



Assessment of Plastic Pellet Spill Response and Shoreline Cleanup Strategies in Sri Lanka: Lessons Learned from the MV X-Press Pearl and MSC Elsa 3 Incidents

G.H.V.S. De Silva*, A.J.M. Gunasekara, H.T.N.I. Piyadasa, R.N. Priyadarshana,
T.G.I.P. Amaranayaka, T. Sripathi, W.I.H.K. Wijerathne, A. Sasitharan,
M.K.S. Swarnamali, S.L.A.I.M. Liyanaarachchi, D.T.A.S.P. Dissanayake

Marine Environment Protection Authority, Narahenpita, Sri Lanka

*vihanga@mepa.gov.lk

Plastic pellet pollution has emerged as a significant marine environmental challenge due to accidental releases associated with maritime transport and container losses at sea. Sri Lanka has experienced two significant pellet spill incidents that differed substantially. The MV X-Press Pearl incident resulted in the world's largest recorded nurdle spill, releasing large quantities of burnt and chemically contaminated plastic pellets following an onboard fire and exposure to hazardous and noxious substances. In contrast, the MSC ELSA 3 incident occurred in Indian waters approximately 300 nautical miles from Sri Lanka and involved the release of predominantly unburnt plastic pellets that dispersed over long distances under prevailing oceanographic and monsoonal conditions. Plastic pellet spill response and shoreline cleanup methods remain relatively underdeveloped, with no universal and standardized shoreline cleanup protocols have not yet been developed. This study evaluates spill response measures and assesses the effectiveness of shoreline cleanup strategies using a shoreline cleanup effectiveness index, while also examining operational challenges encountered during both incidents. Comparative analysis of the two events highlights how shoreline characteristics, pellet condition (burnt vs. unburnt), and ecosystem sensitivity strongly influenced cleanup efficiency and response outcomes. The findings indicate significant variability in response effectiveness between the two incidents and underscore critical gaps in existing preparedness and operational frameworks. The study emphasizes the urgent need for standardized plastic pellet spill response protocols, improved shoreline cleanup strategies, and strengthened international regulations governing the maritime transport of plastic pellets to reduce the risk and environmental impact of future spills.

Keywords: *Coastal ecosystems, Marine plastic pollution, Plastic pellets (nurdles), Shoreline cleanup, Spill response.*