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EPA/ORD aquatic exposure research with MWCNTs and graphene oxide

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Anticipated applications and production volumes of engineered nanomaterials (ENMs) have raised concerns about ENM release and potential adverse effects in the environment. Laboratory studies have demonstrated the impact of commercial surfactants and naturally occurring dissolved organic carbon (DOC) on the stability of multiwalled carbon nanotubes (MWCNTs) in aqueous suspensions. While these studies have demonstrated the efficacy of surfactants and DOC on stabilizing MWCNTs, it is unclear how these surface active agents operate in more complex systems. For example, a reasonable scenario for MWCNT release to the environment is where MWCNT's have been stabilized in suspension with the use of commercial surfactants and then accidentally released into a waterway as surfactant-wrapped MWCNTs where they interact with naturally occurring surfactant-like DOC. Studies have also indicated that graphene oxide (GO), an important member of the graphene family of nanomaterials, is physically stable in the water column but may undergo phototransformation yielding a wide array of transformation products with differing transport and biomarker response characteristics. In this presentation we report on EPA/ORD in-house research with MWCNTs and GO in these key research areas: 1) suspension and stability in the water column, with a focus on the influence of ionic strength and naturally occurring DOC; 2) attachment to surfaces using model (quartz crystal microbalance sensors) and environmental surfaces (sediments); 3) biomarkers of ENM exposure utilizing model cell membranes and metabolomics techniques; 4) phototransformations in the aquatic environment; and 5) modeling exposure in surface waters using the Water quality Analysis Simulation Program (WASP8) updated with particle attachment kinetic parameters.

Biography:

Dr. Dermont Bouchard has 30+ years of experience at USEPA where his research focuses on contaminant transport and fate in the environment. Currently Dr. Bouchard is a Project Leader for Engineered Nanomaterials (ENMs) research where his responsibilities include strategic (EPA/ORD-wide planning for nanomaterials environmental fate research) and tactical (principal investigator for carbon nanotubes and graphene family materials transport and eco-exposure research) planning and research in support of EPA's national program Chemical Safety for Sustainability. Key research interests are ENM interactions with model and naturally occurring surfaces, transport in surface waters, and development of functional assays for ENM attachment, transformation, and biomarker response in support of ENM aquatic exposure model parameterization.