CLAIMS

We claim:

1. A facility comprising:

a) a device configured to generate a beam of radiative energy having an energy range of 5 MeV to 500 MeV,

b) a first shielding barrier surrounding the device, wherein a thickness of the shielding barrier is 0.5 meter to 6 meters, and wherein the shielding barrier comprises:

i. a first radiation shielding wall surrounding the device;

ii. a second radiation shielding wall surrounding the first radiation shielding wall;

iii. radiation shielding fill material positioned between the first radiation shielding wall and the second radiation shielding wall, wherein the radiation shielding fill material comprises at least fifty percent by weight of an element having an atomic number from 12 to 83.

2. The facility of claim 1, wherein the element having an atomic number from 12 to 83 is selected from the group consisting of iron, lead, tungsten, and titanium.

3. The facility of claim 1 ~~or 2~~, wherein the radiation shielding fill material comprises at least fifty percent by weight of at least one of magnetite or hematite based on the total weight of radiation shielding fill material.

4. The facility of claim 3, wherein the radiation shielding fill material is granular.

5. The facility of claims 1 ~~to 4~~, wherein the energy range is selected from the group consisting of 5 MeV to 70 MeV, 5 MeV to 250 MeV, and 5 MeV to 300 MeV.

6. The facility of claims 1 ~~to 5~~, wherein at least one of the first radiation shielding wall or the second radiation shielding wall comprises panels mounted onto a structural exoskeleton.

7. The facility of claims 1 ~~to 6~~, wherein at least one of the first radiation shielding wall or the second radiation shielding wall comprises steel.

8. The facility of claims 1 ~~to 7~~, further comprising a second shielding barrier, wherein the second shielding barrier comprises:

a third radiation shielding wall surrounding the second radiation shielding wall of the first shielding barrier; and

a second radiation shielding fill material between the second radiation shielding wall of the first shielding barrier and the third radiation shielding wall of the second shielding barrier,

wherein the second radiation shielding fill material comprises at least 25 percent by weight of an element having an atomic number from 1 to 8, and

wherein a thickness of the second shielding barrier is from 0.5 meter to 6 meters.

9. The facility of claim 8, wherein the third radiation shielding wall comprises panels mounted onto a structural exoskeleton.

10. The facility of claim 8, wherein the third radiation shielding wall comprises steel.

11. The facility of claim 8, wherein the element having an atomic number from 1 to 8 is selected from the group consisting of hydrogen, carbon, oxygen and boron.

12. The facility of claim 8, wherein the second radiation shielding fill material comprises at least one of borax, gypsum, colemanite, a plastic composite material, or lime.

13. The facility of claims 1 ~~to 12~~, wherein the beam of radiative energy comprises at least one of: particles or photons.

14. The facility of claim 13, wherein the particles are hadrons.

15. The facility of claim 14, wherein the hadrons comprise at least one of protons, neutrons, pions, or heavy ions.

16. The facility of claims 1, wherein the first shielding barrier is structural.

17. The facility of claims 1, wherein the first shielding barrier is non-structural.

~~16~~ 18. A facility comprising:

a. a plurality of electronic devices,

b. a first shielding barrier surrounding the plurality of electronic devices, wherein a thickness of the shielding barrier is 0.5 meter to 6 meters, wherein the shielding barrier comprises:

   i. a first radiation shielding wall surrounding the plurality of electronic devices,

   ii. a second radiation shielding wall surrounding the first radiation shielding wall,

iii. radiation shielding fill material positioned between the first radiation shielding wall, wherein the radiation shielding fill material comprises at least fifty percent by weight of an element having an atomic number from 12 to 83.

~~17~~ 19. The facility of claim ~~16~~ 18, wherein the element having atomic number between 12 and 83 is selected from the group consisting of iron, lead, tungsten and titanium.

~~18~~ 20. The facility of claim ~~16 or 17~~ 18, wherein the radiation shielding fill material comprises at least fifty percent by weight of at least one of magnetite or hematite based on the total weight of the radiation shielding fill material.

~~19~~ 21. The facility of claims ~~16 to~~ 18, wherein the radiation shielding fill material is granular.

~~20~~ 22. The facility of claim ~~16 to 19~~ 18, wherein at least one of the first radiation shielding wall and the second radiation shielding wall comprises panels mounted onto a structural exoskeleton.

~~21~~ 23. The facility of claims ~~16 to 20~~ 18, wherein at least one of the first radiation shielding wall or the second radiation shielding wall comprises steel.

~~22~~ 24. The facility of claims ~~16 to 21~~ 18, further comprising:

a second shielding barrier, wherein the second shielding barrier is positioned between the plurality of electronic devices and the first shielding barrier, wherein a thickness of the second barrier is 0.5 meter to 6 meters, and wherein the second shielding barrier comprises:

a third radiation shielding wall surrounded by the first radiation shielding wall of the first shielding barrier, and

second radiation shielding fill material positioned between the first radiation shielding wall of the first shielding barrier and the third radiation shielding wall of the second shielding barrier,

wherein the second radiation shielding fill material comprises at least 25 percent by weight of an element having atomic number between 1 and 8.

~~23~~ 25. The facility of claim ~~22~~ 24, wherein the third radiation shielding wall comprises panels mounted onto a structural exoskeleton.

~~24~~ 26. The facility of claim ~~22 or 23~~ 24, wherein the third radiation shielding wall is steel.

~~25~~ 27. The facility of claims ~~22 to~~ 24, wherein the element having atomic number between 1 and 8 is selected from the group consisting of hydrogen, carbon, oxygen and boron.

~~26~~ 28. The facility of claims ~~22 to 25~~ 24, wherein the second radiation shielding fill material comprises at least one of borax, gypsum, colemanite, a plastic composite material, or lime.

~~27~~ 29. The facility of claims ~~1 to 26~~ 18, wherein the first shielding barrier is structural.

~~28~~ 30. The facility of claims ~~1 to 26~~ 18, wherein the first shielding barrier is non-structural.