

## Week 12 — Nuclear Terrorism and Nuclear Fusion

## Nuclear Terrorism

1. Trope: Children getting bombs
2. Trope: Smuggled bombs
  - Rumor that Russia smuggled bombs into their embassies during cold war
3. Trope: Nuclear blackmail
  - If they have a bomb, then you can bully others that don't have a bomb
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4. How plausible is nuclear theft?
  - Apollo affair: NUMEC in Apollo, Pa. lost about 200-600 lbs. of HEU in 1965
5. Terrorism in the USA
  - *Although the terrorism injuries and deaths are considered to be low compared to if a nuclear bomb were set off, what would a similar chart look like around the world? Does the US have comparably less deaths/injuries due to terrorism than any other nation?*
6. Hijacking HEU
  - Inside job stealing HEU is very possible and hard to detect
7. Reprocessing
  - MUF: Material Unaccounted For
  - If plant processes 8 tons of PU annually and the error rate is 2%, then that's 160kg annually that goes missing "naturally"
    - How do you know if someone took an additional 6kg of material
8. Can you use reactor-grade plutonium in a bomb?
  - J. Carson Mark—leader of theoretical division Los Alamos Lab
    - Said that reactor-grade and weapons-grade plutonium should be treated the same, both can be explosive
  - *I've always wondered why people always go public with nuclear information when they're worried, but I understand it now—you have the knowledge and the know-how of the devastating possibilities that can occur and so you're driven mad trying to prevent it.*
  - *Read The curve of binding energy*
9. Safeguards over secrecy
  - Secrets aren't useful anymore, it was declassified for "peace"
  - *...you have copies of Phillips's paper... does that mean maybe we can read it?*
10. Nuclear terrorism fears, today
  - Nuclear bombs and material can come off of cargo and into the US
  - They are checked before coming to the US and sealed, and customs don't generally check the cargo when it comes in
11. Case study: Aum Shinrikyo
  - Make the process so difficult that small groups decide it's not worth their time to pursue
12. How likely is a terrorist nuclear attack today?
  - *For nuclear briefcases and other similar smaller bombs, what would the point of such a small bomb be if the explosion would also be small as well? I mean, to me it just seems like a dumb route to go down.*

## Peaceful Nuclear Fusion

### 1. Nuclear Fusion

- Two light ions combine together and release energy
  - Have to overcome the positive charges between the two ions though
    - \* One solution is speed shooting them together
- Don't create waste like nuclear fission

## Magnetic Confinement Fusion

### 1. The Richter affair

- Ex-German physicist Ronald Richter flees to Argentina and get dictator to fund his peaceful fusion project called Project Huemul

### 2. Project Matterhorn-S

- What if you could do what Richter wanted to do?

### 3. Magnetic Confinement declassified

- All fusion research is still classified until 1958
  - Because it might help make an H-bomb or the fusion reactor might generate enough neutrons to make plutonium without a reactor

## Inertial Confinement Fusion

### 1. Idea

- Point high powered lasers at all angles of a sphere of deuterium and tritium which then implodes the outer-layer causing the insides to smash together
- Brueckner likes Siegel's laser idea and goes to AEC, they say to file patents for it
- By November 1969, AEC goes to Brueckner and says that it's all classified and they can no longer work on it and that it's against the law
  - Brueckner and Siegel didn't use any of the AEC's research though

### 2. AEC has 4 problems with the KMS work:

1. Laser fusion involves "restricted data"—the physics is too similar to thermonuclear weapons, which are not yet at all declassified
  - Similar to the Teller-Ulam design of having a fission bomb explode to compress another unit of deuterium and tritium
2. They think Brueckner is using info he got from the AEC when he was a contractor—thus taking government knowledge and trying to profit from it
  - In the past, he knows how hydrogen bombs work
3. KMS is now willing to "play ball"—they won't become another government contractor, they are lobbying against the AEC, they are only interested in private profit
4. AEC doesn't think Brueckner has "invented" any of this anyway—they have an entirely different narrative for the history of this work... but it is completely secret ### So who invented laser fusion?

### 3. No one is aware that other people have been working on this idea previously because of classification

### 4. Resolutions

- KMS get promising results but AEC was right: there is no short-cut to laser fusion
- KMS led to increase declassification

## Fusion Today

### 1. National Ignition Facility (ICR)

- ***Was the reason for the really big laser not igniting because of the drop-off in power?***

### 2. Cold fusion

- Fusion reactions without thermonuclear temperatures are called **cold fusion**
- Pathological science:

- Chasing after something that isn't necessarily proven to work—doesn't work, won't work, attracts cranks