

# Quality assessment of sediments: state of the art in Italy and perspectives using biomarkers approach

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In Italy, dredging in marine coastal areas are authorized after the risk evaluation which includes physical-chemical and microbiological analyses of sediments. Exception made for harbours settled inside high polluted areas ruled by a specific Decree (D.M. November 7<sup>th</sup>, 2008), sampling procedures and variables of interest are defined by a specific Decree Law (January 24<sup>th</sup>, 1996). This DL does not include references for data evaluations and results are compared to: i) quality standards for sediments (DL 152/2006, Tab. 2/A); ii) standard concentration limits for soils (DL 152/2006, Tab. 2, Col. A/B, title V); iii) Sediment Quality Guideline defined by the Italian Environmental Research Institute (ISPRA, *Istituto superiore per la protezione e la ricerca ambientale, ex ICRAM*). Compared to DL January 24<sup>th</sup>, 1996, ISPRA Guideline proposes a different sampling strategy and integrates some physico-chemical analysis (i.e. TBT, mycetes) including ecotoxicological tests but, mainly, proposes a rationale criteria of evaluation of results. Sediment quality is evaluated by a multi-step process taking into account results obtained both by chemical analysis and ecotoxicological tests. Sediments could be classified into six different quality classes (from A1 – good quality, low attention to C2 – bad quality, high attention) and associated different management possibilities ranging from beach nourishment to authorized waste disposal. Results from chemical analysis are classified on the basis of a comparison with three different reference ranges of values defined by the natural concentration limit (LCB) and by the critical concentration limit (LCL). Furthermore, concerning trace elements, ISPRA Guideline proposes two different LCBs depending on the sediment grain-size structure to taking into account the accumulation properties of silts. In spite of described advantages, ISPRA Guideline evidences some applicative problems to be solved. Sampling strategy (i.e. grid size, number of cores per each grid unit, thickness and levels of samples along the core) and analyses that have to be performed on collected samples are quite different compared to the prescriptive Decree Law (January 24<sup>th</sup>, 1996). Furthermore, ISPRA Guideline could be integrated including reference criteria for microbiological data evaluation and a sediment classification process

which includes microbiological results. In case of dredged sediments destined to beach nourishment, ISPRA Guideline does not consider how to define mineralogy and colour compatibility of sediments that are parameters of great importance for the release of authorization. In conclusion, even if ISPRA Guideline proposes for the first time objective criteria well-sized for sediment classification in harbours areas that are easy to apply and clear to understand also by not specialized operators, nevertheless, with the exception of some Region which recognized to the ISPRA Guideline a legal value (DGR 255/09), its application is not prescriptive. Furthermore, some applicative problems remain yet to be solved as previously described. *In itinere* and *post operam* monitoring approaches proposed in ISPRA Guidelines are not ruled by Italian law and are rarely applied due to the costs. Monitoring the effects on biota during and after dredging procedures could better focuses the occurrence of significant impacts. The application of several biological indicators of stress known as biomarkers from molecular to population and community levels will assure a complete picture of biological responses exert by an organism exposed to stress including classical (ruled) and emerging contaminants (not yet ruled). The integration of biological responses analysis with the residue analysis of highly toxic and persistent contaminants including endocrine disruptors will make possible to address cause and effects in terms of biological responses in exposed organisms. A possible strategy to reduce costs of monitoring program could be represented by the development of the biomarker approach in new and more suitable species (i.e. macrobenthos?) and new biomarkers on aquatic vegetation able to detect early stress. The production of a complete and exhaustive law ruling the “sediment” matter could be performed by the Italian Ministry aimed to solve listed problems.