- **Team Name: Bombing4Cancer**

BREAST CANCER HUB℠

Ages: 6-9

- **Title: Radiation and Cancer: Past, Present and Future**
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Abstract

Background: Man-made or accidental exposure to radiation increases the incidence of cancer. Many of these cancers can be preventable with better policies and education.

Aim: To evaluate the relationship of radiation and cancer in the past, present and the future.

Methods: Literature search was undertaken from pubmed, google, Wikipedia, Life span study, OSHA.

Discussion: Past incidents involving radiation exposure lead to increased incidence of various cancers. Ongoing radioactivity exposure at work place continue to pose a risk. As we march into future, controlling radioactive waste becomes an important task to decrease the incidence of these cancers.

Conclusion: Stricter policies maintaining nuclear reactors, atomic bombs and stronger emphasis on education could potentially decrease the risk of radiation induced cancers. Larger studies are needed to examine radioactive waste and its influence on population/animal health.

Atomic Bombings That Changed History
Aftermath that shook the world

- **Hiroshima:** August 6, 1945, The US aircraft ”Enola Gay” dropped atomic bomb nicknamed “Little Boy” over Hiroshima. ~70,000 people died instantly and death toll increased to some 140,000 by December 1945 [1, 2]

- **Nagasaki:** August 9, 1945, second atomic bomb nicknamed “Fat Man” over Nagasaki which killed an estimated 40,000 people on impact [3, 4]

- The radiation released from the explosion caused further suffering – symptoms of radiation poisoning began. These included hair loss, bleeding gums, loss of energy, purple spots, pain and high fevers often resulting in fatalities. Thousands more died from their injuries, radiation sickness and Cancer in the years that followed, bringing the toll closer to 200,000 according to the Department of Energy’s history of Manhattan Project [5, 6]

Hiroshima Before and After [7]

Hiroshima's vibrant downtown

August 6, 1945, mushroom cloud billows into the sky about one hour after the bomb was dropped

Streetcars, bicyclists, and pedestrians make their way through the wreckage of Hiroshima.

Social Stigma: Hibakusha - people who survived, discriminated in Japanese society-thought to be carriers of radiation disease & contagious [6]

The Worst Nuclear Disaster of All Time

Chernobyl, Ukraine April 26, 1986

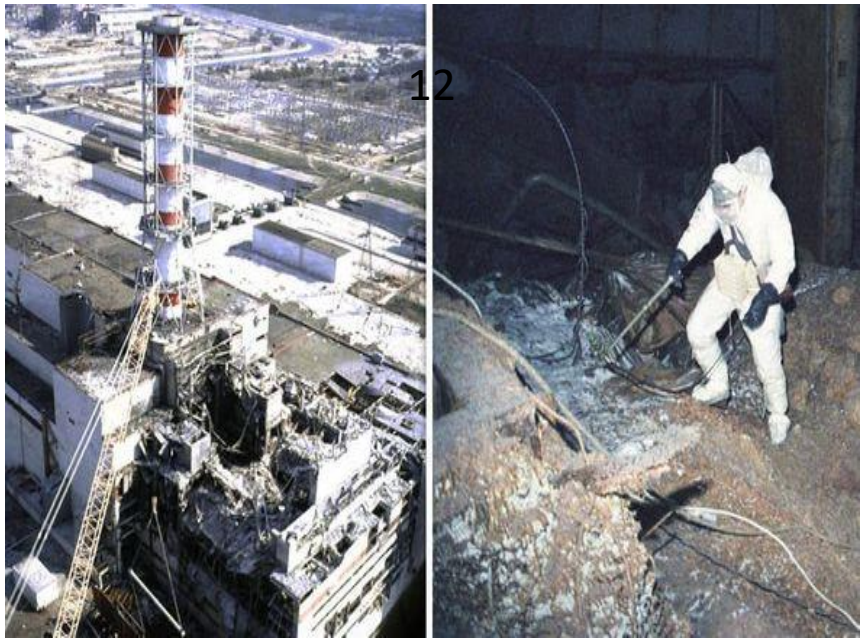
The disaster took place from an explosion of nuclear reactor system

Aftermath

- Massive amounts of radiation escaped and spread across the western Soviet Union and Europe

- **Liquidators** were the civil and military people credited with helping to clean up and trying to prevent both the immediate and long-term damage from the disaster were the major victims [8]

- ~220,000 people had to be relocated from their homes [9]. In the accident's aftermath, 237 people suffered from acute radiation sickness of whom 31 died within the first three months [10]



Chernobyl Disaster and the Liquidators – The Heroes – helping to clean up [11]

Cancer among survivors – Hiroshima/Nagasaki

Cancer risk increased according to how close the person was to the detonation site [2, 4]

Incidence of solid cancers between 1958 and 1998 among the survivors were 10% higher [7]

The spike of Leukemia occurred around two years after the bombing and hit its peak around 1950 [7]

Women had more Cancer than men

Population under age 20 had much higher chance of breast cancer [6, 12]

Top 5 Cancers: mouth cancer, stomach cancer, colon cancer, liver cancer and lung cancer [7]

Cancer among survivors - Chernobyl

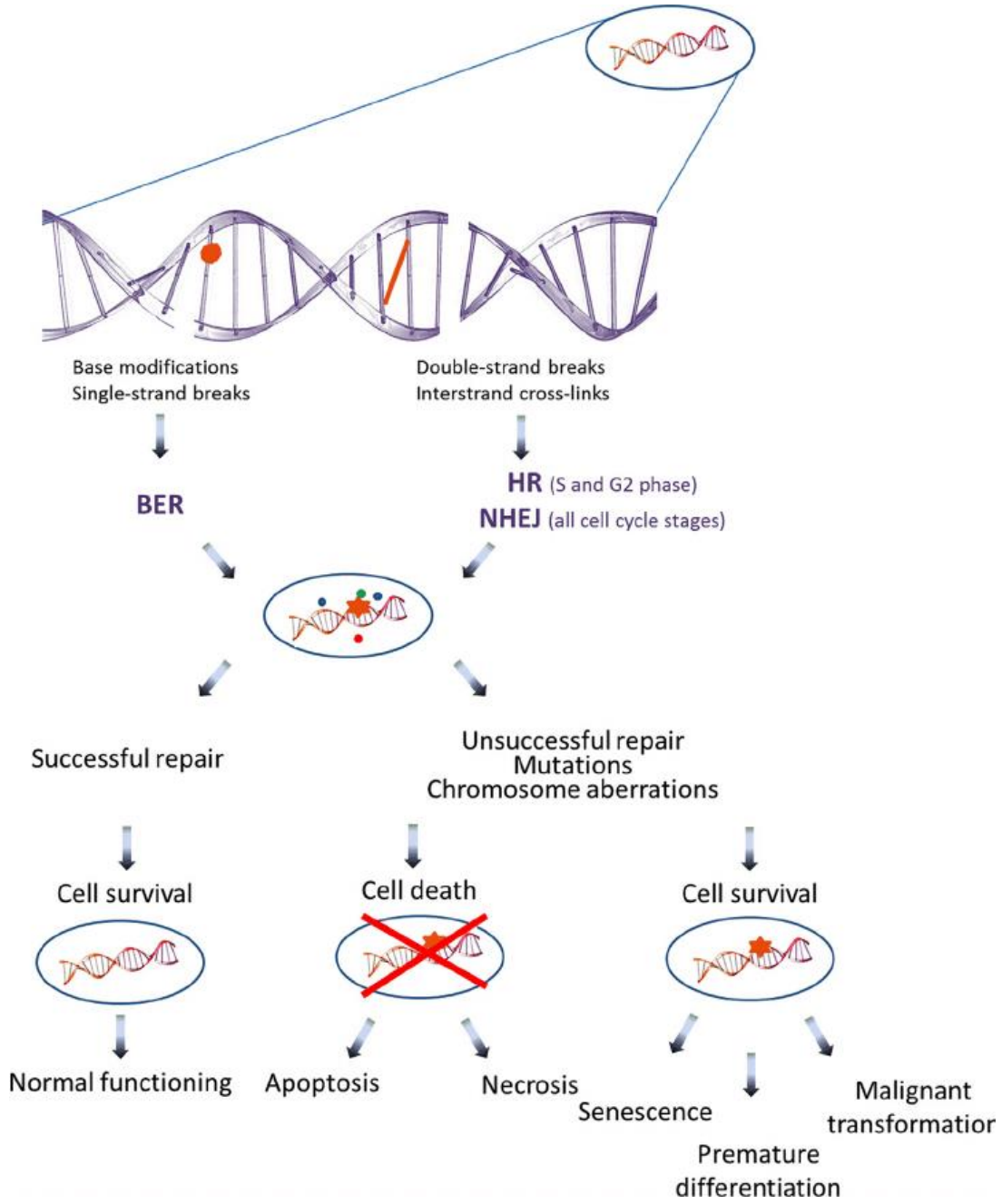
Early days after the accident revealed increased incidence of thyroid cancer among young children and adolescents who lived in the most contaminated areas of Belarus, the Russian Federation and Ukraine [13]

The risk of leukemia among Chernobyl liquidators increased [13]

Small increase in the incidence of breast cancer in the most contaminated areas, which appear to be related to radiation dose was noted [13]

Radiation and Cancer

- Ionizing Radiation cause cancer by damaging DNA
- DNA damage often leaves a molecular fingerprint known as mutational signature [14]



Radioactive Concerns at Workplace [15]

Types of Radiation

- UV [ultraviolet] radiation
- IR [infrared] radiation
- MW [Microwave] radiation
- RF [Radiofrequency] radiation
- ELF [Extremely Low Frequency]

Workplaces

- Health Care facilities
- Research institutions
- Nuclear reactors and their support facilities
- Nuclear weapon production facilities
- Even people in Construction, painting, manufacturing, and mining can get cancer

Common cancers, Source, and Occupations [16]

Cancer	Source	Occupations
Bladder	Benzidline	Rubber, Leather, Dyeing products
Kidney	Wood dust and herbicides	Painting, metalworking, plastics
Larnyx	Wood dust and paint fumes	Petroleum, Rubber, plastics
Leukemia	Pesticides	Agriculture, and oil industry
Liver	Arsenic	Plastic
Lung	Asbetos and Radon	Construction
Lymphoma	Herbicides	Rubber, manufacturing, painting
Head and Neck	Wood dust and radium	Textile and furniture industry
Skin	Sunlight	Outside jobs

Radioactive concerns at workplace [17]

Approximately 4-10% of total cancer in the United States

Globally, it is estimated that 19% of cancers are attributed to work-related exposures

Other factors that play a role in cancer include age, sex, race, Family history, diet, personal habits, and other medical conditions

Radioactive concerns at workplace [15]

- PROTECT AND PREVENT
- Personal protective gear
- Workplace controls
- Worker education – Biosafety training
- Prevention of other factors like smoking
- Developing safety standards and limits for chemical radiation exposure

Radioactive Waste and Cancer [18, 19]

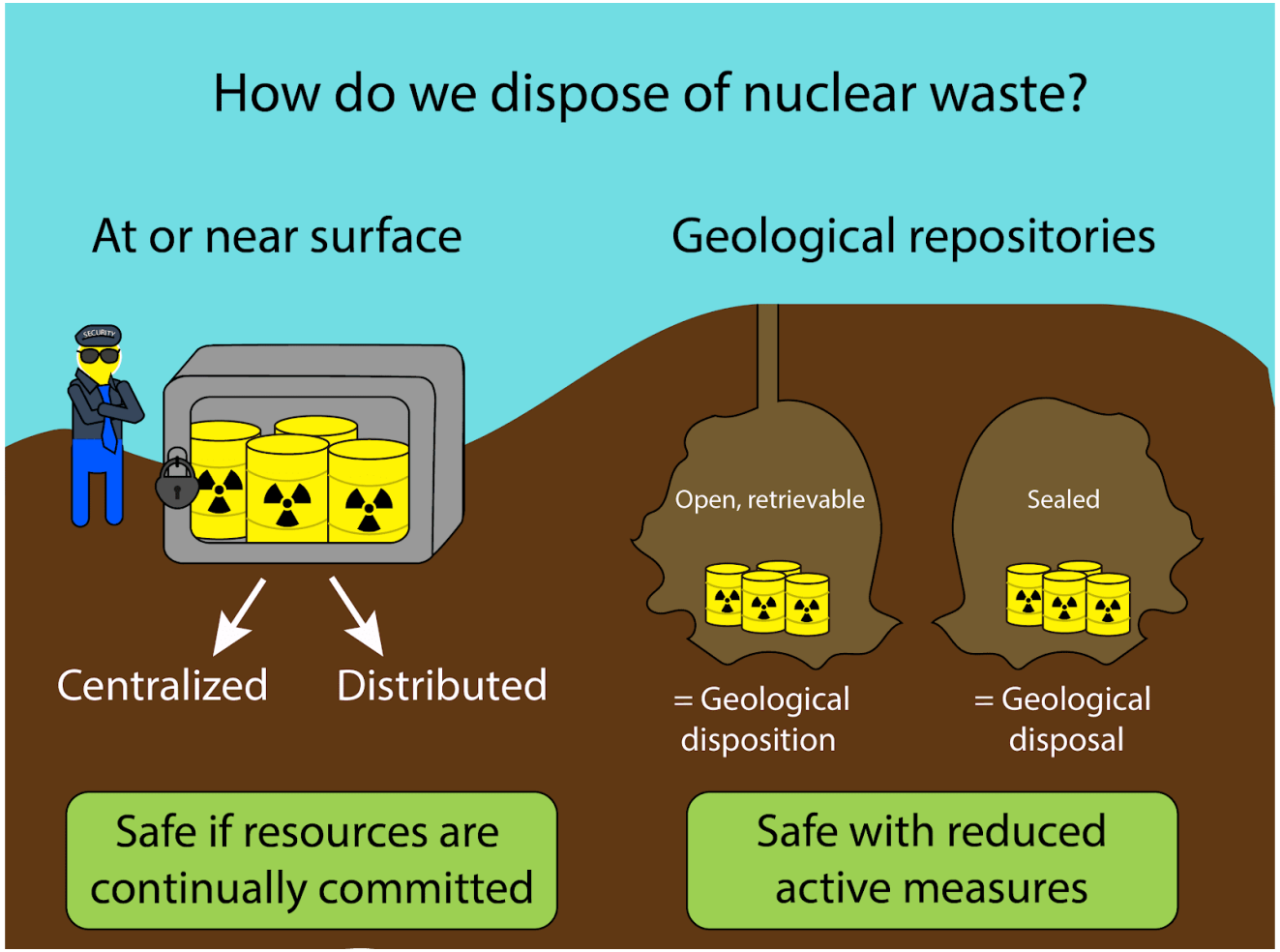
A recent health report found that people who grew up in areas which were contaminated by radioactive waste decades ago might have a higher risk for bone and lung cancers

Radioactive waste persists in soil and is believed to cause cancer even decades later

The radioactive waste from atomic bomb contaminate the soil and nearby creeks. If the creeks ever flood the soil could get contaminated. The trees which got contaminated by the soil would grow contaminated food

Storage and Disposal

- Radioactive waste should be contained so as to avoid any chance of radiation exposure to people or pollution
- Method of disposal depends on low level/Intermediate level/High level radioactive waste [20]
- Disposal and decay process can take about 40-50 years [21]



Current Situation with Atomic disasters

The **radiation** in **Hiroshima** and **Nagasaki** today is on a par with the extremely low levels of background **radiation** (natural **radioactivity**) present anywhere on Earth [22]

Hiroshima Peace Memorial Park [17]

Chernobyl remains abandoned: Based on the data available, 53,000 and 27,000 are reasonable estimates of the number of excess cancers and cancer deaths that will be attributable to the accident in future, excluding thyroid cancers [23]

The abandoned city of Pripyat, near the Chernobyl nuclear power plant [18]

Take away points

- Having a discussion to resolve conflict/problem
- No country should have atomic bombs
- Radioactivity at work and radioactive waste – strict prevention and protect strategy required through education and policy

References

1. https://www.osti.gov/opennet/manhattan-project-history/Events/1945/hiroshima.htm
2. https://cnduk.org/hiroshima-the-truth-about-the-bombing/
3. https://www.aljazeera.com/news/2019/08/hiroshima-atomic-bomb-nuclear-attack-changed-history-190806100602771.html
4. https://www.atomicheritage.org/history/survivors-hiroshima-and-nagasaki
5. https://www.history.com/topics/world-war-ii/atomic-bomb-history
6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4981260/
7. https://www.sciencedaily.com/releases/2016/08/160811120353.htm
8. https://www.warhistoryonline.com/world-war-ii/lasting-effects-atomic-bombings.html
9. https://en.wikipedia.org/wiki/Chernobyl_liquidators
10. https://www.ucsusa.org/nuclear-power/nuclear-power-accidents/history-nuclear-accidents
11. https://en.wikipedia.org/wiki/Chernobyl_disaster
12. https://www.who.int/ionizing_radiation/chernobyl/backgrounder/en/
13. https://www.express.co.uk/news/world/1151586/chernobyl-disaster-what-caused-the-chernobyl-explosion-chernobyl-blame
14. http://www.city.hiroshima.lg.jp/www/contents/1319178283612/index.html
15. https://allthingsnuclear.org/lgronlund/how-many-cancers-did-chernobyl-really-cause-updated
16. https://www.who.int/mediacentre/news/releases/2005/pr38/en/
17. https://www.nippon.com/en/features/h00141/hiroshima-peace-memorial-park.html
18. https://www.weforum.org/agenda/2019/05/what-s-going-on-in-chernobyl-today/