Assessment of Trace Metal Contamination of Oil Production Operations within the Surrounding Environment of the Saltpond Offshore Production Platform

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2012

ABSTRACT

The study focused on the assessment of heavy metal levels in oil production discharges, water column, sediment and benthic fauna *(Chlamys purpurata)* and suitability of *Chlamys purpurata* for the monitoring of oil production operations in the marine environment of the Saltpond Offshore production platform. Environmental samples were taken at increasing distances at upstream and downstream stations of the production platform. Iron (Fe), zinc (Zn), copper (Cu), lead (Pb), cadmium (Cd), chromium (Cr), manganese (Mn), nickel (Ni) and barium (Ba) were determined in oil production discharges, water column, sediment and scallop tissues within the immediate sedimentary environment of the platform. The results show low levels of the trace metals determined in the water column compared to the production discharges. Trace metal concentrations were present in all sediment samples with high levels of Fe and Ba recorded for both upstream and downstream sediment stations. Bioaccumulated metals in benthic fauna were consistent with metal concentrations in sediment with dominant levels documented for Fe and Ba. A high degree of organ specificity was evident in scallop labellum, gills and intestines for Fe and Ba possibly due to filter feeding mechanisms and ion exchange property of the mucous layer covering these organs. Multivariate analysis using agglomerative clusters showed increased similarity between upstream and downstream stations (i.e. 2 and 3) for both small and large scallop size groupings. Levels of metals compared with international standards indicate that Zn, Pb, Cd and Ni in the scallops were higher than the Convention for the Protection of the Marine

Environment of the North-East Atlantic (OSPAR) 2000 blue mussel and European Economic Communities (BEC) 79/923 levels for shellfish. Cd and Ba in sediment were higher than the National Oceanic and Atmospheric Administration (NOAA) standards for Threshold Effects Level (TEL), Effects Range Low (ERL) and Probable Effects Level (PEL). The results of the bioaccumulation and bioconcentration factor assessments showed clearly that uptake of trace metals in the water column is far higher than sediment. This suggests that the release of trace metal contaminants into the ocean could possibly become bioavailable to marine organisms. This may be due to the retention time of these trace metals in the water column with potential public health implications. Further monitoring of trace metals using biota and sediment is recommended.

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