INTERNATIONAL NUCLEAR ATLANTIC CONFERENCE

V ENIN

Comunicação e interação com a sociedade

Ivan Salati

Vice-Presidente ABEN

Belo Horizonte, outubro 2017

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Public Acceptance

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The senses and the ionizing radiation

Ionizing radiation is:

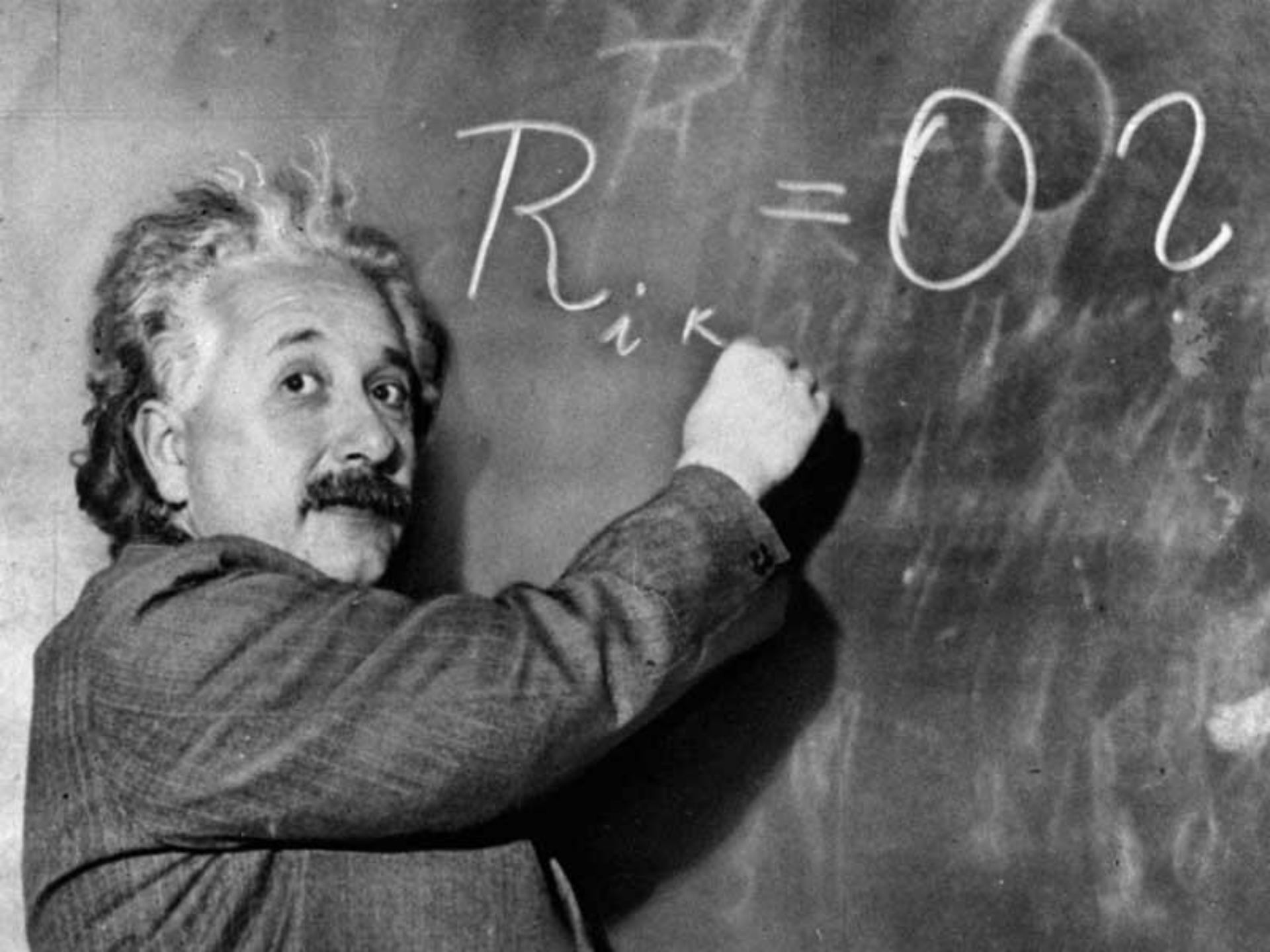
- **invisible (sight)**
- **odorless (smell)**
- **insipid (taste)**
- **inaudible (hearing)**
- **painless (touch)**

This contributes to affect the risk perception

Accidents caused by Radiation

- Most of the situations: the victim do not realize that suffered irradiation.
- Acute radiation syndrome is similar to several ill symptoms that can affect human body.
- The biological effects of exposition to radiation, when they happen, can appear several years after the exposition.

All of these contributes to affect the risk perception =>FEAR


$R_{ik} = 0$

Albert Einstein... [continued below]

Albert Einstein
Old Grove Rd.
Nassau Point
Peconic, Long Island

August 2nd, 1939

F.D. Roosevelt,
President of the United States,
White House
Washington, D.C.

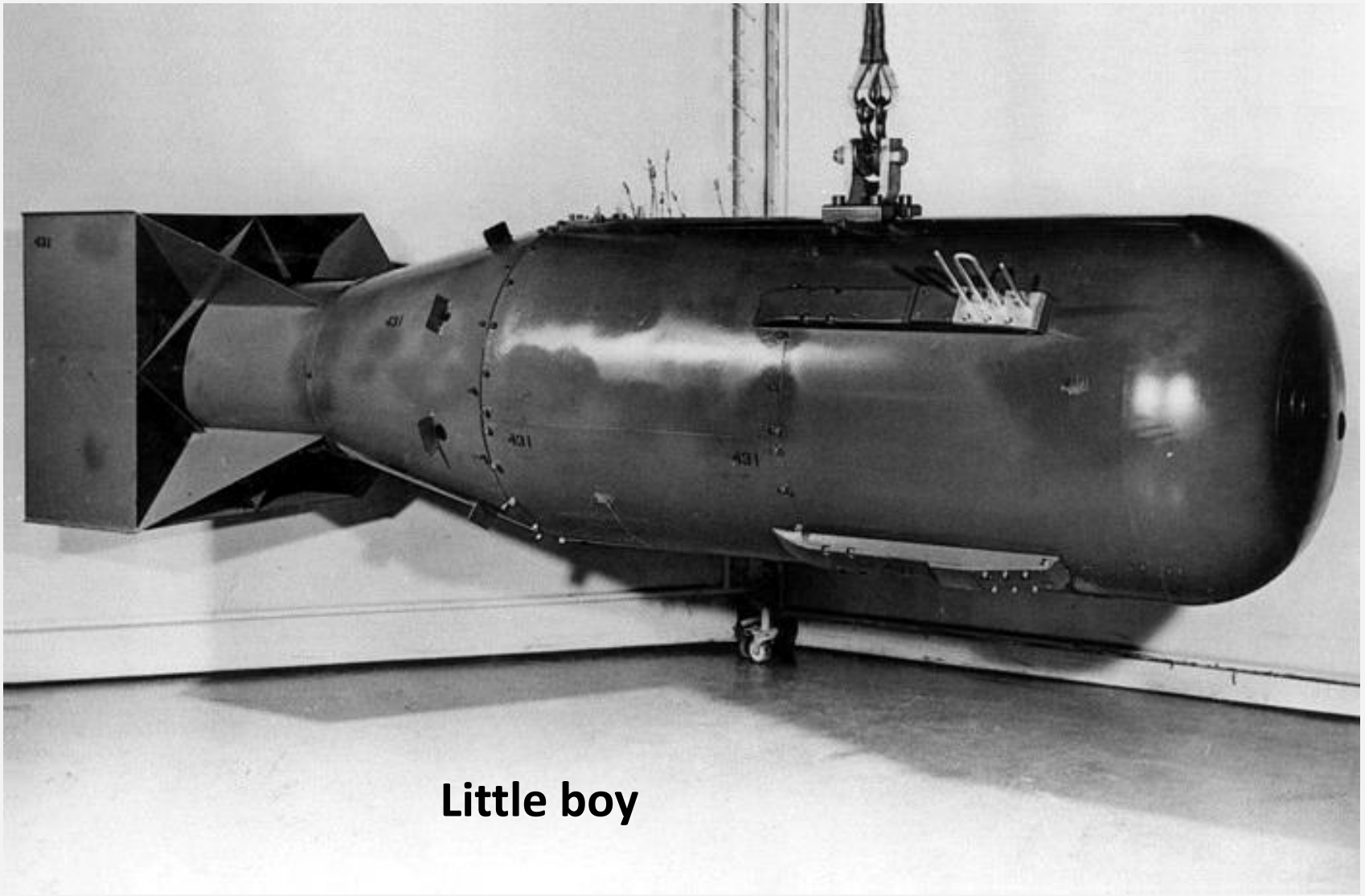
Sir:

Some recent work by E.Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendations:

In the course of the last four months it has been made probable - through the work of Joliot in France as well as Fermi and Szilard in America - that it may become possible to set up a nuclear chain reaction in a large mass of uranium,by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.

This new phenomenon would also lead to the construction of bombs, and it is conceivable - though much less certain - that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However, such bombs might very well prove to be too heavy for transportation by air.

1945: The atomic bombs



Little boy

Exploded in Hiroshima

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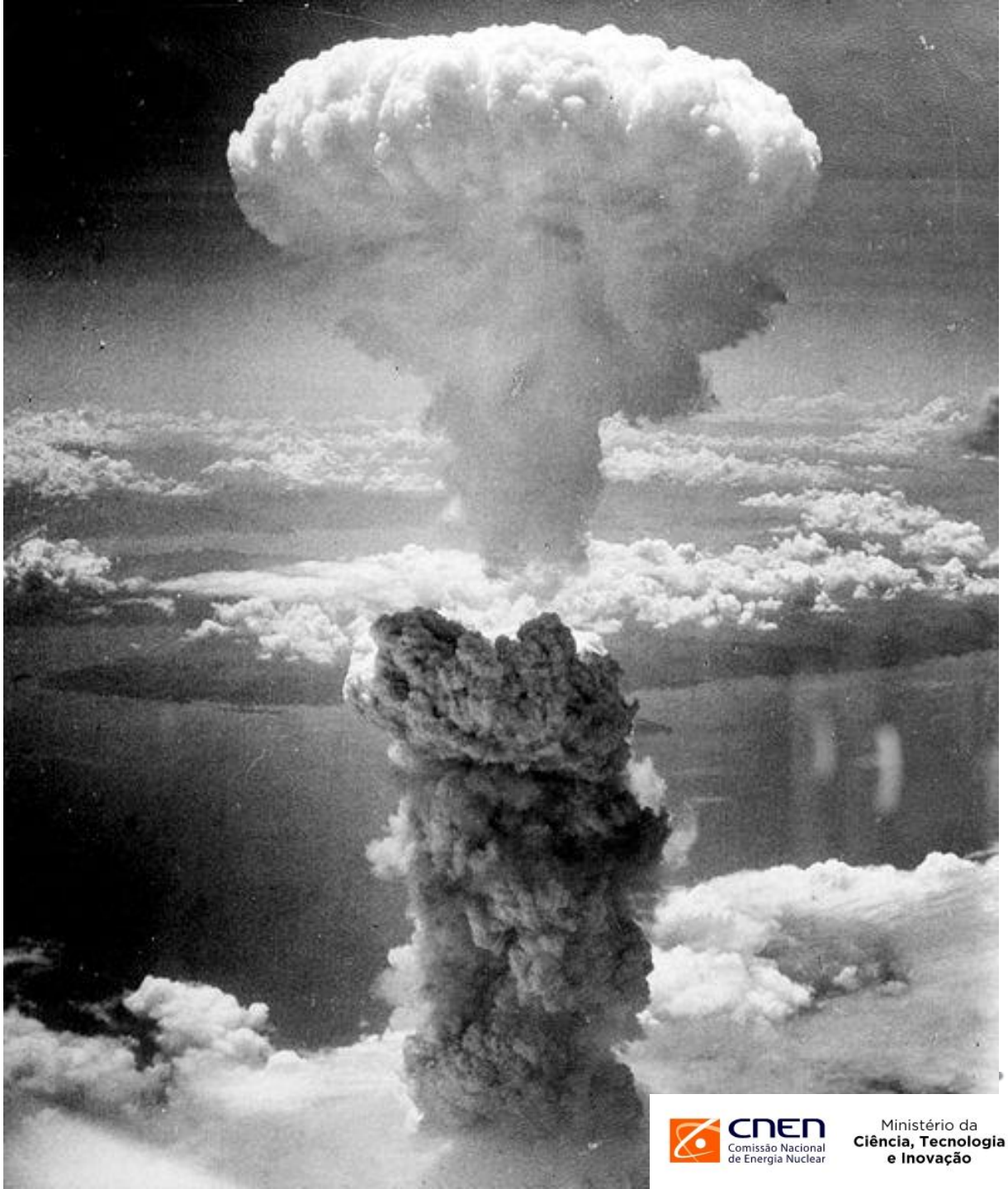
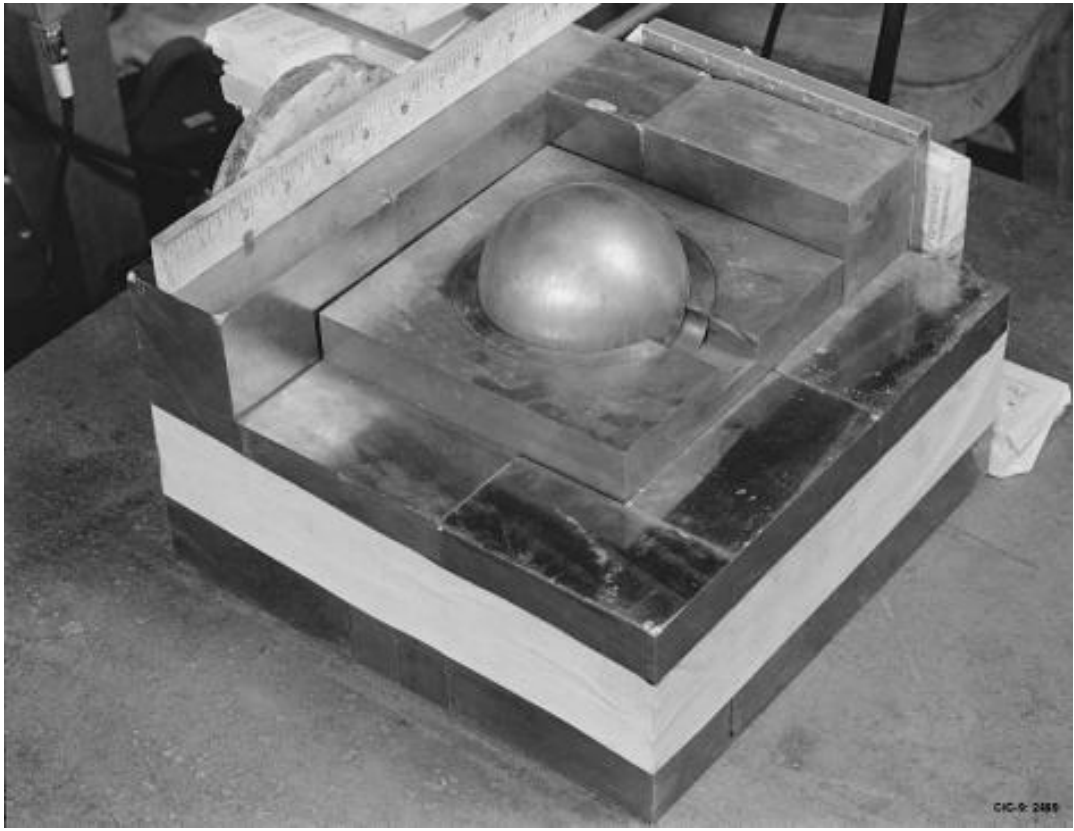


The Plutonium

Naturally-occurring radium is about 200 times more radiotoxic than plutonium, and some organic toxins like Botulism toxin are billions of times more toxic than plutonium.



Demon Core

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1952- The first thermonuclear bomb

1962 - Cuba missiles crisis

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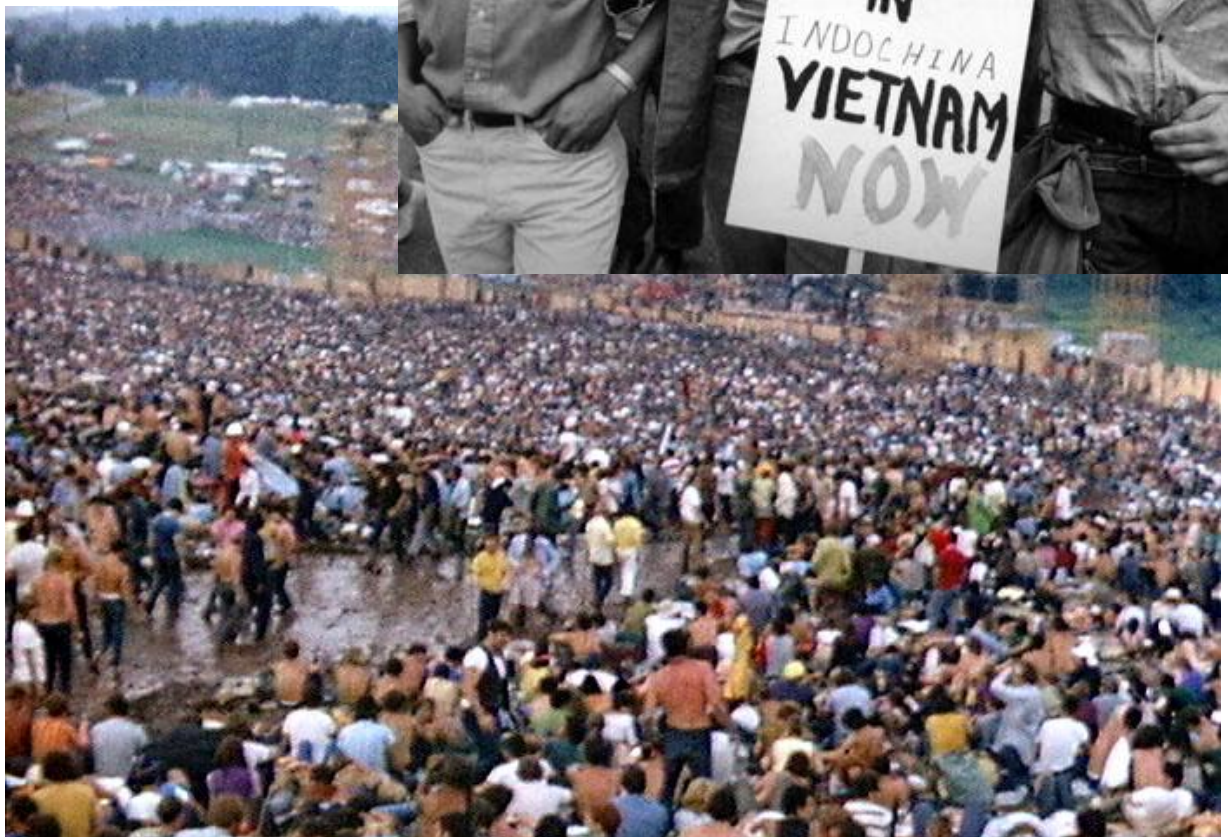
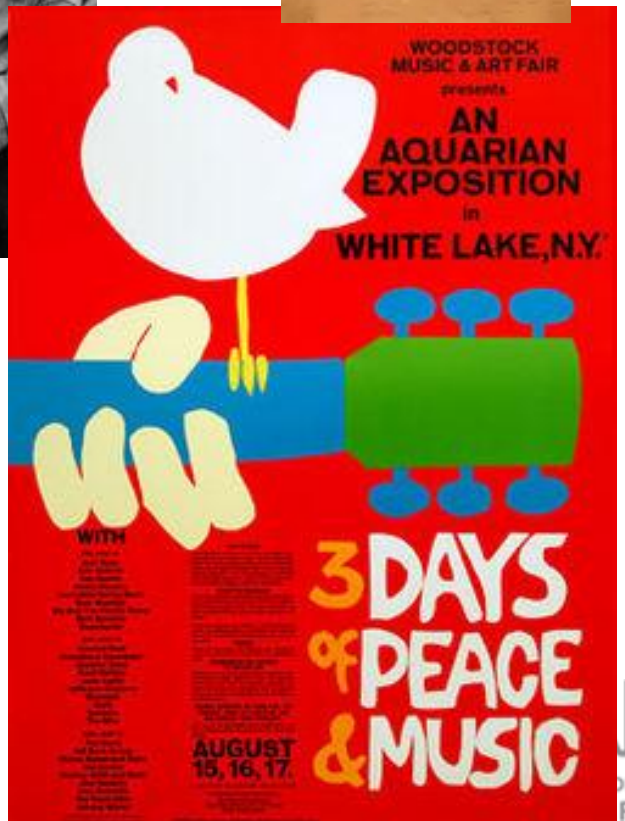
Late 1960's - Movement for peace in the USA





1979: Three Mile Island's Accident

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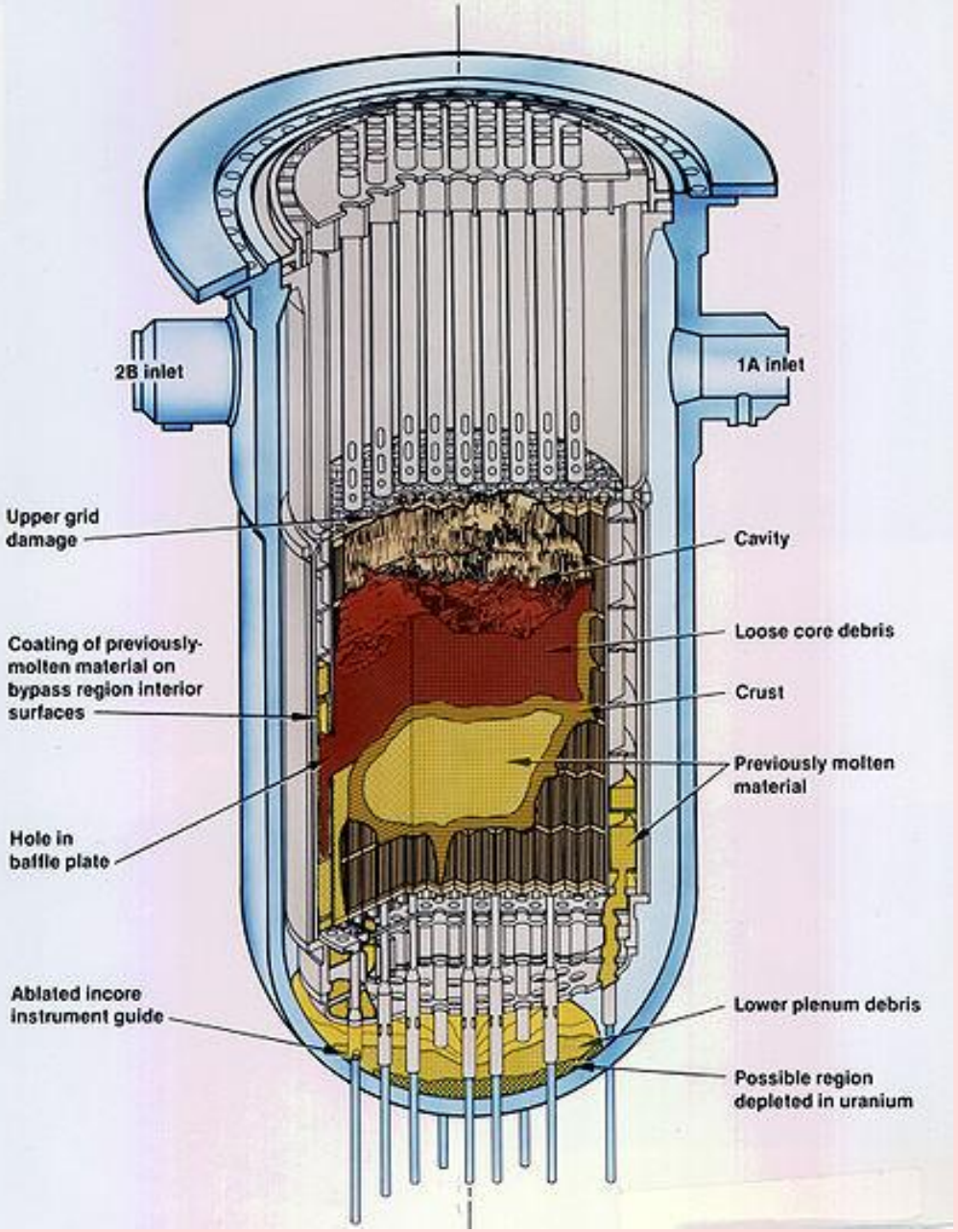
TMI-2 Core End-State Configuration



1979: Three Mile Island's Accident

1986: Chernobyl's accident

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1987: Cs-137 Goiania's accident

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1987: C-137 Goiania's accident

Decontamination work

2001: September 11th

2011: Fukushima

2011: Fukushima

2011: Fukushima

2011: Fukushima

2011: Fukushima

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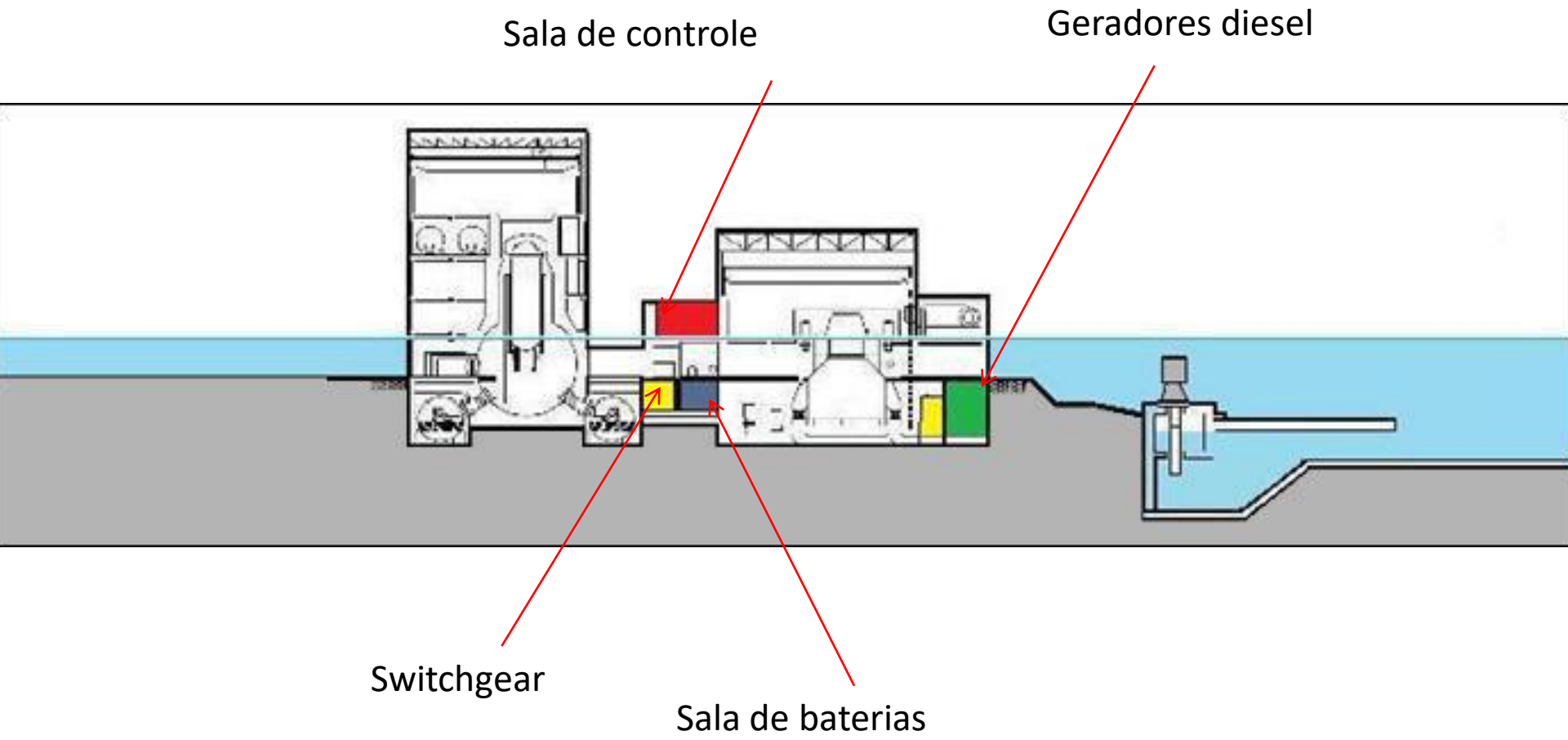

Economical Interests

Protecting Mining Jobs and Communities

A message from Australia's coal miners

Climate change is real and we need a Government that will tackle it.
Doing nothing is no longer an option.

Voters have a choice at the election:

Labor	Coalition
☑ Support $1.5 billion investment in Clean Coal Technology	Continue to neglect Clean Coal Technology
☑ No nuclear power station	Develop nuclear power stations that would replace the coal industry.

It's a simple choice. Vote to protect coal industry jobs and our local communities.

Nuclear Power Will Kill the Coal Industry

If you care about mining industry jobs and local communities don't support the Liberal and National parties' plans to introduce nuclear power stations.

Going nuclear is dangerous and will mean the end of our coal industry. Choose a party that will help clean up the coal industry not destroy it.

Communication: problems in explaining

Many quantities: dose, absorbed dose, effective dose, equivalent dose, dose equivalent, total dose, activity, etc.

Many units: gray, sievert, becquerel, rad, rem, curie.

Time relation: /sec, /hour, /month, /year, /life.

Multiples and submultiples: tera, nano, kilo, mili, micro, etc.

Lack of information

Nuclear Power Plants operating in USA = 99
Responsible for 20% of the electricity generated

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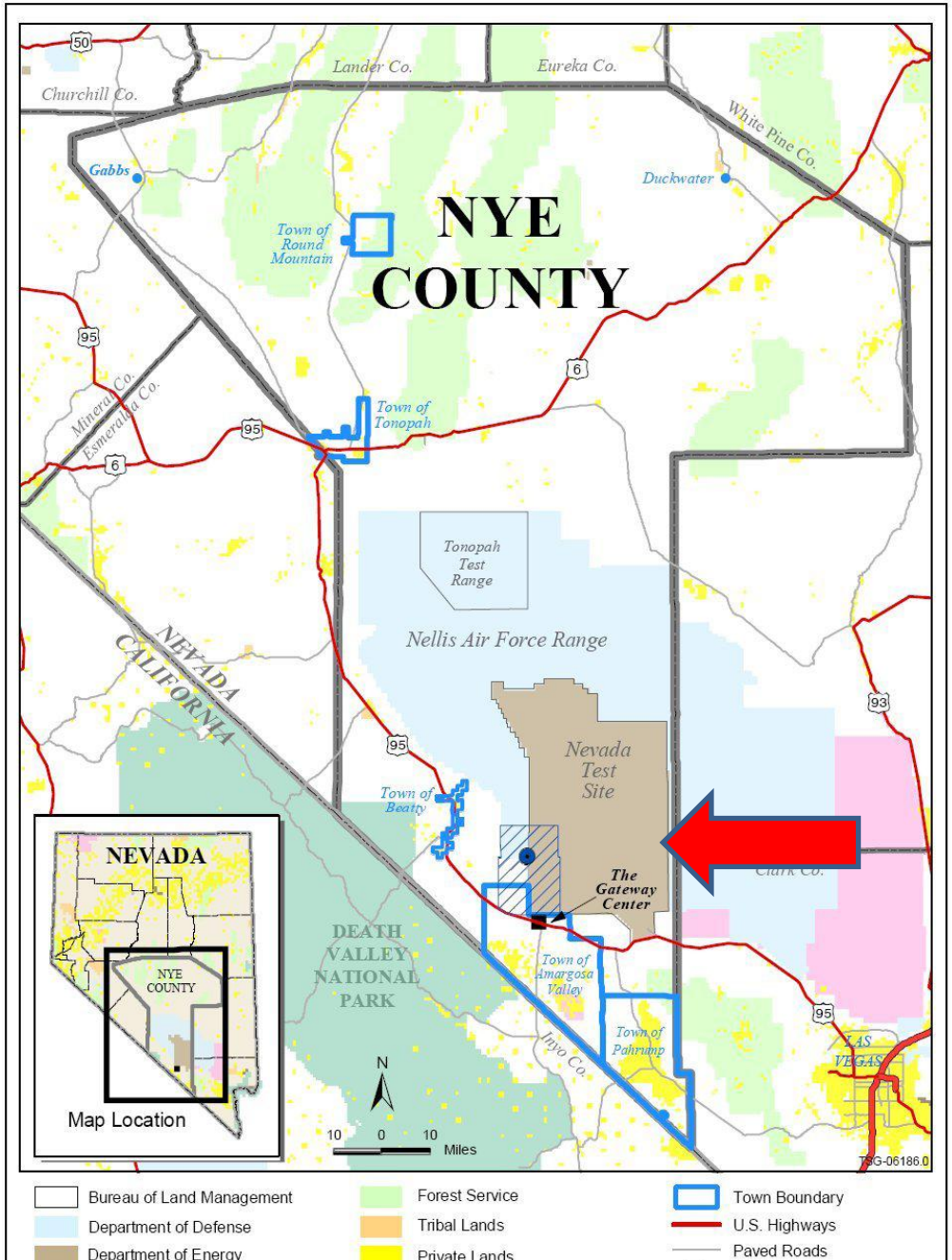
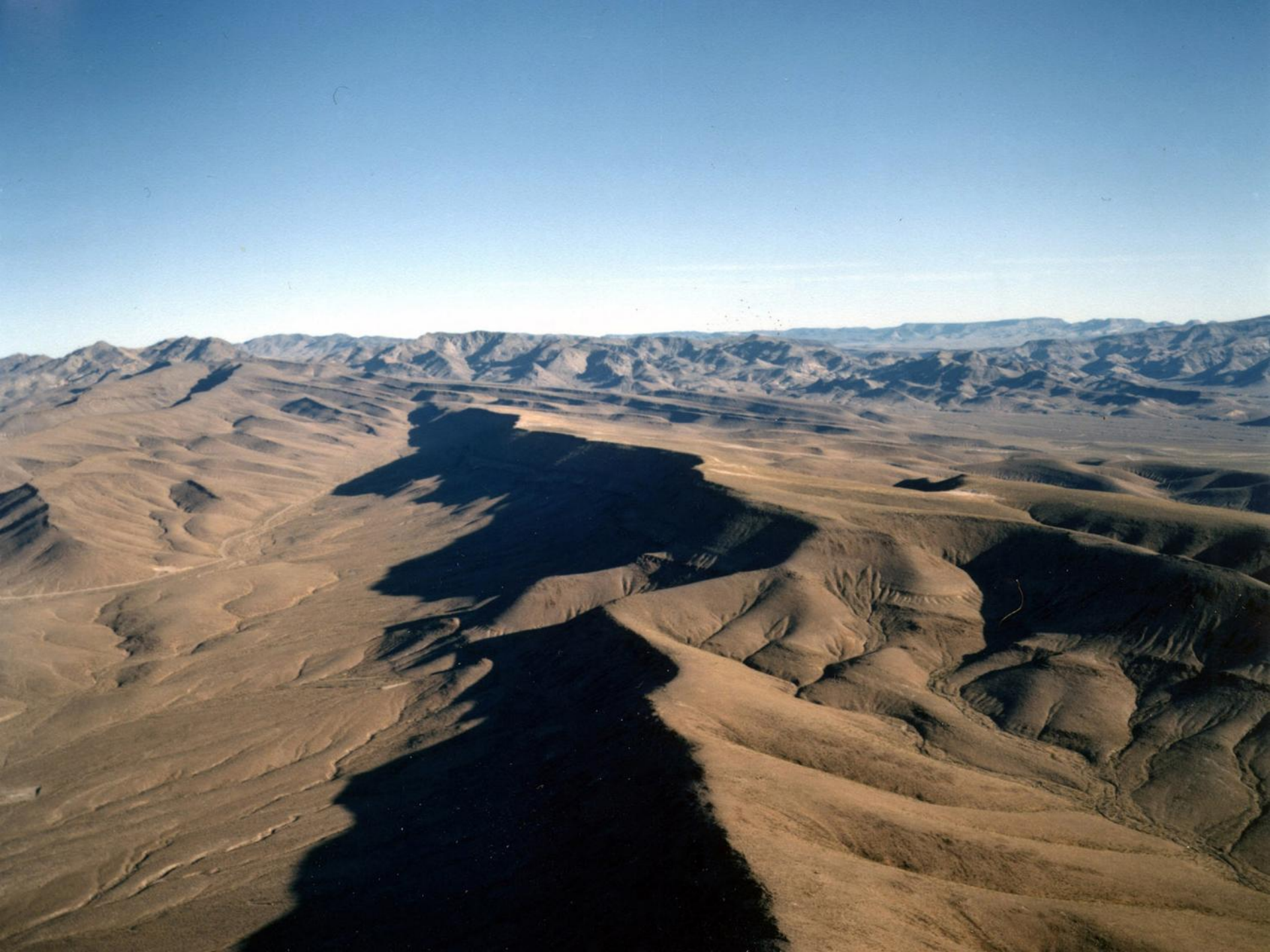
Reasons of rejection of nuclear energy

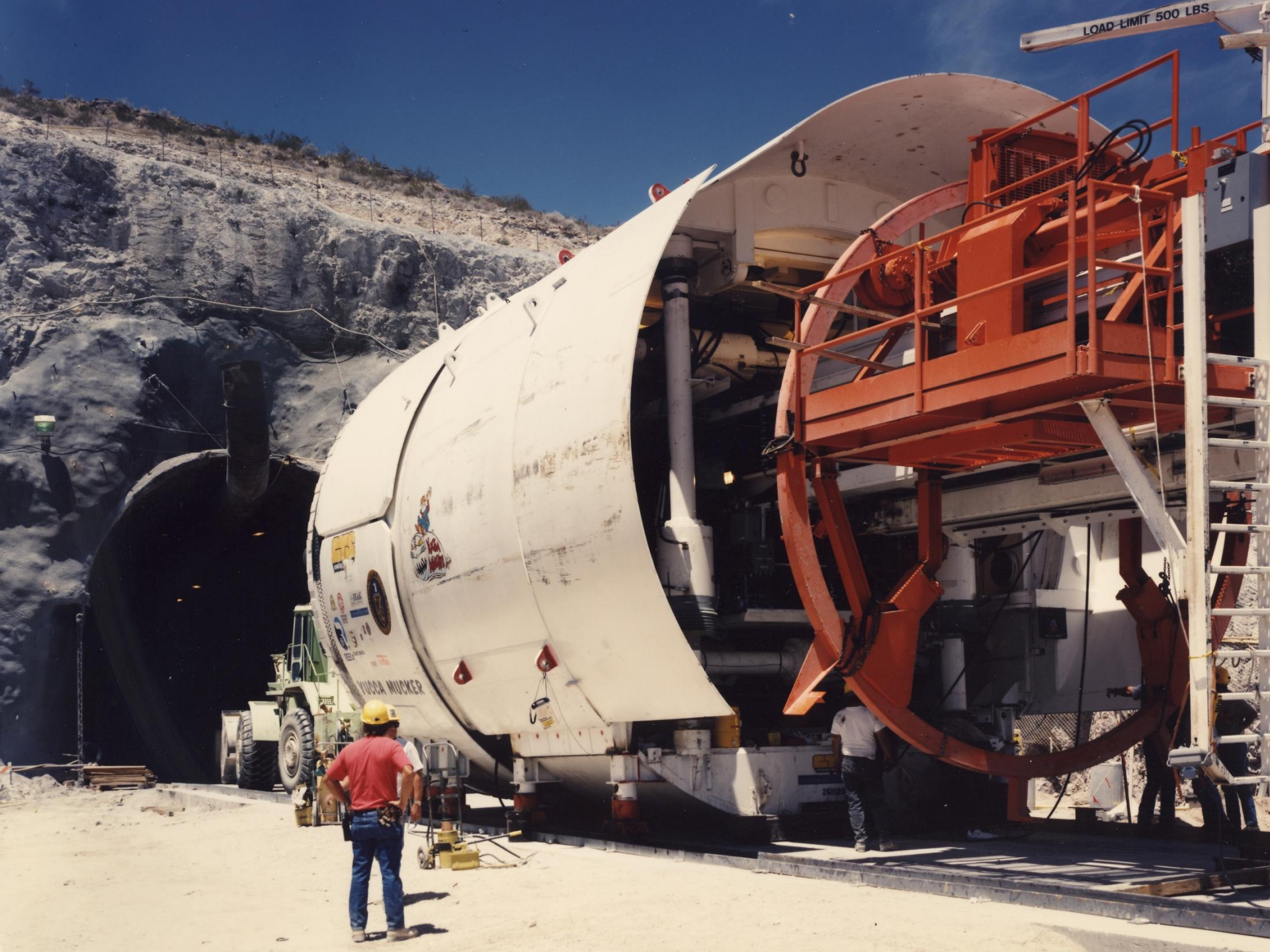
- Risk perception about the nature of radiation
- Risk perception linked to the use of nuclear bombs and to political issues (Iran, North Korea, Brazil)
- Risk perception linked to nuclear and radiological accidents
- Economical interests (nuclear x other energies)
- Difficulties in communication of a complex system to lay persons
- Lack of information or existing misinformation.

Successful and Unsuccessful Cases of Communication in Siting Radioactive Waste Repositories

The Yucca Mountain Repository






LOAD LIMIT 500 LBS
YUCCA MUCKER

Workshop on Stakeholder Dialogue
for Radioactive Waste Disposal

Yucca Mountain

- Some places are indicated as potential sites for receiving the national repository for radioactive waste of high level (HLW).
- US Senate approved Yucca Mountain (Nevada State) as the best place for receiving the national repository.
- Only one vote against the decision (representative of Nevada).
- All studies and calculations were made by experts showing that the repository will be safe for at least 100,000 years.
- The National Academy of Science claimed for a greater time extension study. New work was done to demonstrate that even for 1,000,000 years the deposit will probably remain safe.
- The site region was a desert with scarce population that could be affected.
- An inversion of US$15,000,000,000 was done to do the studies and start the construction.
- The process seemed to be a success in determining the site to the new national HLW repository

Success ??

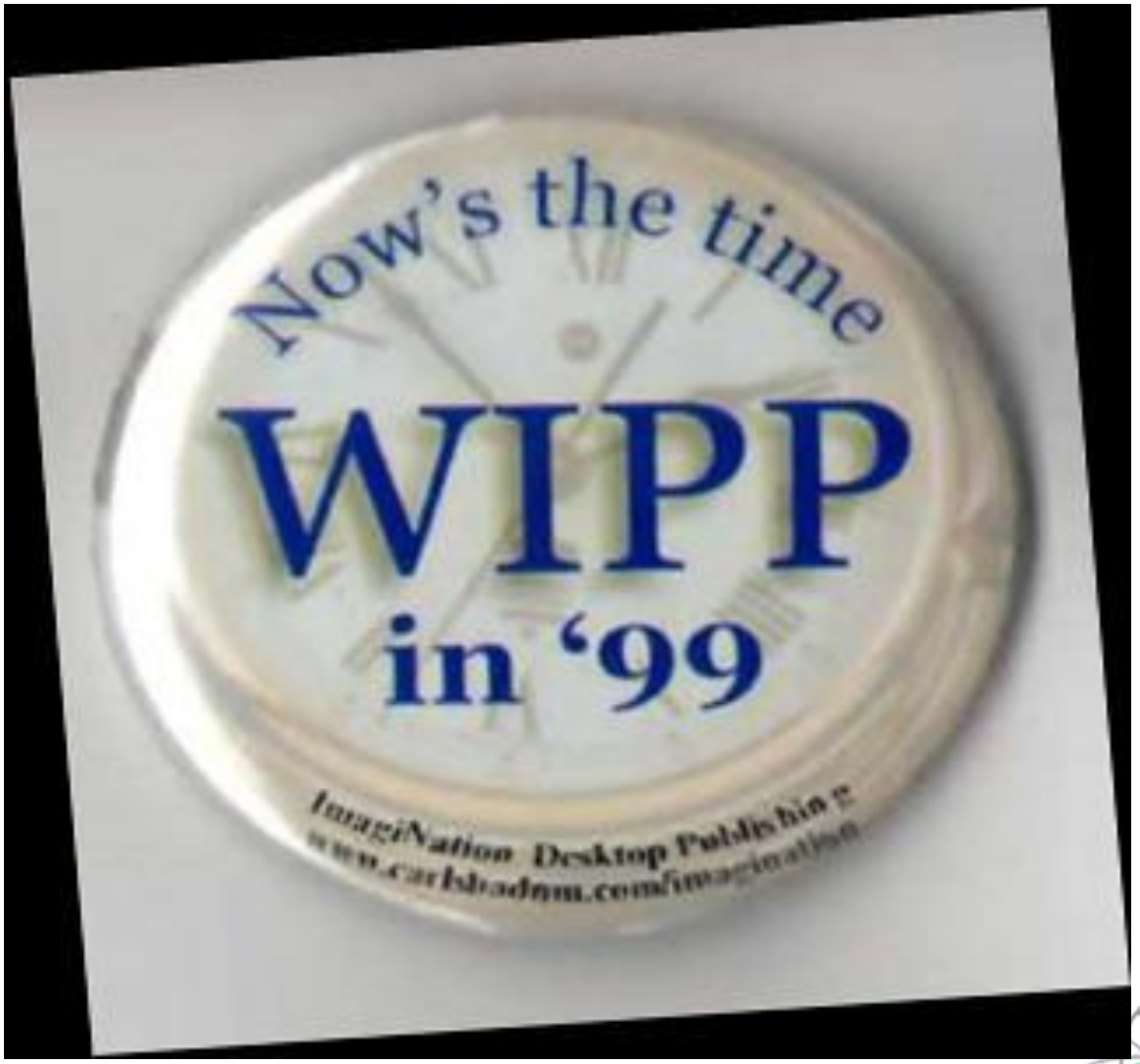
(from a NGO anti-Yucca Mountain after Obama decision)

- Yucca Mountain cannot isolate waste.
- The site was chosen undemocratically.
- Independent science was ignored.
- Vast majority of Nevadans opposed it.
- Nevada prevailed.
- **Success** for current and all future residents because an unsafe site was avoided.

Real reasons for stopping YM

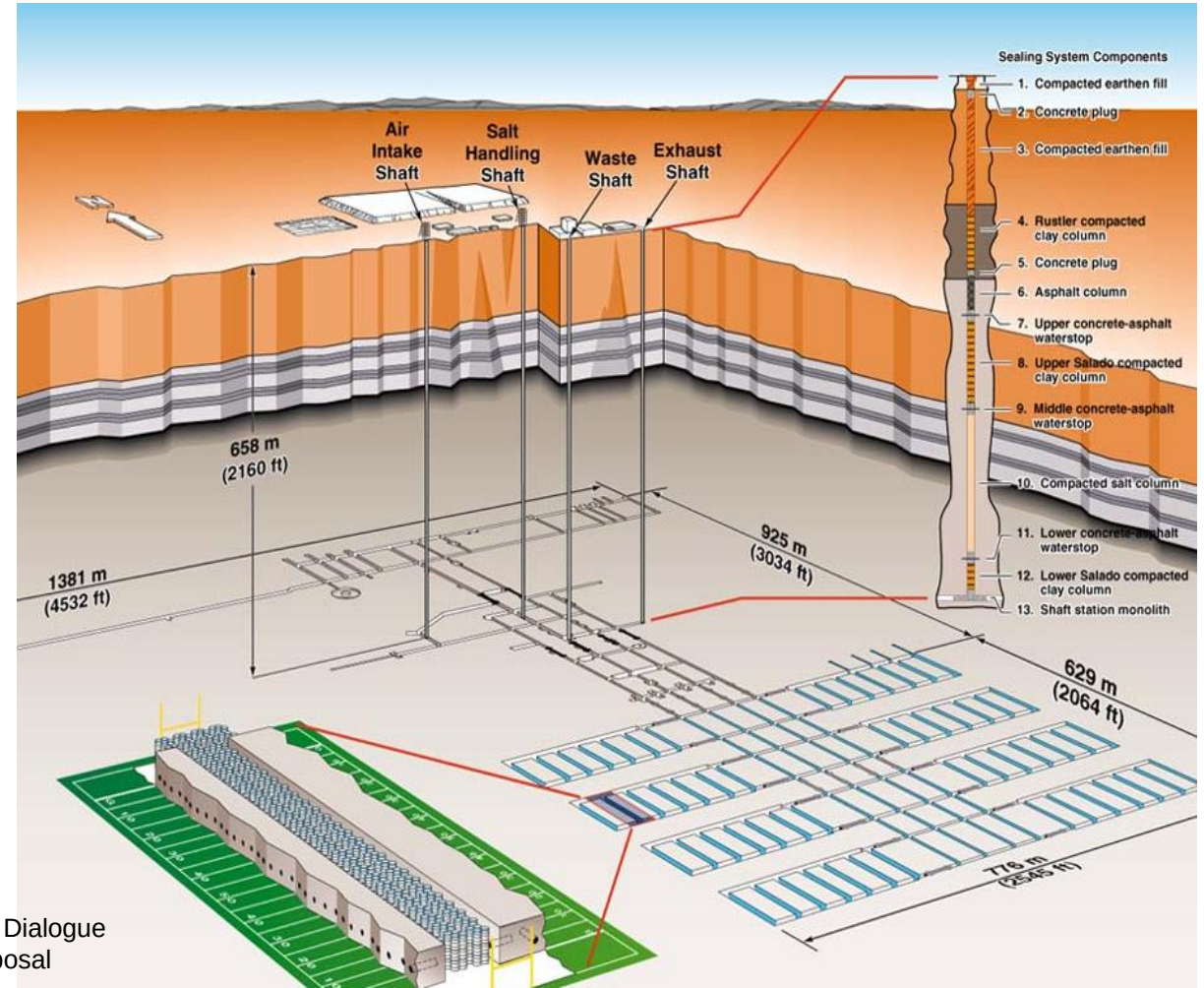
- The main financial support for politicians in Nevada comes from Las Vegas enterprises (games, tourism, shows).
- The main owners of show-business were convinced by the anti-repository activists that an accident during waste transportation to Yucca Mountain could strongly affect their business.
- When Obama became the US. President, his leader in the Congress was the senator for Nevada.
- Then, against all the existing studies, Obama declared: “Yucca Mountain probably isn’t the best place to build the national repository”.

The WIPP repository at Carlsberg, New Mexico, USA

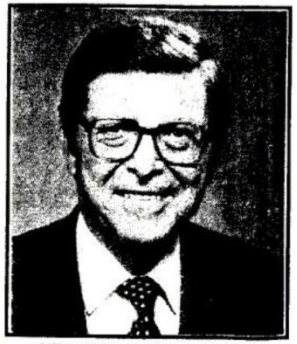


WIPP repository for nuclear waste from defense activities

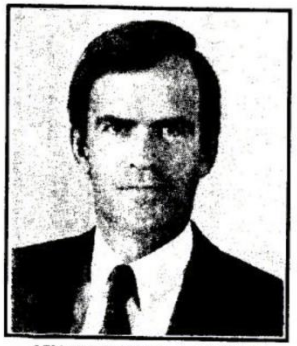
- Operating since 1999; recertified in 2004 & 2009
- 655 m depth in bedded salt



Will Senators Bingaman and Domenici protect New Mexicans' health and safety from WIPP?



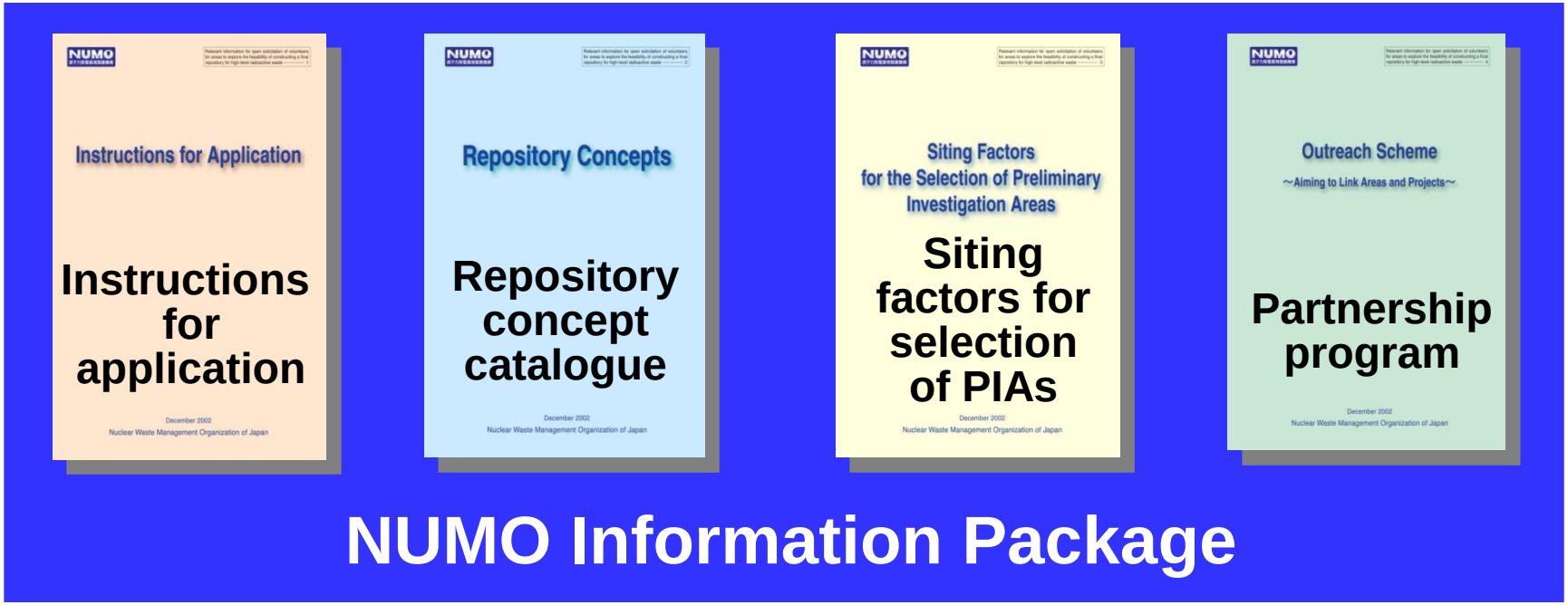
SENATOR PETE DOMENICI



SENATOR JEFF BINGAMAN

The process for choosing a site in Japan

- On 19 December 2002, NUMO officially announced the start of open solicitation to invite volunteer municipalities for Literature Survey
- Information Package distributed to all municipalities in Japan



Why Open Solicitation?

1. Project involves complex socio-political concerns.

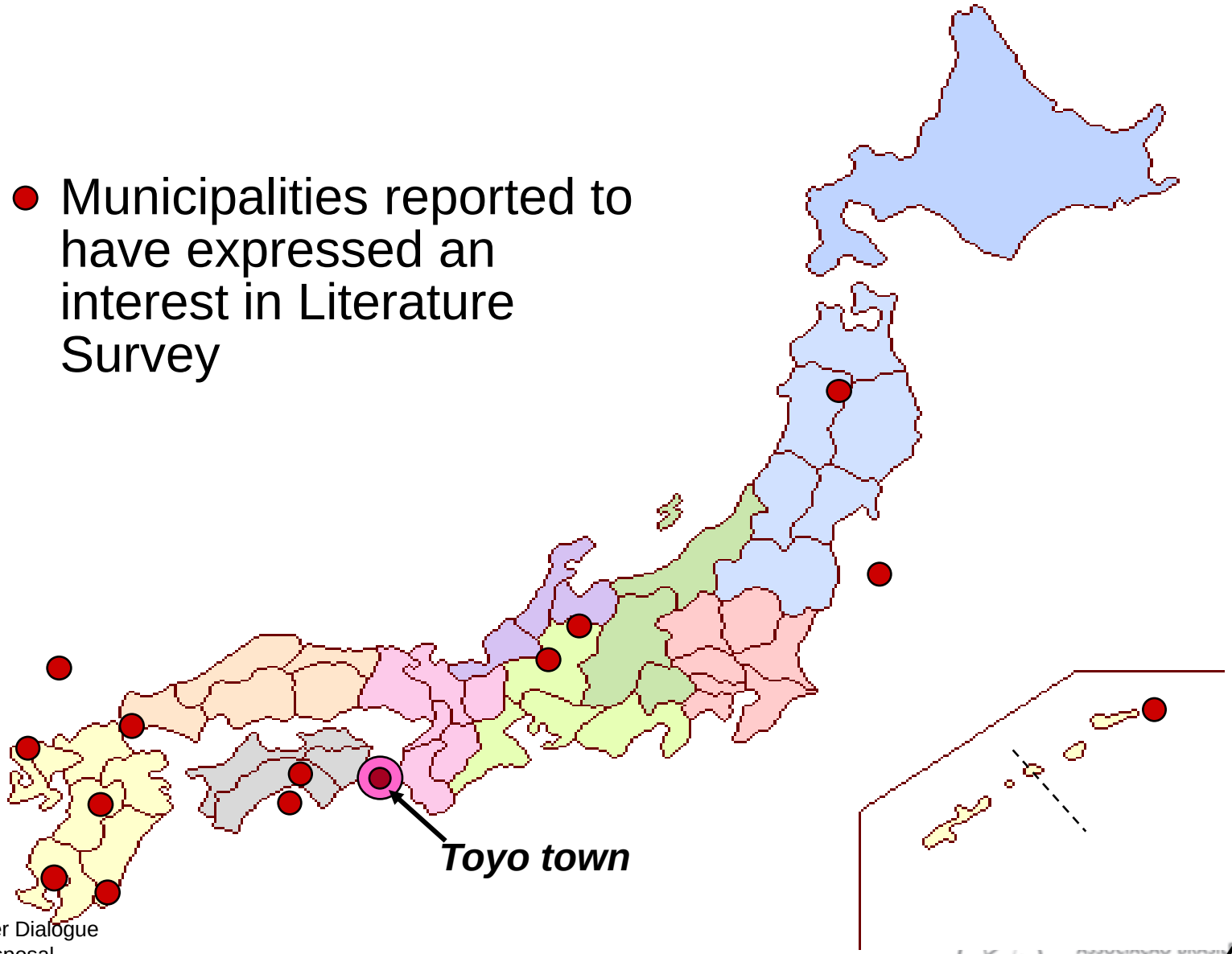
2. Public support is crucial for the success of the project.

3. Autonomous application by the volunteer municipalities supported by residents forms the basis of politically stable conduct of the project.

4. Long-term project lasting for almost a century provides communities a chance for sustainable development .

Responses from municipalities

- Municipalities reported to have expressed an interest in Literature Survey



Evolution since the announcement

- Ten local municipalities were reported to have expressed an interest in Literature Survey (LS), but none lead to the actual application.
- In January 2007, Toyo town became the first municipality to submit an application for LS.

Reasons for failure:

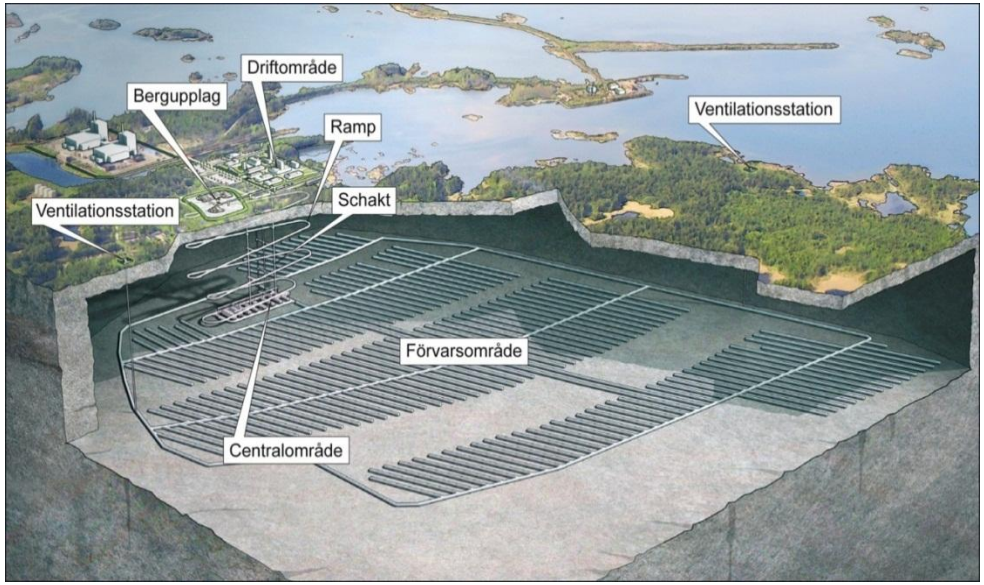
- The lack of prompt arrangements between Federal Government and Municipality gave time to NGOs anti-nuclear to do a strong movement against the repositories.
- Escalation in opposition activities led to the resignation of the mayor and his loss in the following election.
- A newly elected mayor withdrew the application and the literature survey for the town was abandoned.

Lessons learnt from the failure of Toyo-town case

- Failure to take proper and timely countermeasures to remove or ease irrational anxiety and distrust among people raised by negative propagandas by opponent activists
- Failure to gain enough support from local residents and bodies
- Insufficient preparation for facilitating communication with the prefecture and surrounding municipalities
- Inefficient cooperation among NUMO, government and utilities

Sweden - SKB has selected Forsmark

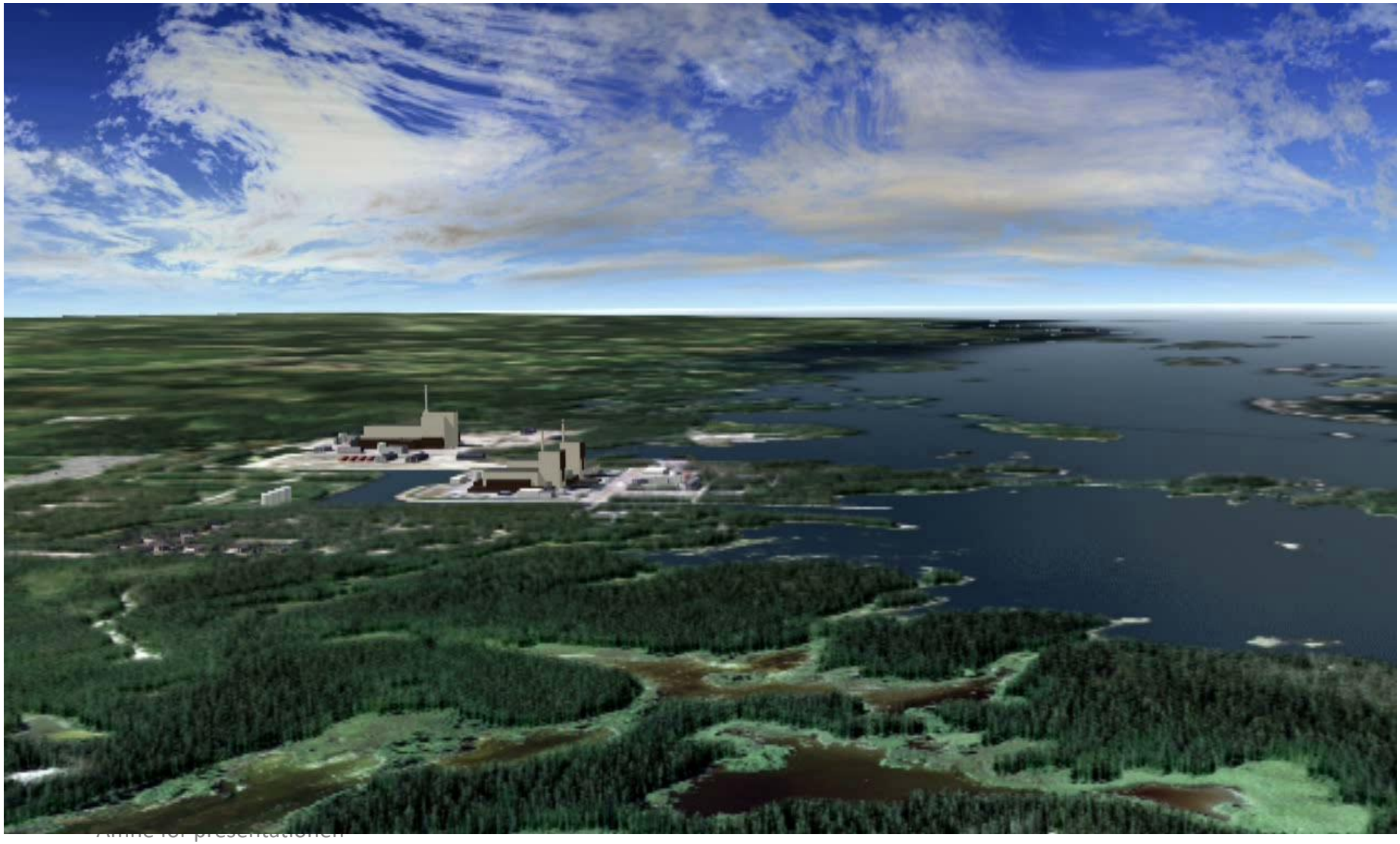
- The Forsmark site offers a bedrock at the repository level which is dry and has few fractures. These properties are of a major significance for long-term safety.



- A repository in Forsmark requires less space compared to a repository in Laxemar, which is advantageous.

- Surface facilities will be constructed in the existing industrial area, which reduces the environmental impact.

Sweden HLW Repository



Nederland - Storage of radioactive material at COVRA in Vlissingen

If you have the opportunity to communicate:

- The types of sources of radiation, the interaction of radiation with matter.
- Most of the ionizing radiation that people are exposed to comes from natural, rather than manmade, sources.
- Biological effects of irradiation, making a clear distinction between high/low dose exposure,
- Difference between external exposure and external/internal contamination.
- The quantity 'dose', the unit sievert and its sub-multiples.

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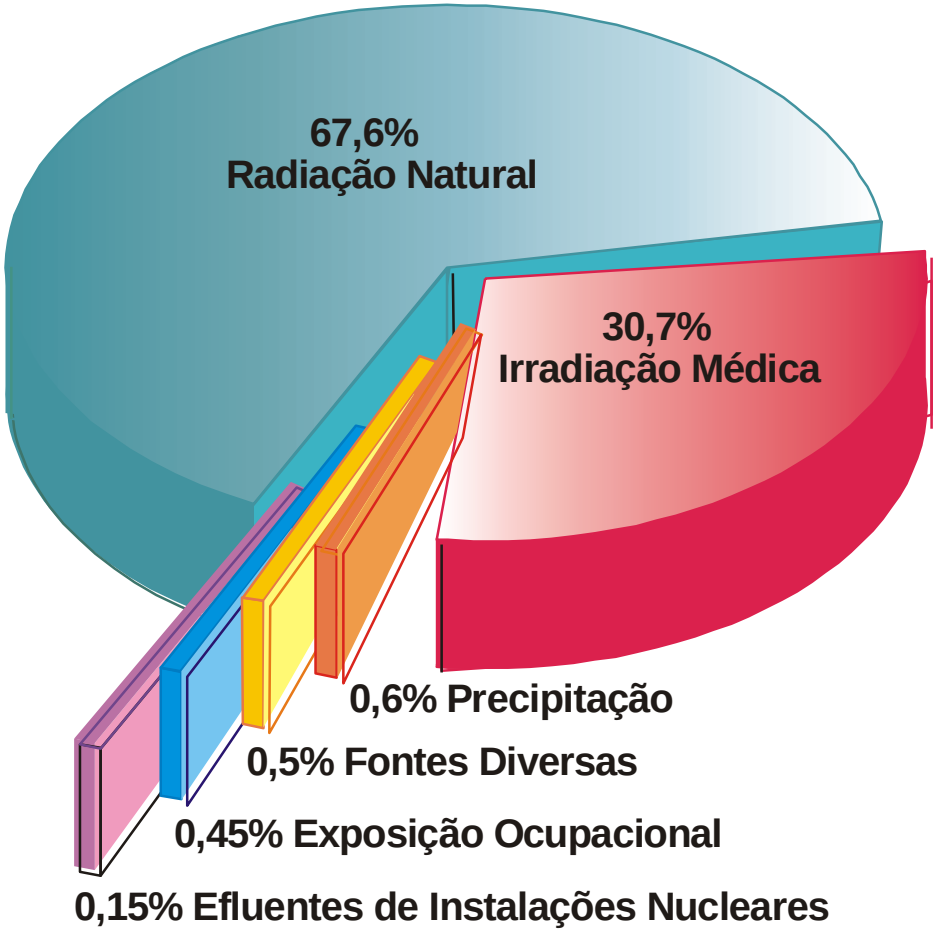
Sources of Ionizing Radiation

Average dose from diferent sources
= 2,4 mSv/year



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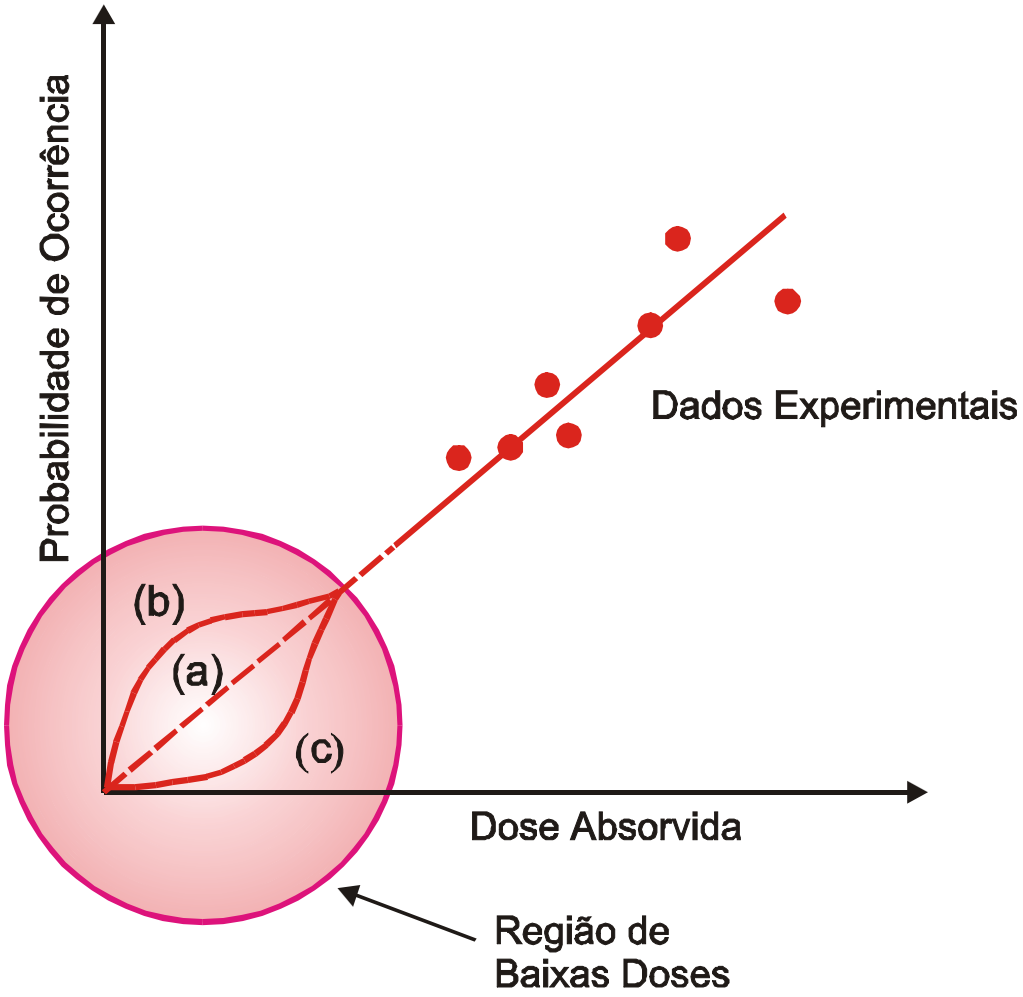
Low Doses



Comparação de doses de fontes de exposição

Fonte de Exposição	Dose
Raios-X dentário	0.005 mSv
Saquinho de 135g de castanha do Pará	0.005 mSv
Raios-X de tórax	0.02 mSv
Voo transatlântico	0.07 mSv
Exposição ocupacional anual média de trabalhador em usina nuclear	0.18 mSv
Tomografia computadorizada de cabeça	1.4 mSv
Dose média anual de radiação no mundo	**2.4 mSv**
Dose média anual de radiação no Reino Unido	2.7 mSv
Dose média anual de radiação nos EUA	6.2 mSv
Tomografia computadorizada de tórax	6.6 mSv
Dose média anual de radônio população da Cornuália (Reino Unido)	7.8 mSv
Tomografia computadorizada de corpo inteiro	10 mSv
Limite anual de exposição para trabalhadores ocupacionalmente expostos (acima da radiação natural de fundo do ambiente)	20 mSv
Nivel para o qual podem ser prontamevnte observadas modificações nas células do sangue	100 mSv
Efeitos agudos de radiação, incluindo náuseas e redução na contagem de glóbulos brancos	1000 mSv
Dose de radiação que provavelmente irá causar a morte de metade dos que a receberem no intervalo de um mês	5000 mSv

Factors that facilitate public acceptance in nuclear enterprises

- Good experience of local population living close to nuclear facilities.
- Trustful, continuous and open information from the nuclear facility to the population.
- Nuclear facilities bring economical positive influence in the region (+jobs, +schools, +energy, +roads, +development).
- Nuclear facilities with good maintenance and good appearance.
- Nuclear energy support from local leadership.

Brazilian Case: Cs-137 Final Repository

Final Repository

- Regional Center for Nuclear Sciences Information Building

Images/symbols pro & against nuclear energy

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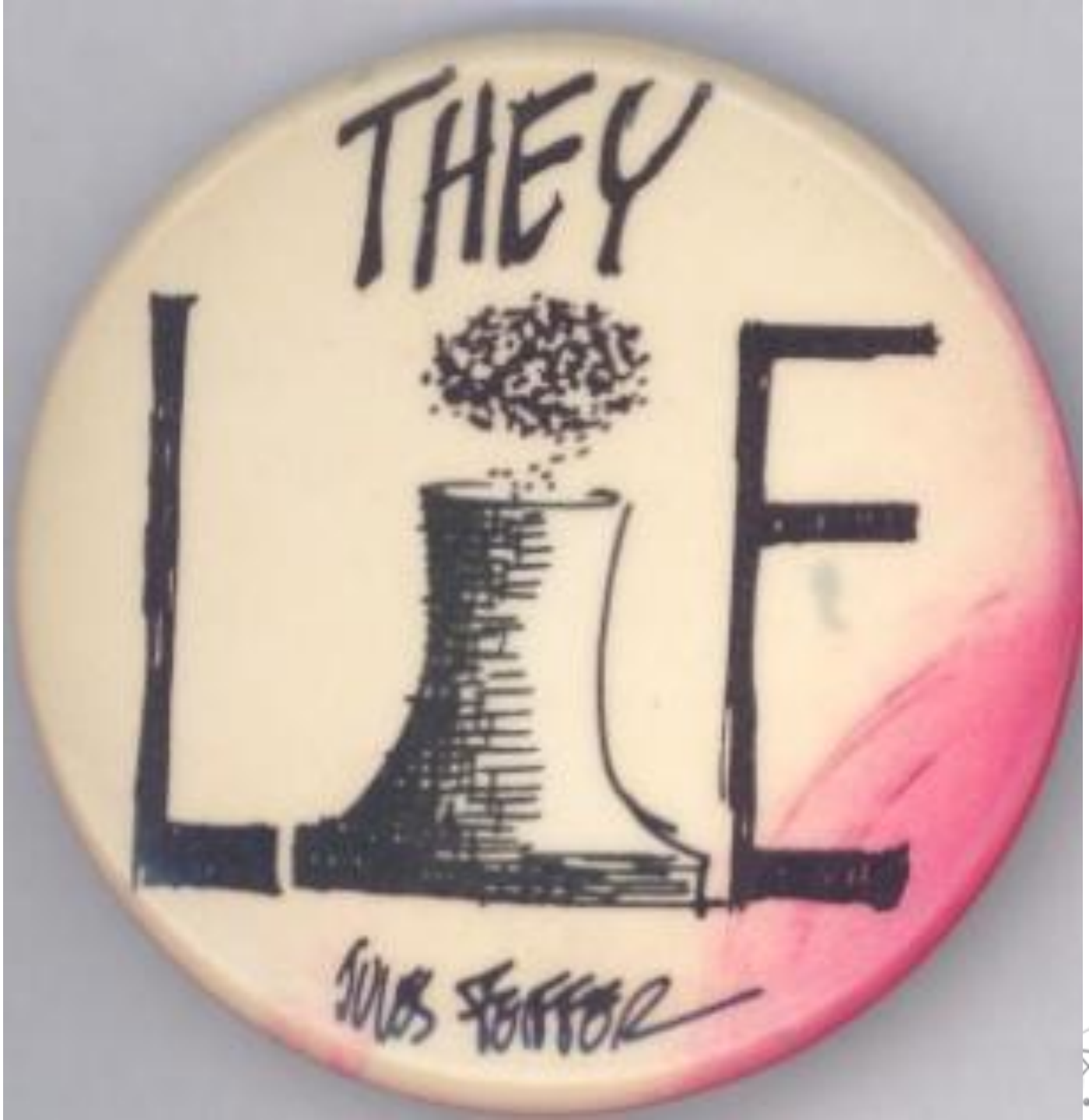

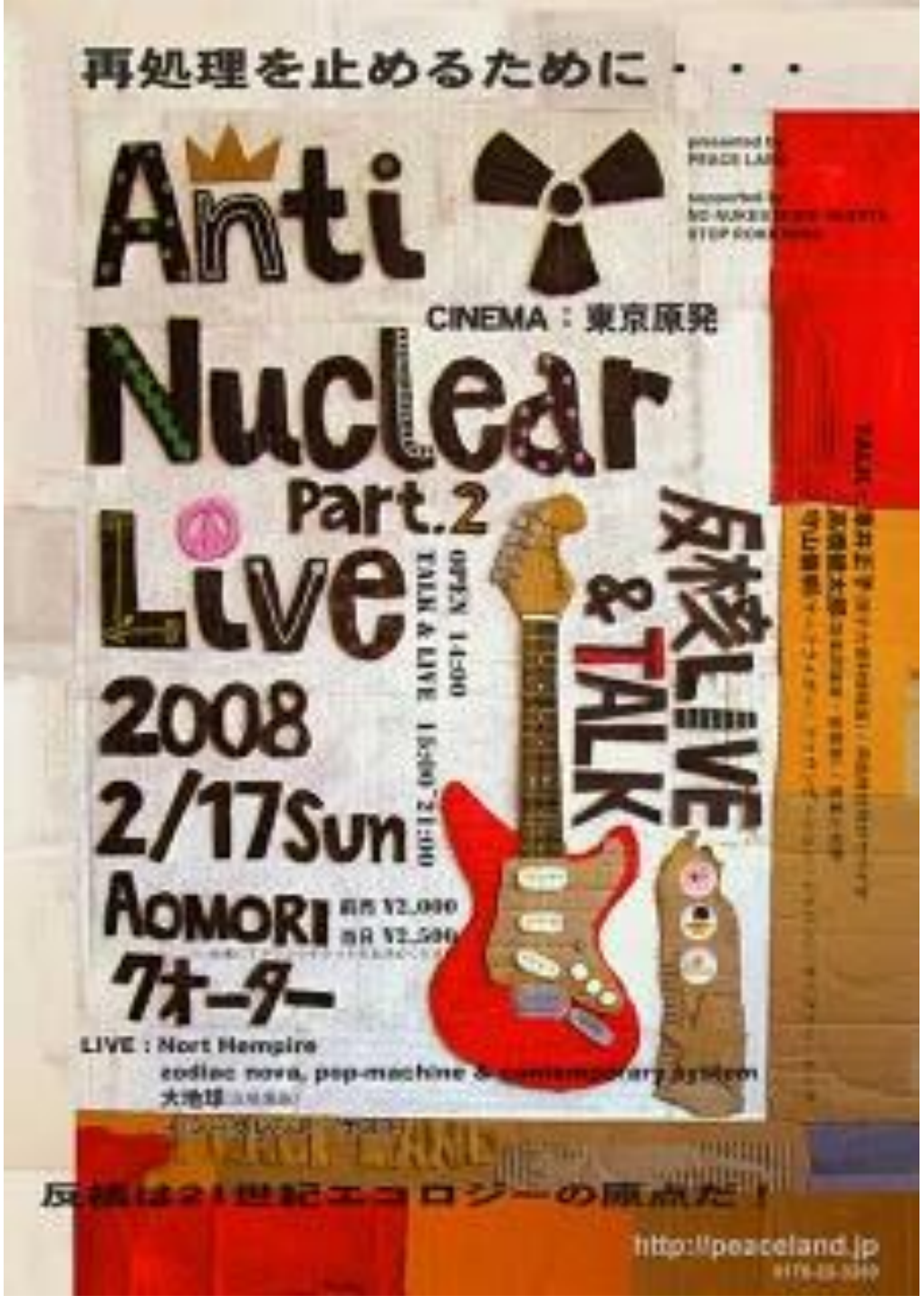

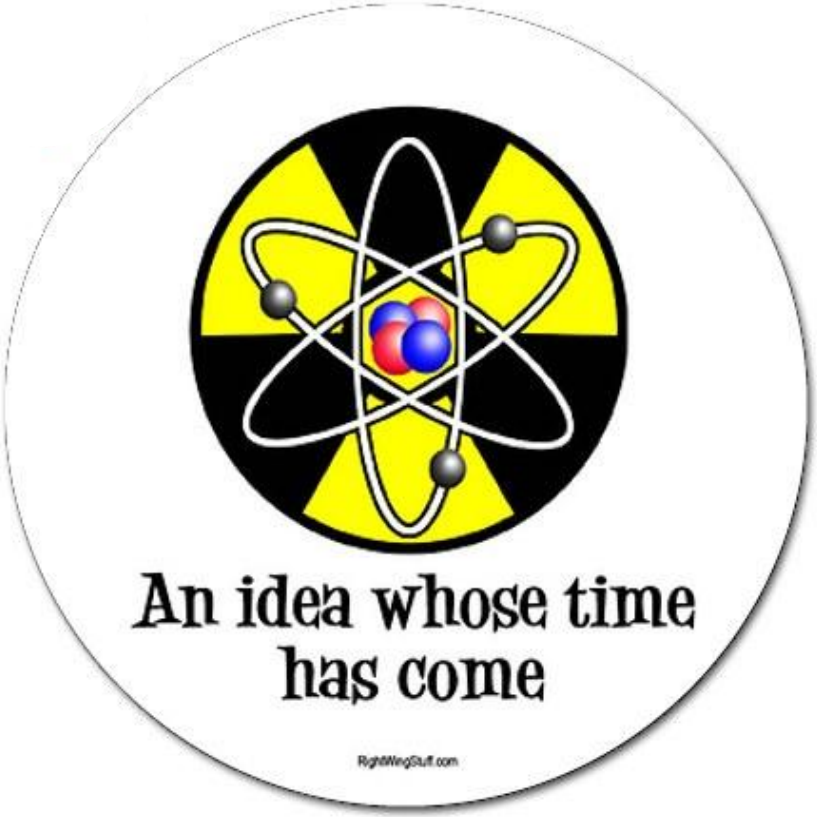

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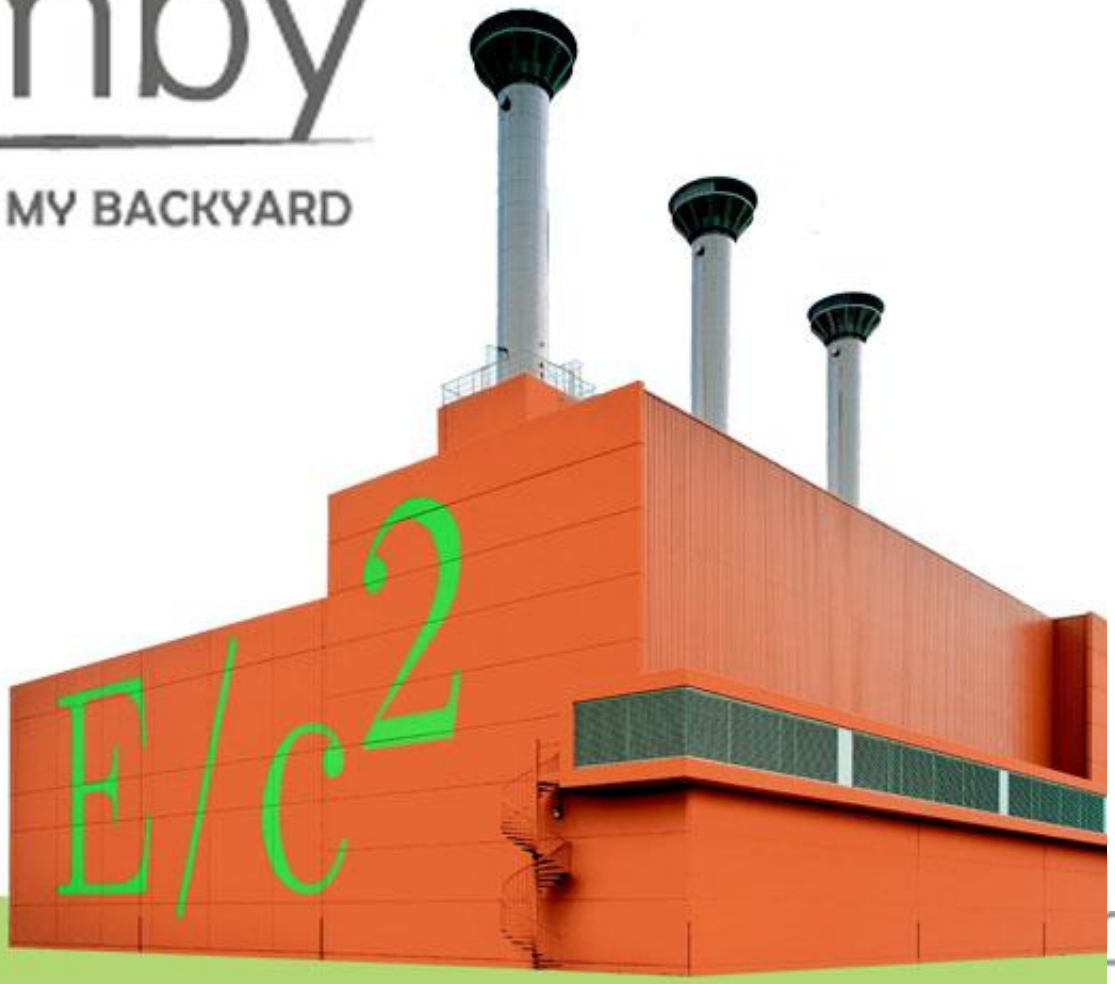
Pimby

PLEASE IN MY BACKYARD




Obrigado