CLAIMS

We claim:

1. A method for discriminating a radioactive anomaly from naturally occurring radioactive materials, the method comprising:

detecting a first number of gamma photons having energies in a first range of energy values within a predetermined period of time;

detecting a second number of gamma photons having energies in a second range of energy values within the predetermined period of time;

determining, in a controller, a ratio of the first number of gamma photons having energies in the first range and the second number of gamma photons having energies in the second range; and

determining that a radioactive anomaly is present when the ratio exceeds a threshold value.

2. The method of claim 1, wherein the radioactive anomaly is highly enriched uranium (HEU).

3. The method of claim 2, wherein the first range of energy values is between about 830 keV and about 1060 keV.

4. The method of claim 3, wherein the second range of energy values is between about 1060 keV and about 3000 keV.

5. The method of claim 4, wherein the threshold value represents naturally occurring radioactive material (NORM) and is about 0.43.

6. The method of claim 1, further comprising:

detecting a third number of gamma photons having energies in a third range of energy values within the predetermined period of time;

detecting a fourth number of gamma photons having energies in a fourth range of energy values within the predetermined period of time; and

determining, in the controller, a ratio of the third number of gamma photons having energies in the third range and the fourth number of gamma photons having energies in the fourth range.

7. The method of claim 6, wherein at least one of the third and fourth ranges is different from the first and second ranges.

8. The method of claim 7, wherein at least one of the third and fourth ranges overlaps with at least one of the first and second ranges.

9. The method of claim 1, further comprising:

placing one or more radioactive material detection apparatuses onto an object to be tested, the one or more radioactive material detection apparatuses being configured to detect the first and second numbers of gamma photons.

10. The method of claim 9, wherein at least one of the one or more radioactive material detection apparatuses includes the controller for determining the ratio of the first and second numbers of gamma photons.

11. The method of claim 9, wherein the controller for determining the ratio of the first and second numbers of gamma photons is located remotely from the one or more radioactive material detection apparatuses, the method further comprising:

transmitting, from the one or more radioactive material detection apparatuses, data representative of the detected first and second numbers of gamma photons to the controller.

12. The method of claim 1, wherein the controller determines that the threshold value is exceeded by the ratio of the first and second numbers of gamma photons.

13. The method of claim 12, wherein the controller provides a warning indication when the threshold value is exceeded.

14. The method of claim 1, wherein the radioactive anomaly is plutonium.

15. A method for determining the presence or absence of an expected radiation source, the method comprising:

placing at least one radioactive material detection apparatus on an object containing the expected radiation source;

detecting, with the at least one radioactive material detection apparatus, a first number of gamma photons emitted by the expected radiation source having energies in a first range of energy values within a predetermined period of time;

detecting, with the at least one radioactive material detection apparatus, a second number of gamma photons emitted by the expected radiation source having energies in a second range of energy values within the predetermined period of time;

determining, in a controller, a ratio of the first number of gamma photons having energies in the first range and the second number of gamma photons having energies in the second range; and

comparing the determined ratio of the first and second numbers of gamma photons with an expected ratio of the first and second numbers of gamma photons for the expected radiation source.

16. A system for discriminating a radioactive anomaly from naturally occurring radioactive materials, the system comprising:

at least one radioactive material detection apparatus configured to detect a first number of gamma photons having energies in a first range of energy values within a predetermined period of time and a second number of gamma photons having energies in a second range of energy values within the predetermined period of time; and

a controller configured to:

(i) determine a ratio of the first number of gamma photons having energies in the first range and the second number of gamma photons having energies in the second range, and

(ii) compare the determined ratio with a threshold value.

17. The system of claim 16, wherein the controller is remotely located from and in communication with the at least one radioactive material detection apparatus.

18. The system of claim 17, wherein the at least one radioactive material detection apparatus is configured to communicates wirelessly with the controller.

19. The system of claim 18, wherein the controller is housed by the at least one radioactive material detection apparatus.

We claim:

1. A method for discriminating a radioactive anomaly from naturally occurring radioactive materials, the method comprising:

detecting a first number of gamma photons having energies for each of a first plurality of gamma energy lines within a predetermined period of time;

detecting a second number of gamma photons having energies for each of a second plurality of gamma energy lines within the predetermined period of time;

summing together the first numbers of gamma photons from each of the plurality of first gamma energy lines to obtain a first gamma photon total;

summing together the second numbers of gamma photons from each of the plurality of second gamma energy lines to obtain a second gamma photon total;

determining, in a controller, a ratio of the first gamma photon total and the second gamma photon total; and

determining that a radioactive anomaly is present when the ratio exceeds a threshold value.

2. The method of claim 1, wherein the radioactive anomaly is highly enriched uranium (HEU).

3. The method of claim 2, wherein each of the first gamma energy lines is between about 830 keV and about 1060 keV.

4. The method of claim 3, wherein each of the second gamma energy lines is between about 1060 keV and about 3000 keV.

5. The method of claim 4, wherein the threshold value represents naturally occurring radioactive material (NORM) and is about 0.43.

6. The method of claim 1, further comprising:

detecting a third number of gamma photons having energies for each of a third plurality of gamma energy lines within the predetermined period of time;

detecting a fourth number of gamma photons having energies for each of a fourth plurality of gamma energy lines within the predetermined period of time;

summing together the third numbers of gamma photons from each of the plurality of third gamma energy lines to obtain a third gamma photon total;

summing together the fourth numbers of gamma photons from each of the plurality of fourth gamma energy lines to obtain a fourth gamma photon total; and

determining, in the controller, a ratio of the third gamma photon total and the fourth gamma photon total.

7. The method of claim 6, wherein all of the third and/or the fourth gamma energy lines lie in a different energy range from the plurality of first and second gamma energy lines.

8. The method of claim 7, wherein the energy range containing the third and/or fourth gamma energy lines ranges overlaps with a range containing the plurality of first and/or second gamma energy lines.

9. The method of claim 1, further comprising:

placing one or more radioactive material detection apparatuses onto an object to be tested, the one or more radioactive material detection apparatuses being configured to detect the first and second numbers of gamma photons.

10. The method of claim 9, wherein at least one of the one or more radioactive material detection apparatuses includes the controller for determining the ratio of the first and second gamma photon totals.

11. The method of claim 9, wherein the controller for determining the ratio of the first and second gamma photon totals is located remotely from the one or more radioactive material detection apparatuses, the method further comprising:

transmitting, from the one or more radioactive material detection apparatuses, data representative of the detected first and second numbers of gamma photons to the controller.

12. The method of claim 1, wherein the controller determines that the threshold value is exceeded by the ratio of the first and second gamma photon totals.

13. The method of claim 12, wherein the controller provides a warning indication when the threshold value is exceeded.

14. The method of claim 1, wherein the radioactive anomaly is plutonium.

15. A method for determining the presence or absence of an expected radiation source, the method comprising:

placing at least one radioactive material detection apparatus on an object containing the expected radiation source;

detecting, with the at least one radioactive material detection apparatus, a first number of gamma photons emitted by the expected radiation source having energies for each of a first plurality of gamma energy lines within a predetermined period of time;

detecting, with the at least one radioactive material detection apparatus, a second number of gamma photons emitted by the expected radiation source having energies for each of a second plurality of gamma energy lines within the predetermined period of time;

summing together the first numbers of gamma photons from each of the plurality of first gamma energy lines to obtain a first gamma photon total;

summing together the second numbers of gamma photons from each of the plurality of second gamma energy lines to obtain a second gamma photon total;

determining, in a controller, a ratio of the first gamma photon total an the second gamma photons photon total; and

comparing the determined ratio of the first and second gamma photon total with an expected ratio of the first and second gamma photon total for the expected radiation source.

16. A system for discriminating a radioactive anomaly from naturally occurring radioactive materials, the system comprising:

at least one radioactive material detection apparatus configured to detect a first number of gamma photons having energies for each of a first plurality of gamma energy lines within a predetermined period of time and a second number of gamma photons having

energies for each of a second plurality of gamma energy lines within the predetermined period of time; and

a controller configured to:

(i) determine a ratio of a sum total of the first number of gamma photons from each of the first plurality of gamma energy lines and a sum total of the second number of gamma photons from each of the second plurality of gamma energy lines, and

(ii) compare the determined ratio with a threshold value.

17. The system of claim 16, wherein the controller is remotely located from and in communication with the at least one radioactive material detection apparatus.

18. The system of claim 17, wherein the at least one radioactive material detection apparatus is configured to communicate wirelessly with the controller.

19. The system of claim 18, wherein the controller is housed by the at least one radioactive material detection apparatus.