CLAIMS:

1. A method for pre-treatment of dissolved and undissolved radioactive matter (radionuclide) in seawater prior to reclamation of seawater into drinking water in a seawater treatment plant, comprising the steps:

   identifying a seawater intake source and collecting seawater from seawater intake source;
   measuring collected seawater for trace of one or more radionuclide;
   diverting collected seawater for electro-coagulation of one or more radionuclide to one or more elected coagulant agent to yield coagulant-laden seawater;
   removing the elected coagulant and one or more radionuclide from coagulant-laden seawater to obtain pre-treated seawater substantially free of one or more radionuclide;
   routing the pre-treated seawater to seawater treatment plant for reclamation into drinking water~~.~~,

~~2. The method of claim 1~~ wherein collected seawater is diverted for electro-coagulation if one or more radionuclide trace level in collected seawater measured exceeds a determined trace standard deviation value associated with one or more radionuclide.

2~~3~~. The method of claim 1 wherein electro-coagulation comprises passing an electric direct current (DC) though collected seawater disposed between an anode apparatus and a cathode apparatus to cause radionuclide containing dissolved ions, suspended solids to coagulate with elected coagulant agent.

3~~4~~. The method of claim 1 wherein collected seawater is measured for trace radionuclide comprising one or more trace radionuclide analytical measurement signal.

4~~5~~. The method of claim 3~~4~~ wherein one or more trace radionuclide analytical measurement signal is digitally supplied to a analytical processor to generate one or more trace radionuclide statistical distribution table and one or more corresponding determined trace standard deviation value of each said trace radionuclide statistical distribution table.

5~~6~~. A system for pre-treatment of dissolved and undissolved radioactive matter (radionuclide) in seawater prior to reclamation of seawater into drinking water in a seawater treatment plant, comprising the steps:

   a seawater intake apparatus for identifying a seawater intake source and seawater intake apparatus collecting seawater from seawater intake source;

   an analyzer device for measuring collected seawater for trace of one or more radionuclide and analyzer device deriving a first trace radionuclide measurement signal;

   a first fluid pump for diverting collected seawater for filtration in a suspension filter, of one or more suspended radionuclide particle and suspension filter for removing the suspended radionuclide particle to yield first pre-treated seawater volume substantially free of one or more suspended radionuclide particle based on one or more first computed trace deviation signal;

   analyzer device for measuring first pre-treated seawater volume for trace of one or more dissolved radionuclide and analyzer device deriving a second trace radionuclide measurement signal;

   a second fluid pump for diverting first pre-treated seawater volume for electro-coagulation in an electro-coagulation module, of one or more dissolved radionuclide to one or more elected coagulant agent to yield coagulant-laden seawater and electro-coagulation module removing the elected coagulant and one or more dissolved radionuclide from coagulant-laden seawater volume to obtain second pre-treated seawater volume substantially free of one or more dissolved radionuclide based on one or more second computed trace deviation signal;

a third fluid pump for routing second pre-treated seawater volume to seawater treatment plant for reclamation into drinking water~~.~~.

~~7. The system of claim 6~~ wherein first computed trace deviation signal is generated by analyzer device and first computed trace deviation signal is indicative of at least one first trace radionuclide measurement signal exceeding a reference set point first trace radionuclide activity concentration value stored in the analyzer device.

6~~8~~. The system of claim 5~~6~~ wherein second computed trace deviation signal is generated by analyzer device and second computed trace deviation signal is indicative of at least one second trace radionuclide measurement signal exceeding a reference set point second trace radionuclide activity concentration value stored in the analyzer device.

7~~9~~. The system of claim 5~~6~~ wherein analyzer device comprising at least one electronic processor.

8~~10~~. A method for pre-treatment of dissolved radioactive matter (radionuclide) in seawater prior to reclamation of seawater into drinking water in a seawater treatment plant, comprising the steps:

identifying a seawater intake source and collecting seawater from seawater intake source;
measuring collected seawater for trace of one or more dissolved radionuclide;

diverting collected seawater for selective radionuclide removal of one or more dissolved radionuclide to yield pre-treated seawater substantially free of one or more dissolved radionuclide;
routing the pre-treated seawater to seawater treatment plant for reclamation into drinking water~~.~~.

~~11. The method of claim 10~~ wherein collected seawater is diverted for selective radionuclide removal if one or more dissolved radionuclide trace level in collected seawater measured exceeds a determined trace standard deviation value associated with one or more dissolved radionuclide.

9~~12~~. The method of claim 8~~10~~ wherein each determined trace standard deviation value is indicative of a determined activity concentration associated with a corresponding dissolved radionuclide.

10~~13~~. The method of claim 8~~10~~ wherein collected seawater is measured for trace radionuclide comprising one or more dissolved trace radionuclide analytical measurement signal.

11~~14~~. The method of claim 10~~13~~ wherein one or more dissolved trace radionuclide analytical measurement signal is digitally supplied to a analytical processor to generate one or more dissolved trace radionuclide statistical distribution table and one or more corresponding determined trace standard deviation value of each said dissolved trace radionuclide statistical distribution table.

12~~15~~. The method of claim 8~~10~~ wherein selective radionuclide removal comprises one or more electro-coagulation process stage wherein each electro-coagulation process stage further comprising a power supply circuit passing an electric direct current (DC) though collected seawater disposed between an anode apparatus and a cathode apparatus to cause radionuclide containing dissolved ions, and colloids to coagulate with one or more elected coagulant agent.

13~~16~~. The method of claim 8~~10~~ wherein selective radionuclide removal comprises one or more ion exchange process stage.

17. A method for pre-treatment of detected dissolved radioactive matter (radionuclide) in a drinking water supply source prior to supply distribution of treated drinking water to one or more supply distribution end-point, comprising the steps:

identifying a drinking water supply source and collecting a drinking water sample from drinking water supply source;
measuring collected drinking water sample for trace of one or more dissolved radionuclide;
diverting drinking water supply source first volume for selective radionuclide removal of one or more dissolved radionuclide to yield a second volume of pre-treated drinking water substantially free of one or more dissolved radionuclide;
routing second volume of pre-treated drinking water to a accumulation pool for subsequent supply distribution of second volume of pre-treated drinking water to one or more supply distribution end-point.

18. The method of claim 17 wherein drinking water supply source first volume is diverted for selective radionuclide removal if one or more dissolved radionuclide trace level in collected drinking water sample measured exceeds a determined trace standard deviation value associated with one or more dissolved radionuclide.

19. The method of claim 17 wherein each determined trace standard deviation value is indicative of a determined activity concentration associated with a corresponding dissolved radionuclide.

20. The method of claim 17 wherein collected drinking water sample is measured for trace radionuclide comprising one or more dissolved trace radionuclide analytical measurement signal.

21. The method of claim 20 wherein one or more dissolved trace radionuclide analytical measurement signal is digitally supplied to a analytical processor to generate one or more dissolved trace radionuclide statistical distribution table and one or more corresponding determined trace standard deviation value of each said dissolved trace radionuclide statistical distribution table.

22. The method of claim 17 wherein selective radionuclide removal comprises one or more electro-coagulation process stage wherein each electro-coagulation process stage further comprising a power supply circuit passing an electric direct current (DC) though collected drinking water supply source first volume disposed between an anode apparatus and a cathode apparatus to cause radionuclide containing dissolved ions, and colloids to coagulate with one or more elected coagulant agent.

23. The method of claim 17 wherein selective radionuclide removal comprises one or more zeolite-based process stage wherein each zeolite-based process stage further comprising passing collected drinking water supply source though at least one granulated zeolite bed apparatus having a determined molecular sieve property to cause radionuclide containing dissolved ions, and colloids and radionuclide in suspension to accumulate substantially within granulated zeolite bed of granulated zeolite bed apparatus.

24. The method of claim 17 wherein selective radionuclide removal comprises one or more ion exchange process stage.

25. The method of claim 17 wherein second volume of pre-treated drinking water is post-treated in a water re-mineralization stage to within a determined quality parameter prior to routing to accumulation pool.

26. The method of claim 25 wherein determined quality parameter comprising a desired Ca^{2+} concentration.

27. The method of claim 25 wherein determined quality parameter comprising a desired Mg^{2+} concentration.

28. The method of claim 25 wherein determined quality parameter comprising a desired pH (solution hydrogen ion activity) concentration scale.

29. The method of claim 25 wherein determined quality parameter comprising a desired alkalinity (aT) concentration scale.

30. The method of claim 25 wherein determined quality parameter comprising a desired Langelier Saturation Index value.

31. A method for pre-treatment of dissolved and undissolved radioactive matter (radionuclide) in seawater prior to reclamation of seawater into drinking water in a seawater treatment plant, comprising the steps:

identifying a seawater intake source and collecting seawater from seawater intake source;

diverting and passing collected seawater through one or more zeolite-based process stage wherein each zeolite-based process stage further comprising passing collected seawater though at least one granulated zeolite bed apparatus having a determined molecular sieve property to cause radionuclide containing dissolved ions, and colloids and radionuclide in-suspension to accumulate substantially within granulated zeolite bed of granulated zeolite bed apparatus;

yielding from one or more zeolite-based process stage pre-treated seawater substantially free of one or more radionuclide;
routing pre-treated seawater to seawater treatment plant for reclamation into drinking water.

32. A computer-implemented method for detection and determination of intake seawater radionuclide contamination risk to one or more seawater treatment plant within the boundary domain of a determined detection area, comprising the steps:

(a) identifying one or more discharge zone within determined detection area wherein one or more identified discharge zone representing the discharge point of ballast water discharged from one or more marine vessel into identified discharge zone;

(b) calculating the total volume of ballast water discharged from one or more discharge zone based in part on the mean ballast water discharge volume from each marine vessel and the mean ballast water discharge frequency within a determined time interval and a contamination coefficient wherein contamination coefficient representing the probable score of ballast water discharged from each marine vessel having a ballast water radionuclide activity concentration value range, to derive a first radionuclide payload value;

(c) calculating the total volume of ballast water discharged from one or more discharge zone based in part on the median ballast water discharge volume from each marine vessel and the mean ballast water discharge frequency within a determined time interval and a contamination coefficient wherein contamination coefficient representing the probable score of ballast water discharged from each marine vessel having a ballast water radionuclide activity concentration value range, to derive a second radionuclide payload value;

(d) identifying the loci proximity area of one or more discharge zone to at least one seawater treatment plant comprising calculation of the propagation probability of total volume of ballast water discharged from one or more discharge zone based at least in part on one or more turbulence transport equation model, and the mean seawater intake volume of identified seawater treatment plant within identified loci proximity area, to derive a probable seawater contamination volume of identified seawater treatment plant;

(e) performing multivariate analysis to derive at least one output variable representing the risk probability of intake seawater radionuclide contamination exceeding a determined variance range.

33. The method of claim 32 wherein multivariate analysis of step (e) is supplied a plurality of variable input comprising at least in part first radionuclide payload value of step (b).

34. The method of claim 32 wherein multivariate analysis of step (e) is supplied a plurality of variable input comprising at least in part second radionuclide payload value of step (c).

35. The method of claim 32 wherein multivariate analysis of step (e) is supplied a plurality of variable input comprising at least in part probable seawater contamination volume of identified seawater treatment plant of step (d).

36. A method for monitoring, detection and reduction of one or more identified radionuclide concentration activity in a reverse osmosis (RO) seawater treatment plant wherein seawater is supplied to a first filtration bank to yield a first permeate subsequently passing first permeate into second filtration bank to yield a second permeate of a determined water specification, the method comprising;

identifying first filtration bank and second filtration bank;
sampling first permeate from first filtration bank for concentration activity count of one or more determined radionuclide;
passing first permeate to second filtration bank to yield second permeate.

37. The method of claim 36 wherein second filtration bank comprising a plurality of reverse osmosis membrane filtration units to treat first permeate into second permeate of a determined water specification.

38. The method of claim 36 wherein first filtration bank comprising a plurality of seawater filtration units to treat seawater into first permeate.

39. The method of claim 36 wherein concentration activity count of one or more determined radionuclide is indicative of the radionuclide contaminate level (RCL) present in sampled permeate.

40. The method of claim 36 wherein first permeate is diverted to a selective radionuclide treatment stage if sampling of first permeate is indicative of a concentration activity count exceeding a determined maximum RCL to yield first permeate substantially free of one or more determined radionuclide prior to passing to second filtration bank.

41. A computer-implemented method for CFD (computational fluid dynamics) modeling of seawater contamination from one or more identified radionuclide from transport and discharge of ballast water from one or more marine vessels within a target domain boundary grid space wherein at least in part contaminated seawater is utilized as intake seawater for a seawater treatment plant identified in target domain boundary grid space, the method comprising:

(a) identifying and deriving at least one grid area within target domain boundary grid space a calculated radionuclide concentration activity count of seawater body within grid area;

(b) identifying one or more turbulence model transport equation model within grid area and target domain boundary to derive probable radionuclide concentration activity count of seawater body within a determined loci proximity area inclusive of identified seawater treatment plant;

(c) performing multivariate analysis using source terms and input variables from the group of steps (a) and (b) to derive at least one output variable representing the probable radionuclide concentration activity count of one or more identified seawater intake stream volume of identified seawater treatment plant.