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CONSIDERATION OF THE FEASIBILITY OF EFFECTIVE EMERGENCY RESPONSE ACTIONS

Asian Nuclear Safety Network (ANSN)
Regional Workshop on Radiological Environmental Impact Assessment for Nuclear Installations
Hosted by the Government of the Philippines through the Philippine Nuclear Research Institute (PNRI)
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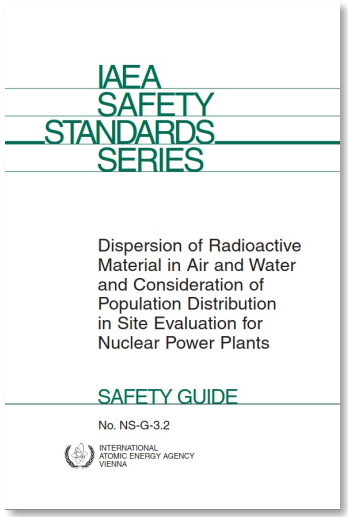


6.1. Before final approval of a nuclear power plant site, the feasibility of an emergency plan should be demonstrated. There should be no adverse site conditions which could hinder the sheltering or evacuation of the population in the region or the ingress or egress of external services needed to deal with an emergency.

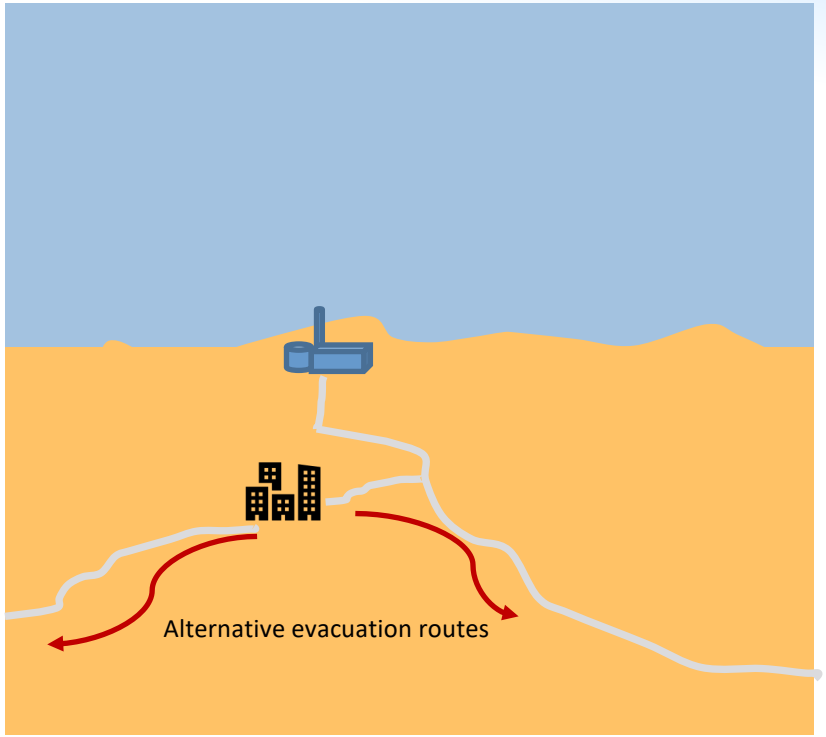
- Other aspects of the emergency plan include:
  - Provision of stable iodine tablets
  - Food bans
  - Communication

Population considerations

Population considerations during site selection stage

- Need to be reasonably confident that it will be possible to produce a feasible emergency plan for the proposed reactor technology at the selected site when the emergency plan is eventually assessed
- Factors to consider include:
  - Population density around the site (including transient populations)
  - Distance to population centres
  - Presence of special groups (hospitals, prisons, schools, etc)
  - Transport and communication infrastructure
  - Geographical features that could hinder emergency countermeasures such as evacuation
  - Potential for population growth

Feasibility of emergency plan (evacuation)



Alternative evacuation routes (with sufficient capacity) in different directions exist – site suitable

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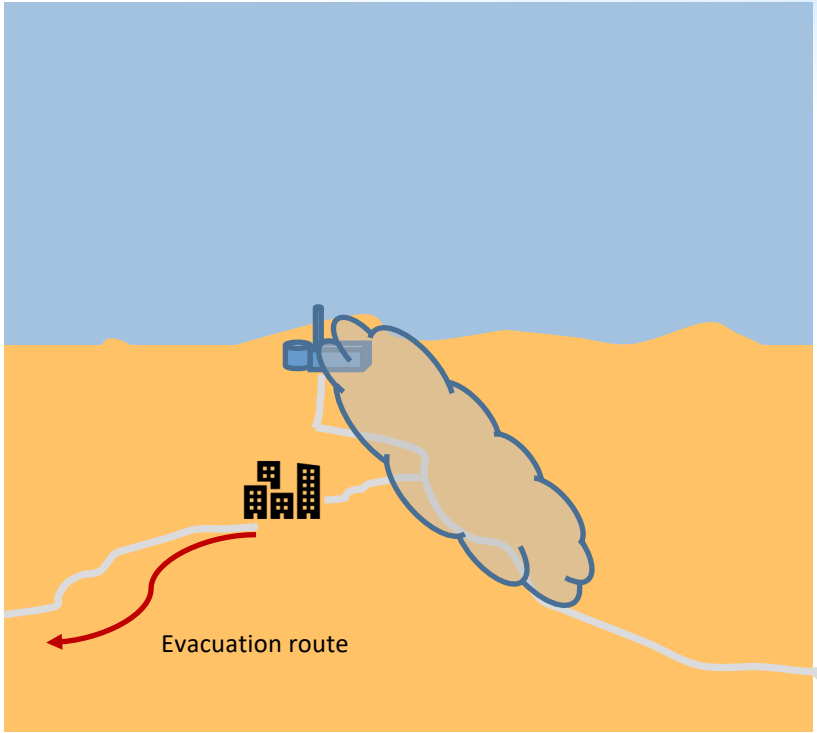
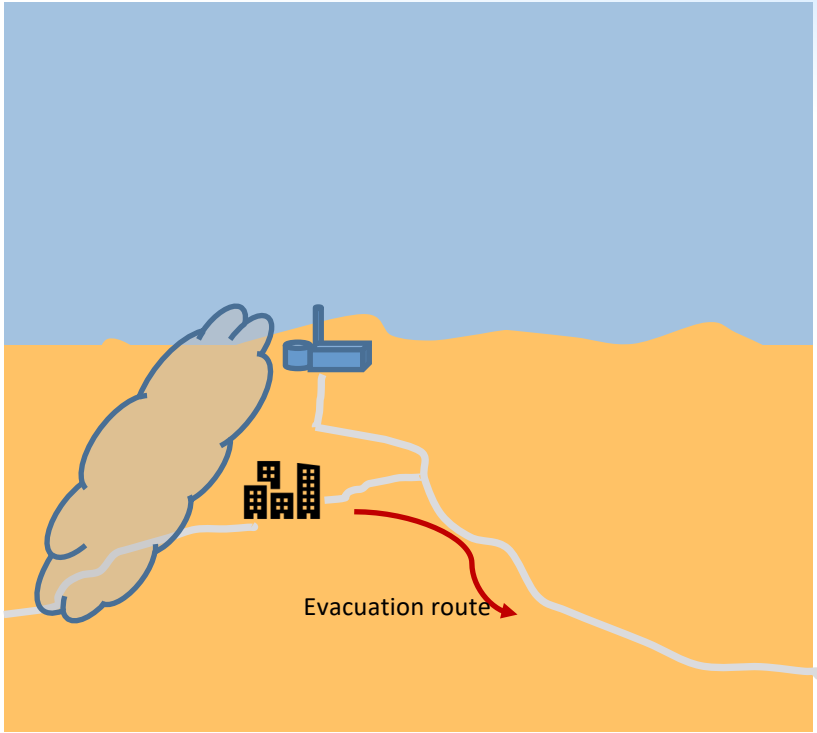
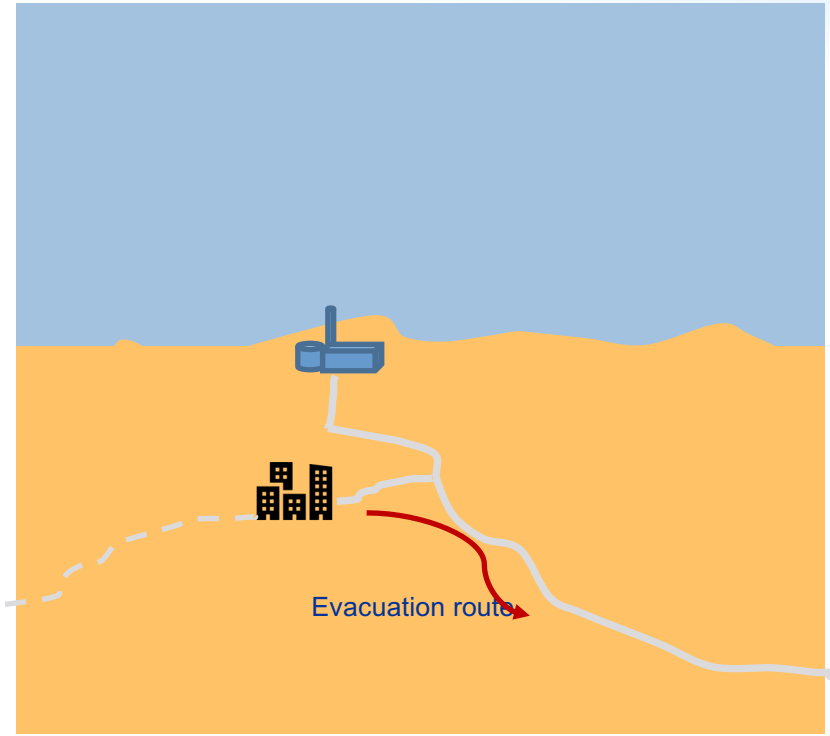
Feasibility of emergency plan (evacuation)



Feasibility of emergency plan (evacuation)

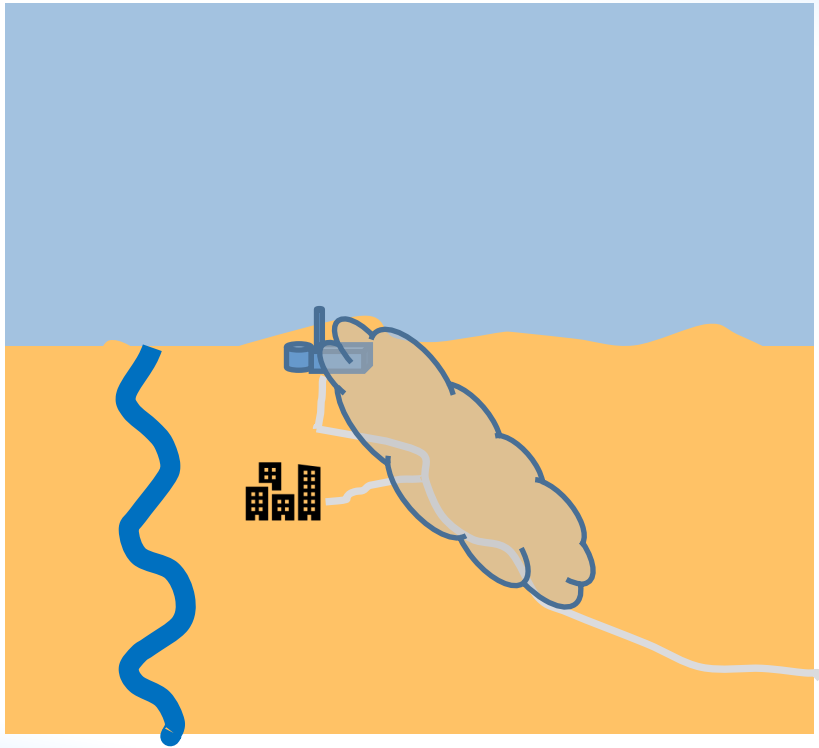


Feasibility of emergency plan (evacuation)



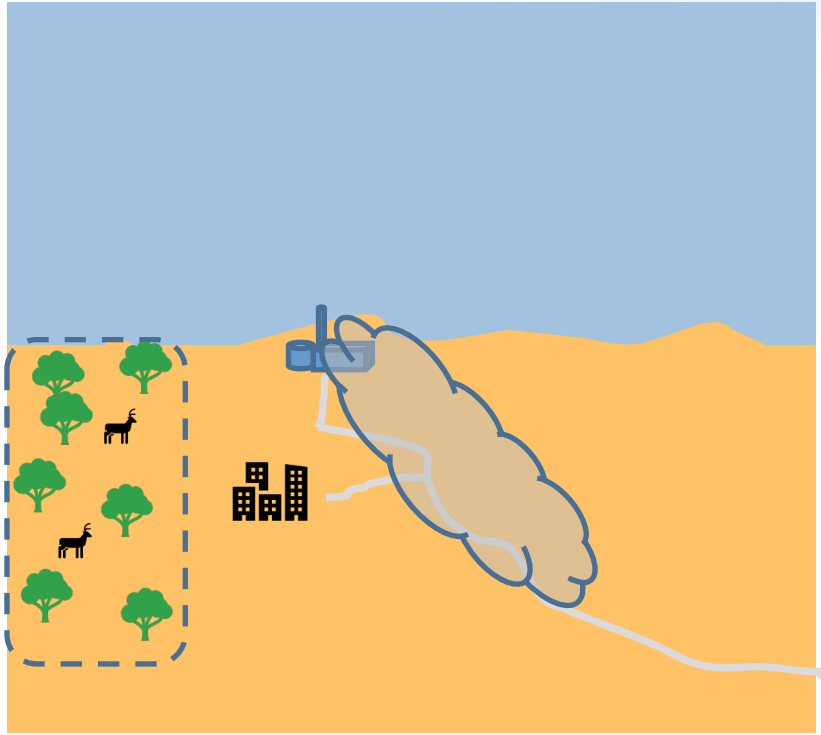
Alternative evacuation routes in different directions do not exist but could be constructed – site suitable

Feasibility of emergency plan (evacuation)



Physical barrier preventing construction of an alternative evacuation route – site unsuitable

Feasibility of emergency plan (evacuation)



Administrative barrier (national park or special area) preventing construction of an alternative evacuation route – site unsuitable

Evacuation

A transport analysis should be performed to demonstrate that the transport infrastructure for multiple evacuation routes is capable of effecting an evacuation of the required number of people – taking special groups (see below) into account – in the required amount of time (within a few hours) to avoid significant exposure

Such analysis will need to consider for each alternative route *inter alia*:

- the number of people to evacuate
- the vehicles available
- transport needs and arrangements for any special groups (see below)
- the time to alert people and to prepare to evacuate (also considering the special groups)
- typical traffic volumes and speeds
- traffic bottlenecks such as bridges

Evacuation

The presence of large populations in the region or the proximity of a city to the site may diminish the effectiveness and viability of an emergency plan

Specific circumstances of any special groups of the population should be recognized and taken into account

- For example, hospital patients may be need to be accompanied by medical staff with appropriate medical equipment

Feasibility of emergency plan (sheltering)

Features that might make sheltering difficult would include places where large numbers of people may congregate, for example:

- open air stadia
- rail/bus stations
- markets

In such cases, arrangements would need to be considered for these people to move to a sheltered place that has sufficient capacity

Feasibility of emergency plan (other countermeasures)

Other emergency response actions such as implementing food bans and taking stable iodine tablets should be possible to implement regardless of site characteristics

- Any deposited activity will take some time to work its way through the food chain giving more time to implement food bans
  - May need to consider foraged food – e.g. wild berries or mushrooms – or non-commercial local food production
- Stable iodine tablets should have been pre-issued to people considered at risk, only notification to take the tablets should be required
- Adequate communication needs to be demonstrated

Collection of information

The feasibility of an emergency plan should be demonstrated on the basis of site specific natural and infrastructural conditions in the region

- Infrastructure means transport and communications networks, industrial activities and, in general, anything that may influence the rapid and free movement of people and vehicles in the region of the site

Other information on the region should be collected for demonstrating the feasibility of an emergency plan, such as:

- information on the availability of sheltering
- the systems for the collection and distribution of milk and other agricultural products
- special population groups such as those resident in institutions (for example, hospitals and prisons)
- industrial facilities
- environmental conditions such as the range of weather conditions

Collection of information

Many site related factors should be taken into account in demonstrating the feasibility of an emergency plan; the most important ones are:

- population density and distribution in the region
- distance of the site from population centres
- special groups of the population who are difficult to evacuate or shelter, such as people in hospitals or prisons, or nomadic groups
- particular geographical features such as islands, mountains, and rivers
- characteristics of local transport and communications networks
- industrial facilities which may entail potentially hazardous activities
- agricultural activities that are sensitive to possible discharges of radionuclides
- possible concurrent external events

Concurrent external events

Summary

If no feasible emergency plan can be established, then the proposed site should be considered unacceptable

It is possible that conditions assessed for the purposes of approval of the site and design will change over time

- The site related factors considered in the emergency plan, such as infrastructural developments, should be reviewed periodically during the operational phase of the plant

CASE STUDY: FEASIBILITY OF EMERGNCY PLAN

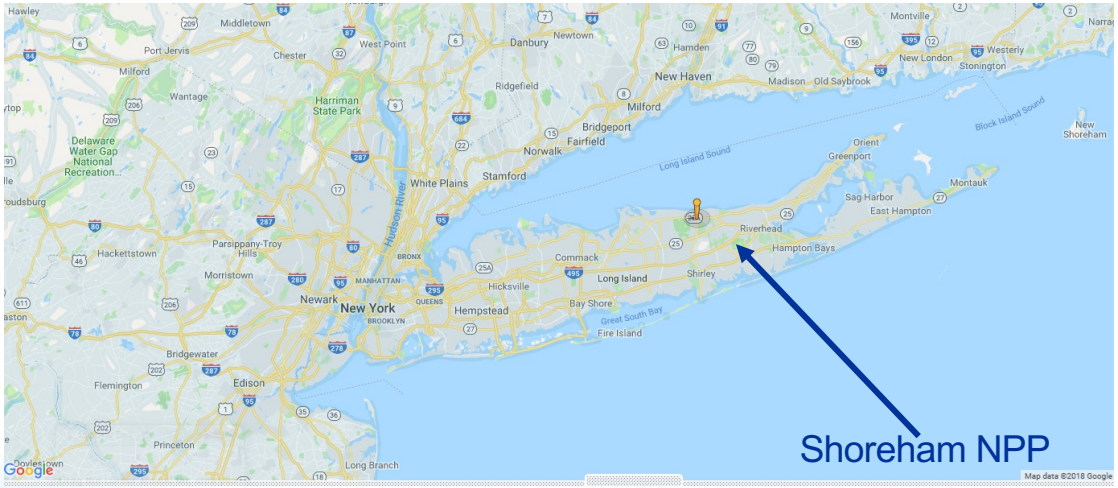
Experience from Shoreham NPP, US

Case Study: Feasibility of Emergency Plan – the Shoreham NPP, US

1965: LILCO (Long Island Light Company) first announced its intention to build a NPP somewhere in Suffolk County

Within a year LILCO had bought a 455-acre site between the sparsely populated hamlets of Shoreham and Wading River

- LILCO declared plant would be on-line by 1973 at a cost of $65-$75 million



Case Study: Shoreham NPP

LILCO also bought land for a second NPP in affluent Lloyd Harbor

- This time local residents reacted negatively and a well-funded campaign of opposition was launched

1968: LILCO decided to increase the size from 540 to 820 MW

- This decision delayed the schedule and added significantly to the costs
- Opposition grew
- Poor public relations
- Lloyd Harbor NPP plans abandoned

Late 1970s: costs approaching $2 billion, mostly because of low worker productivity as well as design changes ordered by federal regulators

Case Study: Shoreham NPP

1979: Three Mile Island accident increased anti-nuclear sentiment and activism and Shoreham became a focal point.

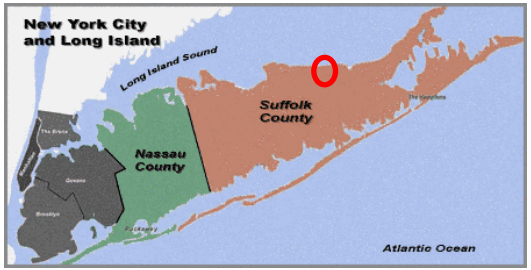
- June: 15,000 protesters met at Shoreham for the largest demonstration in Long Island history.
- Accident also led to federal regulators declaring that operators of nuclear plants would have to work out evacuation plans in cooperation with state and local governments.

1983: the Suffolk Legislature declared that the county could not be safely evacuated

- New York's newly elected governor, Mario Cuomo, ordered state officials not to approve any LILCO-sponsored evacuation plan

A protestor at the Shoreham nuclear power station

From *Malcolm Grimston, 'The Importance of Politics to Nuclear New Build'. London: Chatham House,*



Case Study: Shoreham NPP

1984: LILCO pressed ahead and completed Shoreham

1985: Federal permission for low power tests

1986: Chernobyl accident

Late 1980s: failure to agree evacuation plans was still delaying an operating licence for the plant

1989: after more than two years of negotiations and abortive deals, Cuomo and the chairman of LILCO signed an agreement that prevented the plant ever operating but made electricity consumers responsible for most of Shoreham's costs.

1994: Shoreham was fully decommissioned

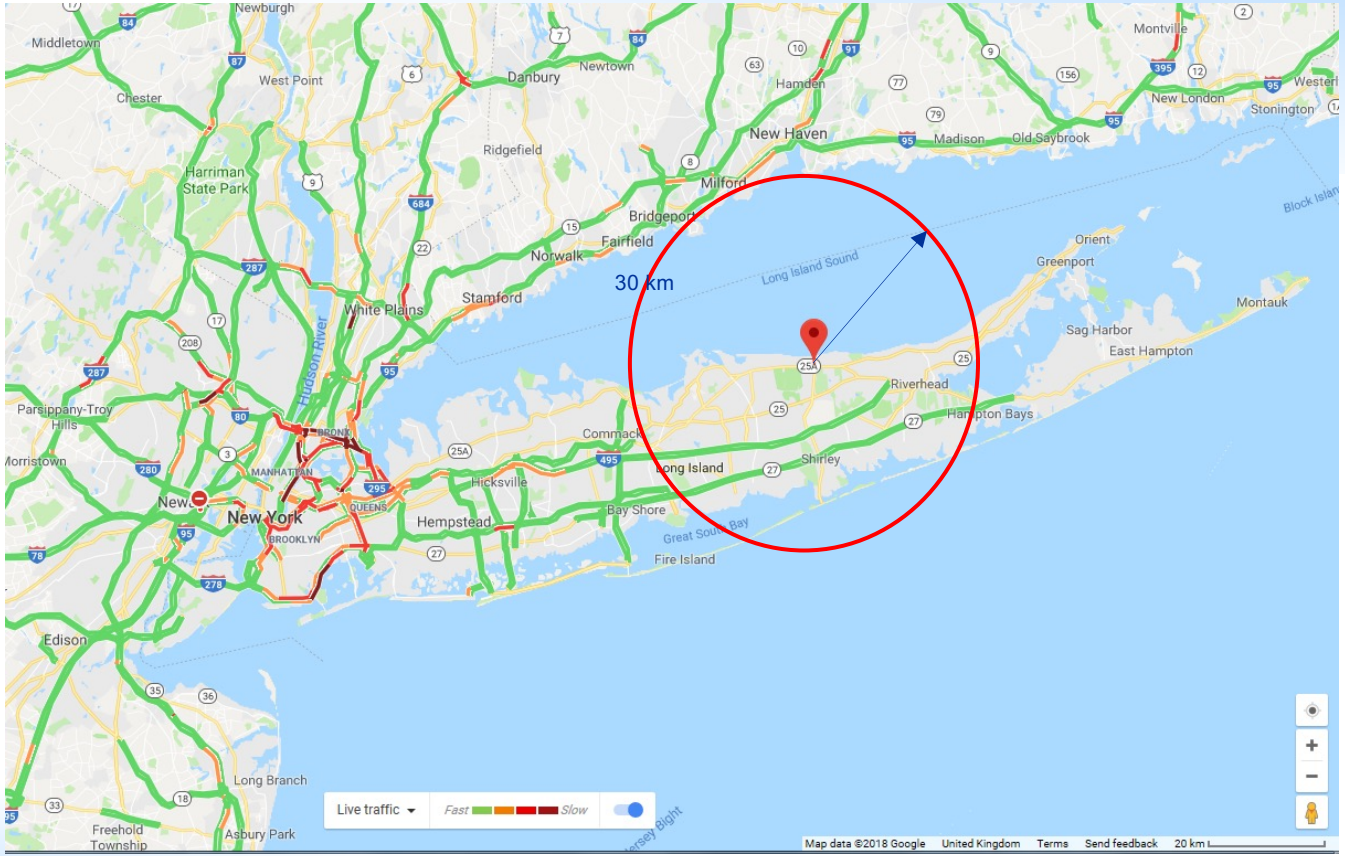
- total cost of the project was $6 billion
- it never produced a kW of commercial power

Case Study: Shoreham NPP - QUESTION

Why might the Emergency Plan not be feasible?

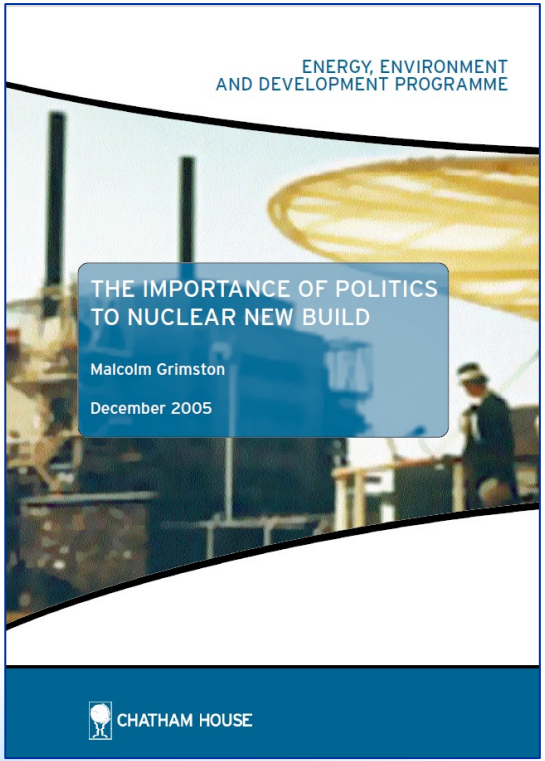
Or

Was it more political interference pandering to anti-nuclear activism?



Case Study: Shoreham NPP

Further reading



https://www.chathamhouse.org/sites/default/files/public/Research/Energy,%20Environment%20and%20Development/dec05nuclear.pdf

CASE STUDY: SPECIAL POPULATION GROUPS

Experience from the evacuation from Fukushima

Evacuation and Special Population Groups – experience from Fukushima

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Correspondence

Loss of life after evacuation: lessons learned from the Fukushima accident

Koichi Tanigawa, Yoshio Hosoi , Nobuyuki Hirohashi , Yasumasa Iwasaki , Kenji Kamiya

Altmetric 78

DOI: http://dx.doi.org/10.1016/S0140-6736(12)60384-5

Article Info

No data is available

Summary Full Text Tables and Figures References

This is a report of the tragic events that befell hospital inpatients and elderly people in the emergency evacuation after the Fukushima Daiichi Nuclear Power Plant accident on March 11, 2011.

Emergency evacuation of hospital inpatients and elderly people

- there were 8 hospitals and 17 nursing care facilities located within a 20 km radius of the Fukushima Daiichi NPP
- estimated numbers 240 and 980 respectively

Koichi Tanigawa *et al.* Loss of life after evacuation: lessons learned from the Fukushima accident: Lancet: Volume 379 Issue 9819 889-891, 10 March 2012.
http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)60384-5/fulltext

Evacuation – experience from Fukushima
timeline of events

11 March evening: national government issued a State of Atomic Emergency - evacuation ordered for residents within a 2km radius of the plant

12 March morning: evacuation area was expanded to a 10km radius

12 March afternoon (after the first explosion of the No. 1 reactor): Government ordered evacuation from a 20km radius

13 March evening: 840 patients in hospitals or nursing care facilities remained – evacuation ordered

14 March: evacuation takes place – no medical staff

- more than 50 patients died either during or soon after evacuation, probably owing to hypothermia, dehydration, and deterioration of underlying medical problems
- there were no deaths related to radiation or the explosion of the reactors in the 20km radius
- no significant contamination was found in the patients evacuated despite the fact that 48 hours had passed between the first explosion and their evacuation.

Evacuation – experience from Fukushima
Lessons learned

The nuclear disaster plans in Japan recommended emergency evacuation of residents within an 8–10 km radius around nuclear power plants.

- However, no specific plans for hospital inpatients or elderly people in nursing facilities had been established.

By contrast with physical injuries caused by the collapse of buildings or the tsunami, radiation itself does not create any immediate threat to life. Rather, ill-prepared evacuation might increase the health risk of hospital inpatients or elderly people. In the case of nuclear disasters, therefore, evacuation of these vulnerable people should be carefully done with medical arrangements in place before transfer.

In preparation for nuclear disasters, detailed evacuation plans for these populations should be developed. Essentials that need consideration include distribution of hospitals and nursing facilities, number of patients in the area, available vehicles and accompanying medical personnel for transportation, evacuation routes, estimated time for evacuation, available hospitals and facilities for evacuees, and location of monitoring posts for radiation levels.

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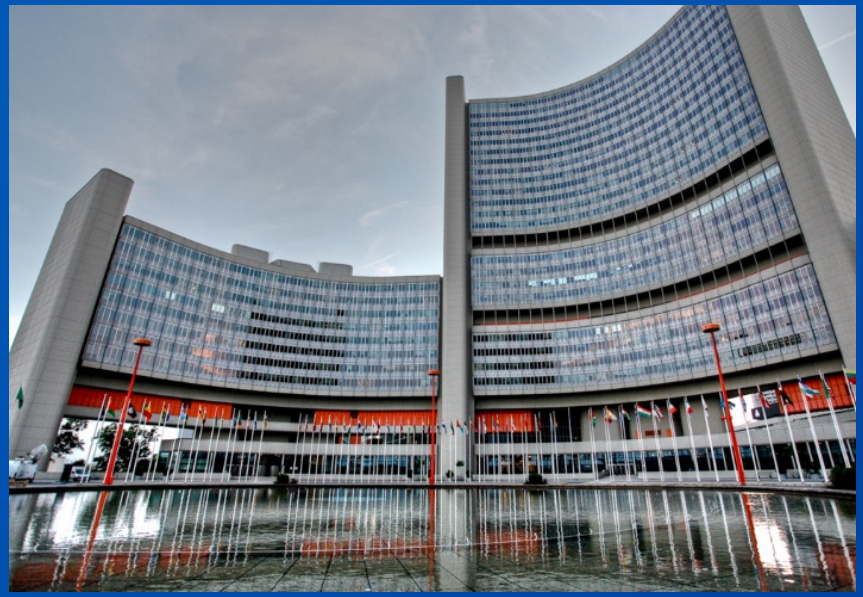

Thank you!
Questions?

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