Present status of 137 Cs in seawaters of the Lombok Strait and the Flores Sea at the Indonesia Through Flow (ITF) following the Fukushima accident

Preprint *in* Marine Pollution Bulletin · December 2017
DOI: 10.1016/j.marpolbul.2017.12.042

2 authors:

Heny Suseno
Badan Tenaga Nuklir Nasional

Ikhsan Budi Wahyono
Badan Pengkajian dan Penerapan Teknologi

Marine Pollution Bulletin 127 (2018) 458–462

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Baseline

Present status of ^{137}Cs in seawaters of the Lombok Strait and the Flores Sea at the Indonesia Through Flow (ITF) following the Fukushima accident

Heny Suseno[a,*], Ikhsan Budi Wahono[b]

[a] Marine Radioecology Group, Center for Radiation Safety Technology and Metrology - National Nuclear Energy Agency, Jl. Lebak Bulus Raya No. 49, Kotak Pos 7043 JKSKL, Jakarta Selatan 12070, Indonesia

[b] Technology Center for Marine Survey - Agency for Assessment and Application of Technology, Jakarta, Indonesia

ARTICLE INFO

Keywords:
Radiocesium
ITF
Lombok Strait
Flores Sea
Fukushima

ABSTRACT

Due to thermocline and surface water from the western equatorial Pacific Ocean, which are transported to the Indian Ocean, Indonesian marine waters play an important role in the global ocean circulation. The objective of this study was to assess the spatial distribution of ^{137}Cs in the Lombok Strait as part of a national monitoring program concerning the possible impacts of radionuclides released as a result of the Fukushima accident. Sampling was conducted in the Flores sea and Lombok Strait on 15 to 24 November 2013. Measurements for the Lombok strait showed that ^{137}Cs concentrations at surface layer, thermocline layer and 1000 m depth were 0.27 Bq m^{-3}; 0.42 Bq m^{-3} and < MDA (0.01 Bq m^{-3}), respectively. The water concentration of ^{134}Cs at all monitoring stations were under MDA (0.01 Bq m^{-3}). The results the study indicate that the radiocesium input was from global fallout.

The Nuclear accident at Fukushima Dai-Ichi on March 11, 2011, due to the massive earthquake and giant tsunami, resulted in extensive releases of radionuclides. Following this accident, the marine environment was contaminated by radionuclides due to atmospheric deposition, direct releases of contaminated water to the sea and run off of radioactive pollution from terrestrial sources (Bailly du Bois et al., 2012). The most radiologically significant radionuclide is radiocesium (^{137}Cs, $t_{1/2}$ = 30.17 y; ^{134}Cs, $t_{1/2}$ = 2.06 y) which has high solubility in sea water and chemical similarity to K^+ and hence can be transported by marine currents to long distances from its source (De Pourcq et al., 2015; Bailly du Bois et al., 2012). Furthermore, a large inventory of radiocesium was released from Fukushima. Information on the existence of radiocesium derived from Fukushima which is now present in the marine environment is important for risk determination to marine ecosystems and public health due to its relative long residence time in the ocean (Nakata and Sugisaki, 2015). Due to ^{134}Cs having a relatively short half-life it can be used to identify the Fukushima NPP origin of radio-cesium, independent of any contributions of global fallout and the Chernobyl accident (Povinec et al., 2013). Furthermore, general information on the level of radiocesium in the marine environment is important to evaluate risks of public health and marine ecosystem from anthropogenic radioactivity (Nakata and Sugisaki, 2015).

Many studies have now been conducted regarding the impact of the Fukushima accident in the marine environment (Nakano and Povinec, 2012; Kryshev et al., 2012; Buck and Upton, 2012; Inoue et al., 2012; Manolopoulou et al., 2013; Huh et al., 2012; Jha et al., 2012; Watabe et al., 2013; Ueda et al., 2013; Glavič-Cindro et al., 2013; Steinhauser et al., 2014; Yamamoto et al., 2014; Mori et al., 2015). However, there is still only limited studies in Indonesian marine waters especially for the Indian Ocean. The Indian Ocean studies are also important because of its role in the circulations of water masses on a global scale. Water masses are well known to transport from warm water in the North Pacific Ocean to the Indian Ocean through Indonesian Seas (Gordon et al., 2010). To date the study of fate and behavior of radionuclide tracers in the Indian Ocean have attracted less interest than the Pacific Oceans or Atlantic Oceans (Povinec et al., 2011). Although radiocesium is one of the anthropogenic radionuclides which is a good indicator of radionuclide contamination in marine environments (Duran et al., 2004), the scientific cruises of the Geochemical Ocean Sections (GEOSECS) and World Ocean Circulation Experiment (WOCE) did not collect radiocesium data in the Indian Ocean (Povinec et al., 2011; Aoyama et al., 2016).

Due to thermocline and surface waters from the western equatorial Pacific Ocean which are transported to the Indian Ocean, the Indonesia Through Flow (ITF) plays an important role in global ocean circulation (Ding et al., 2013; Rosenfield et al., 2010). As a connector of the Pacific and the Indian Oceans, The Indonesian Through Flow (ITF) is an important part of the global conveyor belt (Gordon et al., 2010). In

* Corresponding author.
E-mail address: henis@batan.go.id (H. Suseno).

https://doi.org/10.1016/j.marpolbul.2017.12.042
Received 26 April 2017; Received in revised form 13 December 2017; Accepted 18 December 2017