HISTORY-WHY ARE WE AT THIS STAGE?

- 1955 U.S. NAS recommends geological disposal (Disposal of Radioactive Waste on Land, 1957)
- 1959 At IAEA U.S. laboratories reports on successful laboratory scale studies of vitrification of high level waste (HLW) andmeans of immobilizing HLW
- 1965 Project Salt Vault field scale disposal of spent nuclear fuel at final temperatures and radiation doses
- After 50 years of effort, there is, as yet, no vitrification at Hanford and no high level waste or spent fuel disposal in geologic formations in the world

COULD ANY PRIVATE COMPANY SURVIVE THIS PERFORMANCE?

Demanding assurances for 1,000,000 years makes no sense.

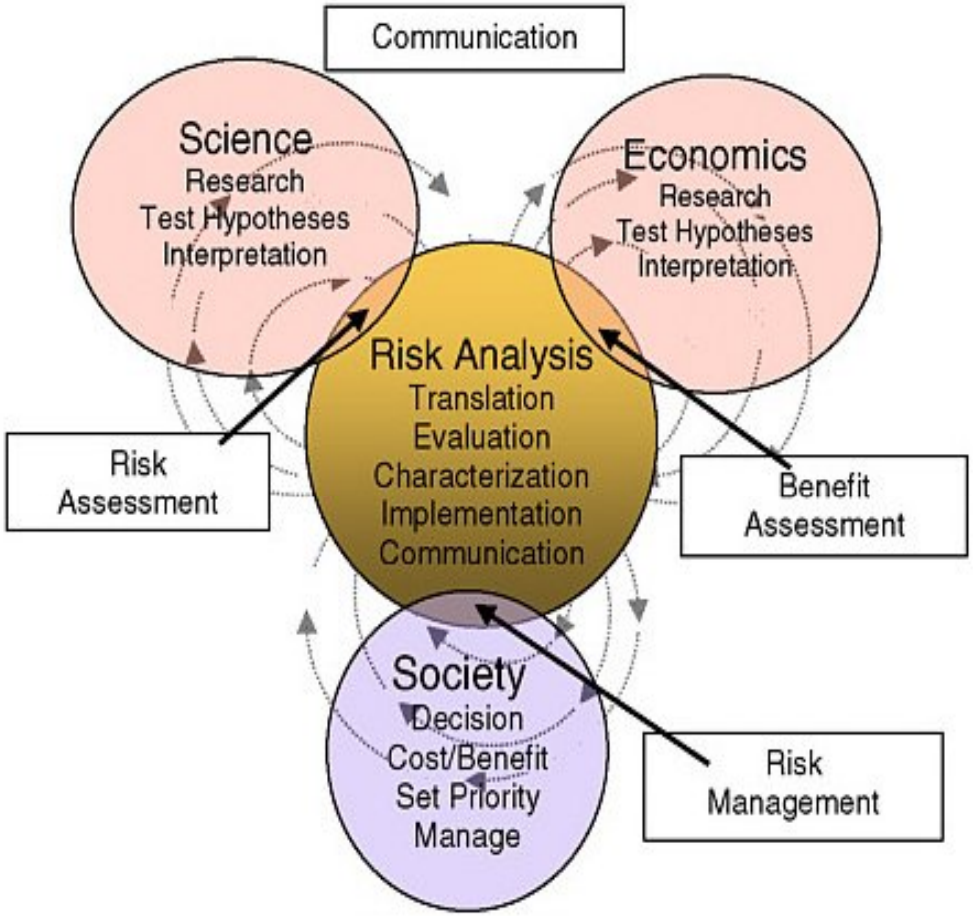
WHAT CAN BE DONE?

- **Having the proper science is a necessary but not sufficient condition. Without proper science, not possible to obtain scientific, public and political trust.**
- **"If problem" is framed as finding a sustainable "solution", then it might be "resolved " (making a decision that is satisfactory to most of the participants)**
- **No guarantees of a solution but making realistic choices improves chances of reaching that solution.**
- **Disposal of wastes is a multi-attribute problem that lasts over times previously unimaginable.**

USE MODERN DECISION MAKING METHODS

Environmental Health Sciences Decision Making Workshop 2009

U.S. National Academy of Sciences Science and Decisions-Advancing Risk Assessment, 2009



Base choices on realistic alternatives, not idealized alternatives.
Consider the likelihood of long term increased economic activity
Take into account the intra- and inter-generational benefits and costs.

WHAT TO DO WITH HIGH LEVEL WASTE? (1)

1. Set a realistic objective function for 3-5 generations, say 100 years and an option to achieve it.
2. Design the system for that time frame but make sure that there will not be a catastrophic release at the end of that period.
3. Since the energy content of even high level waste after that time is low, the releases, if any, will be slow
4. Design the system to be reversible, modifiable and the wastes retrievable, if necessary.
5. Test with modeling and at pilot and field scales.
6. At the end of each time period, repeat the process.

WHAT TO DO WITH HIGH LEVEL WASTE? (2)

For each option at each time period, we need to ask:

- **Would we be more or less safe than if we repeated the previous option?**
- **Would it cost more or less?**
- **Would it more publically acceptable, that is to be implemented, in comparison to any of the other options?**

Possible Options

1. **Continue pool and dry surface storage**
2. **Centralize surface storage**
3. **Reprocessing**
4. **Wastes to the Waste Isolation Pilot Plant**
5. **Sub-seabed sediment disposal**
6. **Others**

WHAT TO DO WITH HIGH LEVEL WASTE?(3)

Advantages Of This Approach

1. Some of these or other systems, disposal in sub-seabed sediments, will be more believable than Yucca Mountain, just as protective of public health and the environment over the same periods as the presently proposed system.
2. The cost will be much lower than the capitol costs for the 1,000,000 year protected facility.
3. If repairs are needed, they can be made with the science and technology and with the social expectations available at that time.

WILL THERE BE PROBLEMS?

1. For government officials to admit that they promised to do something that they knew was impossible is extremely difficult. Perhaps it would be even more difficult for the National Academy of Sciences/NRC to admit it was wrong.
2. No mathematically optimal solutions are possible. So we shall have to depend upon clumsy (garbage can) solutions to muddle through while striving for societally acceptable solutions.
3. AS Nicolo Machiavelli wrote about 500 years ago "the reformer has enemies in all those who profit by the old order, and only lukewarm defenders in all those who would profit by the new order."