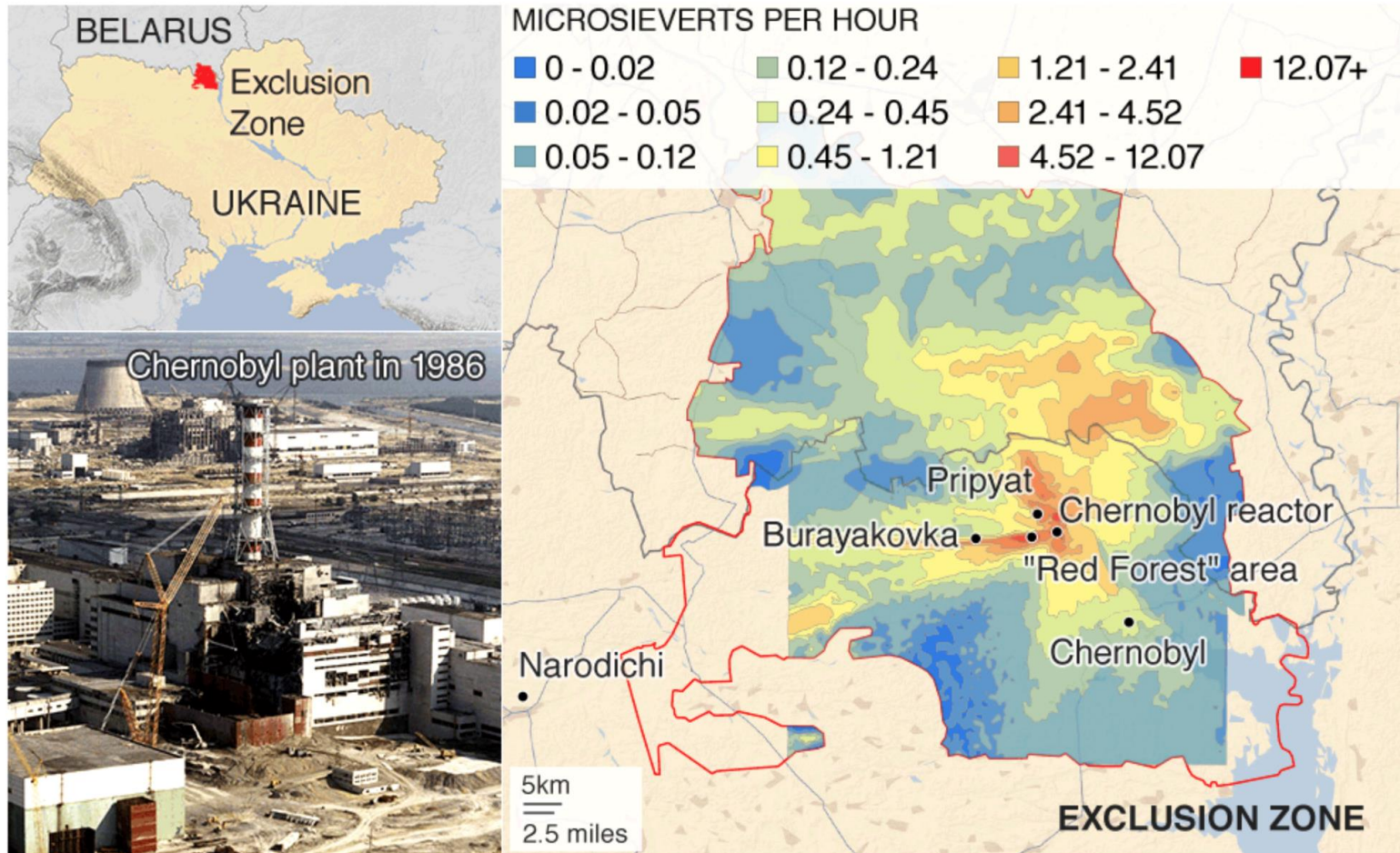
Scandinavia was badly affected and there are still areas of the UK where farms face post-Chernobyl controls.



# 33 Years after Chernobyl Disaster

<https://www.bbc.com/news/science-environment-47227767>

## Current radiation levels in the Chernobyl exclusion zone



Source: University of Georgia and University of Portsmouth with data from Ukrainian Institute of Agricultural Radiology and ARPA Russia-Belarus

BBC



# Latent Cancers

## Chernobyl, Ukraine (1986)

- Contamination 10,000 sq. km.
- 100,000 evacuated, 250,000 permanently relocated.
- As of 2005, 6,000 thyroid cancers attributable to Chernobyl, 15 deaths
- Estimated 53,000 excess cancers and 27,000 excess cancer deaths, excluding thyroid cancer.



Source: L Gronlund, D Lochbaum, E Lyman, "Nuclear Power in a Warming World." Union of Concerned Scientists, December 2007; L Gronlund, "How Many Cancers Did Chernobyl Really Cause? Updated Version. UCS April 17, 2011

# Fukushima March 11, 2011

**Most of the radioactive fallout landed Northwest of Dai-ichi complex.**

**Evacuation Pattern:  
Complex  
Confusing  
Changing**

**Evacuation Pattern  
as of 9-30-11:  
Restricted  
Deliberate, &  
Suggested Areas**  
**Note:** U.S. Citizens  
evacuated much  
further.





# Fukushima and Thyroid Cancer

As of December 31, 2014, thyroid ultrasounds were conducted on 298,577 children

86 had confirmed tissue diagnosis of thyroid cancer

Rate less than two years after increased radiation exposure was 28.8/100,000

In Japan usual rate 0.1-0.9/100,000,  
in US 0.2-1.76/100,000 in same age group

# More Contradicting facts...

- Baby Formula “safe” contamination
  - Change the level of what was considered safe
- Hauling loads of contaminated debris
  - Dilution/help the people of Fukushima
- Schools near incinerators - No Geiger counters!
  - Radioactive waste burned in incinerators all over Japan
- Top soil stored in blue plastic bags
  - Will these last 300 years when 10x half life is done?







# Case Study - 1

You meet a new patient, a 7 year old Japanese girl, daughter of a Japanese postdoc at the University. Her parents accompany the girl for a well child check. As you talk socially, the parents relate to you that they are worried because as they were studying in Tokyo, their daughter spent 10 days north of Tokyo on her grandparent's farm when the 2011 Tsunami and the power plant disaster happened. Their daughter was returned home to them in Tokyo on March 14th, 2011 and seemed fine, but was just one year old.



# Case Study continued

- What do you want to know from the parents?
- Other history?
- What would you like to focus on with the exam?
- Would you like to do any tests?
- How would you approach talking with the parents - reassurance/anxiety/resources?

# Fukushima March 11, 2011

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**Note:** U.S. Citizens evacuated much further.





# What is Your Role?

Legitimate patient concerns

Advocate for patient safety and public health

Prevention of the “Radiation Exposure Experiments”

UN Ban on Nuclear Weapons

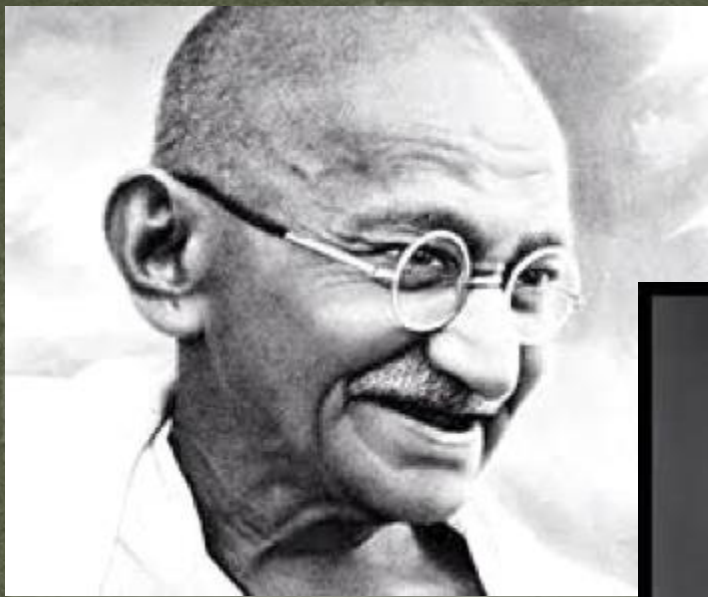
PSR, Union of Concerned Scientists, trustworthy  
sources of information, government and industry ties

Speaking up/out, avoid the disaster, create peace,  
doesn't matter when or how - took a while even for  
Sachiko to find her voice



During Helen Keller's 1948 trip to Japan, she was met by thousands of Japanese people eager to welcome her. Sachiko was one of 5,000 people who saw Keller at the Nagasaki train station. When Sachiko was diagnosed with thyroid cancer in the 1960s, she channeled Keller's determination to overcome her illness.





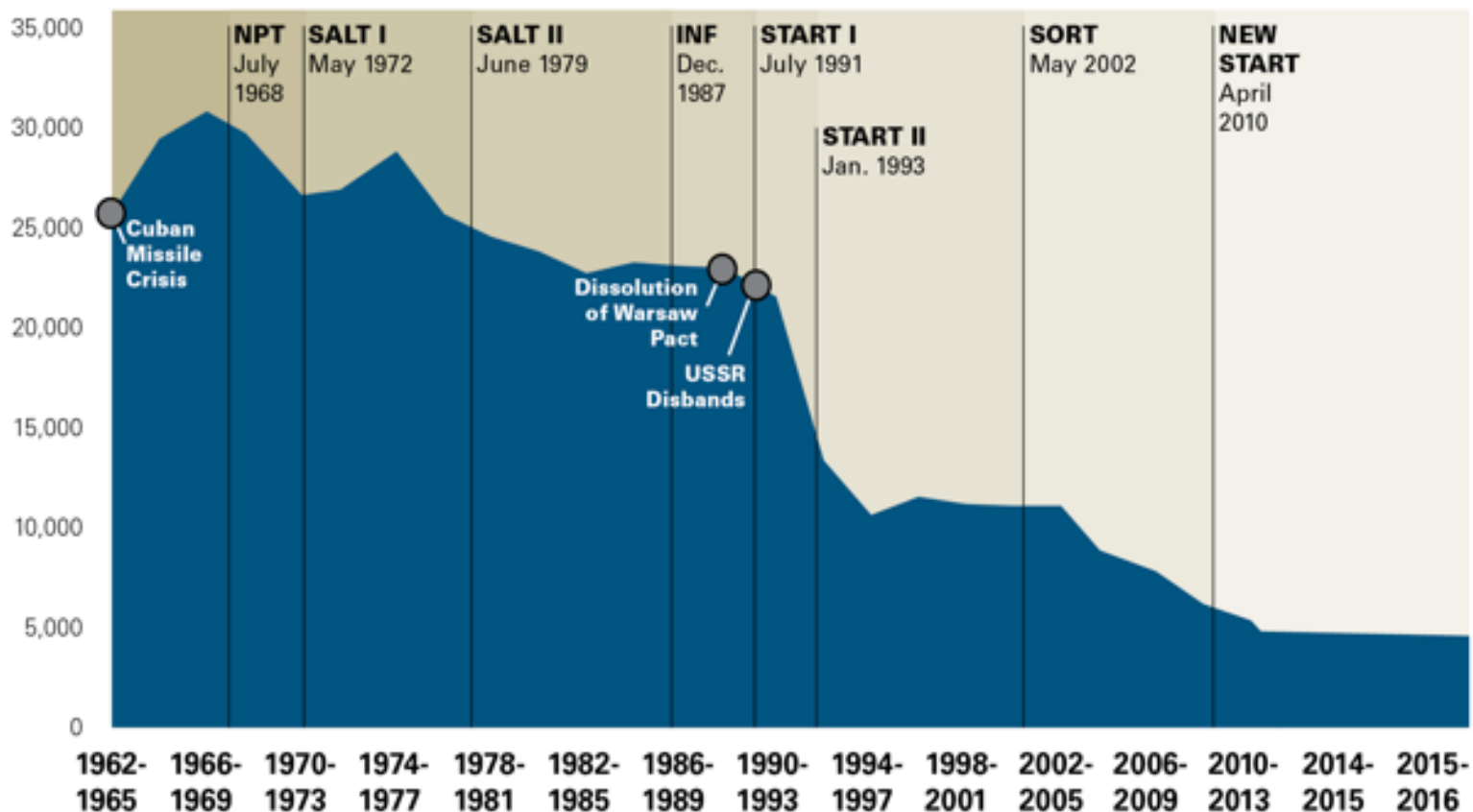
To heal from war, Sachiko studied peace and her teachers of peace.





## U.S. Nuclear Weapons Stockpile, 1962-2016

Since the late-1960s, the United States and Russia have signed a series of nuclear arms treaties that have contributed to steep cuts in their active and inactive nuclear warhead stockpiles.



Sources: U.S. Department of State, U.S. Department of Defense, Arms Control Association. Updated: July 22, 2016.

# Things You Can Do

- **INFORM YOURSELF**

- [www.preventnuclearwar.org/](http://www.preventnuclearwar.org/) (for information on the “Back from the Brink” campaign)
- [www.psr.org/issues/nuclear-weapons-abolition/](http://www.psr.org/issues/nuclear-weapons-abolition/) (for information on nuclear disarmament)
- [www.NIRS.org](http://www.NIRS.org)
- [www.bbc.com/news/science-environment-47227767](http://www.bbc.com/news/science-environment-47227767)



# Things You Can Do

## **GET THE WORD OUT**

**Schedule a presentation on nuclear disarmament by PSR** to a group you are a member of.

**Contact your City Council representative.**

Ask for her/his support of the “Back from the Brink” resolution.

**Write a letter to editor (250 words) or op ed (600 words).**

Try to focus on one of 5 “Back from the Brink “ goals and tie it to what is happening in the news. Send it to Capitol Times - [host.madison.com/ct/opinion/](http://host.madison.com/ct/opinion/)

Wisconsin State Journal - [host.madison.com/forms/online\\_services/letter/](http://host.madison.com/forms/online_services/letter/)

**Endorse the “Back from the Brink” nuclear disarmament resolution.** Get your school, faith community, employer, community group, political party to endorse campaign on the following website: [www.preventnuclearwar.org](http://www.preventnuclearwar.org)

# Things You Can Do

## LOBBY YOUR SENTATORS AND REPRESENTATIVES

**Senators Baldwin and Johnson** - ask them to co-sponsor:

- **S.272**, the “No First Use of Nuclear Weapons bill”,
- **S.401**, the “hold the LYNE – low yield nuclear explosive” bill which stops funding for the low yield Trident warhead.
- **S.200**, the “Sole Authority” bill which restricts the president’s ability to authorize a nuclear first strike without congressional approval.
- **S.312**, the “Prevent a Nuclear Arms Race” bill

**Representative Pocan** – thank him for sponsoring the:

- **HR 1249**, the “INF Treaty Compliance Act”,  
and ask him to support
- **HR 921**, the “No First Use of Nuclear Weapons bill”,
- **HR 1086**, the “hold the LYNE – low yield nuclear explosive” bill which stops funding for the low yield Trident warhead.
- **HR 669**, the “Sole Authority” bill which restricts the president’s ability to authorize a nuclear first strike without congressional approval.



# Things You Can Do

## **LET YOUR MONEY SPEAK**

### **Divest in Nuclear Weapons**

The privately owned companies that are most heavily involved in the nuclear weapon industrial complex include: Bechtel, Boeing, General Dynamics, Honeywell International, Lockheed Martin, Northrop Grumman. Check the website below to see which financial institutions invest in these companies. <https://www.dontbankonthebomb.com>



### **Invest in Peace, the Environment and Socially Responsible Financial Institutions**

See this web site to find financial institutions that do NOT invest in nuclear weapons...

<https://www.dontbankonthebomb.com>



For a list of the top performing environmentally and socially conscious companies:

[newsletters.briefs.bloomberg.com/document/9ez2ka6ag1ez85t23h/rankings](https://newsletters.briefs.bloomberg.com/document/9ez2ka6ag1ez85t23h/rankings)





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- Electronic "Action Alerts" that allow you to quickly take action on current legislation

Your commitment to a safe and healthy future is appreciated.