Iodine-129 (15.7 Ma) is a naturally occurring radioisotope of iodine. The ratio of $^{129}\text{I}/^{127}\text{I}$ was estimated to be $\sim 10^{-12}$ in the ocean and $10^{-11}$ in the territorial environment in pre-nuclear era. Releasess from nuclear weapon tests have increased this ratio to $\sim 10^{-10}$. However, a large amount of iodine-129 was released from various nuclear facilities, and the greatest releases of $^{129}\text{I}$ are from two European reprocessing plants, especially in recent years. By 1998, 2600 Kg and 220 Kg of $^{129}\text{I}$ have been discharged to the marine environment and atmosphere from La Hague (France) and Sellafield reprocessing plants, respectively. This amount is tens times larger than the total $^{129}\text{I}$ inventory in the pre-nuclear ocean and weapon test releases. Although there is no significant radiation risk for the human health at present level of $^{129}\text{I}$, the continuously increasing production and release of $^{129}\text{I}$ make the accumulation of $^{129}\text{I}$ in the environment, immigration, cycle and long term radioecological risk should be give more attention due to its long half-life, high accumulation in human thyroid and high mobility. Iodine is a conservative element in the ocean, the large amount of iodine-129 discharged to the marine system can therefore be used as a oceanographic tracer to study the physical dispersion, mixing and circulative processes of water mass in the ocean. In Risø national laboratory, a radiochemical neutron activation analysis method was developed, using this method the radioecology and tracer of iodine-129 was studied. Some representative works are presented below.

1. Evaluation of radiation exposure of humans to iodine-129. The human and animal thyroids collected from different places, such as Tianjin in China, Gemol in Belarus, Ribe in Denmark, human urine in Denmark, seafood in China were analysed for iodine-129 concentration and $^{129}\text{I}/^{127}\text{I}$ ratio, the exposure level were compared with other places.

2. Reconstruction of radiation dose from I-131 in the Chernobyl contaminated regions. The investigations show a strong dependence of childhood thyroid cancer incidence on thyroid exposure dose from short-lived radioiodine isotopes (i.e. $^{131}\text{I}, ^{133}\text{I}$) released from the Chernobyl accident. However, the short half-life of $^{131}\text{I}$ (20.8 h) and $^{133}\text{I}$ (8.02 d) makes the evaluation of thyroid dose from these isotopes not easy. Due to the long half-life of $^{129}\text{I}$, the $^{129}\text{I}$ concentration in environmental samples can be used to reconstruct the $^{131}\text{I}$ and $^{133}\text{I}$ dose to thyroids. Soil samples from areas in Belarus, Russia and Sweden contaminated by the Chernobyl accident were analysed for $^{129}\text{I}$ and $^{137}\text{Cs}$ by gamma-spectrometry. The atomic ratios of $^{129}\text{I}/^{137}\text{Cs}$ ranged from 0.10 to 0.30, with an average of 0.18. It confirmed that the $^{129}\text{I}/^{137}\text{Cs}$ ratios could be to reconstruct the deposition pattern of $^{131}\text{I}$ in these areas.

3. Application of I-129 as an oceanographic tracer. By analysing the time series seaweed samples collected from the coast of Denmark, Norway, and west Greenland, seawater samples from Baltic Sea, North Sea, Belt Sea, lake water from Denmark and other Baltic Seas for $^{129}\text{I}$ and $^{127}\text{I}$, the transportation, mixing and water mass from North Sea to North Atlantic, Artic and Baltic Sea and the origination of I-129 in the Baltic Sea were studied.

4. Chemical speciation of I-129. Seawater samples from in the North Sea, Kattegat and Baltic Sea were analyzed for $^{129}\text{I}$ and $^{127}\text{I}$ in both iodide and iodate species and total inorganic iodine. The possibility of using this method to study the geochemical cycle of iodine in the ocean was investigated.