Dismantling the Bay Bridge Old East Span: Controlled Implosion Yields Greatest Net Environmental Benefit for Water and Sediment Quality

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Dismantling of the old east span of the Bay Bridge commenced immediately upon completion of the new east span on Labor Day, 2013. The environmental benefits of removal are reduced hazards to navigation, reduced net fill in the Bay, and removal of pollutant sources contained in the old structure. A significant challenge was how to remove submerged concrete pier foundations with the least environmental impacts. Planning studies showed the greatest net environmental benefit of removal was by means of controlled implosion, rather than conventional mechanical means, which poses greater impacts and risks. Controlled implosion of Pier E3 was successfully implemented as a pilot project in November, 2015.

In addition, the posters in this cluster present the environmental study predictions and findings from three monitored implosion events for water quality and benthic sediment quality. Sound pressure waves impacts were the greatest potential concern and were mitigated by attenuation. Water and sediment quality effects were predicted and proven to be minimal, localized, and temporary. Innovative technologies applied in a setting with a robust environmental baseline demonstrate net environmental benefit.

Keywords: Monitoring, plume mapping, water quality, sediment, implosion, pH, turbidity

Poster Cluster Title: Water Quality and Sediment Monitoring - State of the Art Plume Mapping Technology

Monitoring Water Quality Effects from Controlled Implosion in a Dynamic Tidal Estuary

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Innovative plume mapping technology verified the predictions of minimal, localized, and temporary pH increases following controlled implosion of underwater bridge piers. The transient increase of pH above water quality objectives (8.5) was modeled during environmental planning studies and determined to be the most significant potential water quality impact resulting from controlled implosion, whereas turbidity and dissolved oxygen were predicted to remain within background conditions.

Plume mapping is an innovative technology that has been applied to a variety of stationary discharges, but implosion of underwater structures in a tidal estuary presents a unique challenge. Implosions are timed for slack water, to maximize the performance of blast attenuation systems. Following implosion, affected water masses travel and disperse in response to tide and wind driven currents. The exact location and dispersion of the plume following an implosion is unpredictable because of the dynamic nature of Bay currents.

Current tracking drogues help follow the mass of water affected by the implosion using radio transmitters One vessel trolls back and forth longitudinally through the plume, continuously monitoring pH, turbidity, dissolved oxygen, conductivity, and temperature vs. depth as the sensor array is raised and lowered through the water column.

The maximum pH was as high as 9, and attained the water quality objective (8.5) within an hour. Turbidity effects are indistinguishable from background. Innovative technologies applied to three different implosions under very different tidal and weather conditions show that while effects can vary depending on wind and tide conditions at the time of the event, water quality effects are minimal and transient within a small radius around the imploded structure, as predicted.

Evidence of the implosion and monitoring equipment, graphical data of the monitored parameters and discussion of the results will be presented.

Keywords: Water Quality, monitoring, pH, turbidity, plume, mapping, implosion

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Sediment Quality Effects from Bridge Removal

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Investigating impacts to benthic sediment quality in the Bay following pier removal via controlled implosion requires a robust baseline of ambient conditions. Baseline sediment quality has been established by the Regional Monitoring Program in San Francisco Bay (RMP). Sediment quality effects were predicted and verified using pre- and post-implosion RMP techniques: metals concentrations and toxicity testing using sediment-water interface cores (SWIC).

Samples were collected using a Van Veen grab sampler with a random stratified sampling approach. Sediments were subsampled into cores for toxicity testing. The remainder of each grab was homogenized and analyzed for metals. Additionally, sonar surveys of the bottom provided detailed bathymetry of the area before and after the implosion.

Most metals showed no change in concentration post-implosion compared to pre-implosion, with the exception of lead, which were occasionally higher than RMP sediments. This was observed both pre- and post-implosion. Replicate subsamples were heterogeneous, sometimes varying in lead concentrations by a factor of five or more. However, none of the samples, including samples with high lead, showed an increase in toxicity. This suggests that the lead is a result of historic activities, such as sand blasting lead paint from the former east span structure of the Bay Bridge.

Sonar surveys show that pre-existing scour crater around the Piers steadily accumulated sediments after the implosion, showing that the former erosional environment had shifted towards depositional with removal of the pier.

The results show the benefit of establishing a robust baseline in an industrialized urban setting. The RMP data set not only establishes ambient concentrations of lead and other metals, but also shows that toxicity is occasionally observed in SWIC toxicity tests.

This poster presents images of the sonar surveys, photographic evidence of the sediment sampling techniques, description of the data, and the findings.

Keywords:	Sediment, RMP, benthic community, sampling, monitoring, metals, toxicity
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