San Diego Law Review

Volume 40 | Issue 2 Article 8

5-1-2003

The Applicability, Apprpriateness, and Enforcement of the "Background Levels" Standard for Contaminated Sediment Cleanup Under California State Water Resources Control Board Resolution 92-49

Benjamin Benumof

The Applicability, Appropriateness, and Enforcement of the "Background Levels" Standard for Contaminated Sediment Cleanup Under California State Water Resources Control Board Resolution 92-49*

TABLE OF CONTENTS

* J.D. Candidate 2003, University of San Diego School of Law; Ph.D. (Geology) 1999, University of California, Santa Cruz; B.S. (Geological Sciences) and B.A. (Geography) 1994, University of California, Santa Barbara. The author will join the Irvine office of Watt, Tieder, Hoffar & Fitzgerald as an associate in the fall of 2003.

The author is grateful to Russell Fairey of Moss Landing Marine Laboratories, Monterey Bay, California for discussions regarding sediment toxicity and chemical concentrations in the San Diego Bay region and for his research assistance. In addition, the author would like to thank Professor John Minan of the University of San Diego School of Law for his invaluable assistance in the development and editorial stages of this Comment. This Comment is dedicated to the author's wife Kim, whose unbounded love and support inspires him to thrive in all that he does, his beautiful baby girl Maile, whose smile brightens each and every day, and his parents, who have always been, and who continue to be, his biggest fans.

I. INTRODUCTION

In 1989, in an effort to enhance public understanding regarding the important, but poorly quantified, problem of contaminated sediments in ports and waterways and also to suggest how it might be remedied, the National Research Council (NRC)[1] concluded that contaminated sediments are "widespread throughout U.S. coastal waters and potentially far reaching in [their] environmental and public health significance."[2] Unfortunately, however, the NRC identified several scientific, technological, legal, and regulatory barriers to effective sediment remediation: (a) insufficient data for the comprehensive listing and prioritization of contaminated sites, (b) the lack of widely accepted techniques for identifying and assessing contamination in marine sediments, (c) poor documentation of direct risks to human health and the ecosystem, (d) limitations regarding the use of newly developed dredging technology, and most important, (e) the lack of well-defined sediment quality objectives[3] necessary for the development of

1. The NRC was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the academy's purposes of furthering knowledge and advising the federal government. The NRC has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The National Academies, *The National Research Council*, *at* http://www.nas.edu/nrc/ (last visited Apr. 23, 2003).

2. COMM. ON CONTAMINATED MARINE SEDIMENTS, NAT'L RESEARCH COUNCIL, CONTAMINATED MARINE SEDIMENTS: ASSESSMENT AND REMEDIATION 1 (1989) [hereinafter CONTAMINATED MARINE SEDIMENTS].

3. California law defines a "sediment quality objective" as the "level of a constituent in sediment which is established with an adequate margin of safety, for the reasonable protection of the beneficial uses of water or the prevention of nuisances." CAL.

meaningful and effective legal cleanup standards.[4]

Almost a decade later, in 1997, in an effort to assist in the decisionmaking and to address the key management and technological issues associated with the remediation of contaminated marine sediments, the NRC reached essentially the same conclusion. It did so although it reported substantial advancements in contaminant sampling and analysis, documentation of specific human health and ecosystem risks, and further development of predictive sediment quality tools, such as empirically derived sediment quality objectives.[5] Put simply, the concern over the problems created by contaminated marine sediments is not new,[6] and the challenges involved in the management of contaminated sediments are multifaceted, technically complex, and legally difficult to overcome.[7]

Along the coast of California, the contamination of sediments in major urban ports, harbors, and waterways,[8] such as San Diego Bay[9] and San

---

WATER CODE § 13391.5(d) (West 1992). Note that sediment quality objectives are also commonly referred to as "sediment quality criteria" or "sediment quality guidelines" in the environmental toxicology literature. "Beneficial uses" of the state's waters are those uses that may be protected against quality degradation, including, but not limited to "domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves." *Id.* § 13050(f) (West 1992 & Supp. 2003).

4. *See generally* CONTAMINATED MARINE SEDIMENTS, *supra* note 2.

5. *See* COMM. ON CONTAMINATED MARINE SEDIMENTS, NAT'L RESEARCH COUNCIL, CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS: CLEANUP STRATEGIES AND TECHNOLOGIES 64, 107–09, 142–47, 161–68 (1997) [hereinafter CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS].

6. *See generally* Kenneth S. Kamlet & Peter Shelley, *Regulatory Framework for the Management and Remediation of Contaminated Marine Sediments*, 27 ENVTL. L. REP. 10483 (1997) (discussing the complexity of contaminated sentiment regulation and management at both state and federal levels). Incidents of sediment damage to fisheries and wildlife have been recognized for at least sixty years, although widespread concern did not surface until the late 1970s. *See* W. Andrew Marcus, *Managing Contaminated Sediments in Aquatic Environments: Identification, Regulation, and Remediation*, 21 ENVTL. L. REP. 10020, 10020 (1991). Public and scientific pressure to regulate contaminated marine sediments erupted after serious damage to fisheries and wildlife that occurred in the Hudson River, Puget Sound, and the Great Lakes was nationally publicized. *Id.*

7. *See* CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 154; *see also* Marcus, *supra* note 6, at 10020–22.

8. Sediment contamination in ports, harbors, and waterways commonly arises when industries that are located in or upstream of urban waters directly discharge wastes into the ports, harbors, and waterways. *See* CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 15. The most prevalent pathway of sediment contamination is via the sorption of dissolved substances onto sediment surfaces. Marcus, *supra* note 6, at 10021. In addition, dense urban populations can contribute contaminants through sewage discharges, automobile emissions, and other waste

Francisco Bay,[10] poses a direct threat to water quality, the health and welfare of the public, the health of bottom-dwelling organisms, and consequently, the well-being of animals that depend on the viability of bottom-dwelling organisms for feeding.[11] In short, California's bays are undergoing a dilemma of increasing magnitude among (a) the need to protect the health and welfare of the public, benthic biota,[12] and aquatic-dependent wildlife,[13] (b) the degraded quality of coastal waters and marine sediments,[14] (c) major economic impacts that often result from high remediation and toxic cleanup costs,[15] and (d) the lack of a well-defined and consistent state approach to dealing with contaminated sediments.[16]

Although routine sediment sampling and toxicity testing has been successfully carried out throughout California's large urban bays since the early 1970s[17] and has led to both the detection of a variety of industrial wastes[18] and the development of regulatory standards for the

---

generating activities. CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 15. Sediments can also be contaminated by remote sources, such as stormwater runoff and effluents containing heavy metals, oil, pesticides, and fertilizers. *Id.*

9. *See* Russell Fairey et al., *Assessment of Sediment Toxicity and Chemical Concentrations in the San Diego Bay Region, California, USA*, 17 ENVTL. TOXICOLOGY & CHEMISTRY 1570, 1573 (1998) (detailing the geographic setting and a listing of contaminated sites in San Diego Bay).

10. *See generally* TOM GANDESBERY & FRED HETZEL, REG'L WATER QUALITY CONTROL BD., S.F. BAY REGION, AMBIENT CONCENTRATIONS OF TOXIC CHEMICALS IN SAN FRANCISCO BAY SEDIMENTS (1998) (detailing the geographic setting and a listing of the contaminated sites in San Francisco Bay), *available at* http://www.swrcb.ca.gov/rwqcb2/download/sfbaysediment.pdf.

11. *See* CAL. REG'L WATER QUALITY CONTROL BD., SAN DIEGO REGION, FINAL REGIONAL BOARD REPORT, SHIPYARD SEDIMENT CLEANUP LEVELS: NASSCO & SOUTHWEST MARINE SHIPYARDS, SAN DIEGO BAY 3, 11 (Feb. 16, 2001), *available at* http://www.swrcb.ca.gov/rwqcb9/programs/sediment_shipyards.html [hereinafter FINAL REGIONAL BOARD REPORT].

12. Biota is defined as the "animal and plant life of a region" or "flora and fauna collectively." DICTIONARY OF GEOLOGICAL TERMS 55 (Robert L. Bates & Julia A. Jackson eds., 3d ed. 1984).

13. *See* FINAL REGIONAL BOARD REPORT, *supra* note 11, at 26 (stating that biomagnification of contaminants can occur in the food chain when smaller contaminated organisms are consumed by larger marine and nonmarine species, including humans); *see also* Fairey et al., *supra* note 9, at 1570.

14. *See* FINAL REGIONAL BOARD REPORT, *supra* note 11, at 1, 11; *see also* Fairey et al., *supra* note 9, at 1570, 1578.

15. *See* FINAL REGIONAL BOARD REPORT, *supra* note 11, at 30; *see also* CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 10, 20.

16. *See* FINAL REGIONAL BOARD REPORT, *supra* note 11, at 1–3 (stating that, to date, the state has not provided the Regional Boards with clear guidelines or standards for developing cleanup levels and so each Regional Board has been forced to consider the scientific validity of different sediment cleanup levels as part of its own routine quality control assessments).

17. Fairey et al., *supra* note 9, at 1570.

18. *See* SAN DIEGO INTERAGENCY WATER CONTROL PANEL, CAL. STATE WATER RES. CONTROL BD., SAN DIEGO BAY 1988 ANNUAL REPORT 6–7 (1989) (stating that over the last fifty years, San Diego Bay has been subjected to routine discharges of untreated

protection of area residents and aquatic-dependent wildlife,[19] studies carried out over the past two decades have identified elevated concentrations of several anthropogenically deposited chemicals in marine sediments,[20] particularly polychlorinated biphenyls (PCBs).[21] In fact, many areas of both San Diego Bay and San Francisco Bay have been identified on high priority water quality impairment lists, such as the Clean Water Act of 1977.[22] For example, along the eastern shoreline of San Diego Bay[23] and adjacent to the National Steel and Shipbuilding Company (NASSCO) and Southwest Marine, Inc. (Southwest Marine) shipyards, elevated levels (concentrations) of copper, lead, mercury, zinc, and PCBs have been documented in bay bottom sediments.[24] These contaminants, which have caused or threaten to cause ecosystem degradation and now require treatment and removal, have accumulated over a combined 154 tideland acres[25] and 64 offshore acres[26] as a result

industrial and shipping waste from fish canneries, commercial shipyards, several U.S. naval installations, aircraft manufacturing plants, and kelp processing facilities).

19. *See* Fairey et al., *supra* note 9, at 1570. Regulatory standards include the Porter-Cologne Water Quality Control Act, CAL. WATER CODE §§ 13000–14958 (West 1992 & Supp. 2003), and various other policies and procedures, such as resolutions adopted by the California State Water Resources Control Board, *see, e.g.*, STATE WATER RES. CONTROL BD., RESOLUTION NO. 92-49: POLICIES AND PROCEDURES FOR INVESTIGATION AND CLEANUP AND ABATEMENT OF DISCHARGES UNDER WATER CODE SECTION 13304, http://www.swrcb.ca.gov/plnspols/wqplans/res92-49.html (as amended Oct. 2, 1996).

20. *See* Fairey, et al., *supra* note 9, at 1570 n.2 (citing J.W. ANDERSON ET AL., CAL. STATE WATER RES. CONTROL BD., CHARACTERISTICS AND EFFECTS OF CONTAMINATED SEDIMENTS FROM SOUTHERN CALIFORNIA C-297 (1989)); *see also id.* at 1570 n.3 (citing R.K. JOHNSTON, NAVAL OCEAN SYSTEMS CENTER, USE OF MARINE FOULING COMMUNITIES TO EVALUATE THE ECOLOGICAL EFFECTS OF POLLUTION: TECHNICAL REPORT 1349 (1990)).

21. Andrew Robertson, *National Status and Trends Program: A National Overview of Toxic Organic Compounds in Sediments*, *in* 2 OCEANS '89: AN INTERNATIONAL CONFERENCE ADDRESSING METHODS FOR UNDERSTANDING THE GLOBAL OCEAN 573, 577 (1989). Upon contamination from anthropogenically derived pollutants such as PCBs, aquatic sediments pose a particularly pernicious form of pollution due to their potential to act as long-term reservoirs that can introduce toxins into the marine environment long after discharge has taken place and far from the original source. *See* Marcus, *supra* note 6, at 10020–22.

22. Fairey et al., *supra* note 9, at 1570.

23. *Id*. at 1573.

24. FINAL REGIONAL BOARD REPORT, *supra* note 11, at 1.

25. *Id*. at 11–12 (noting that the NASSCO and Southwest Marine facilities cover approximately 127 and 27 tideland acres, respectively). "Tideland" refers to the near-shore area covered by the "tidal range." "Tidal range" is defined as "[t]he difference between the level of water at high tide and low tide." DICTIONARY OF GEOLOGICAL TERMS, *supra* note 12, at 525.

26. FINAL REGIONAL BOARD REPORT, *supra* note 11, at 11–12 (noting that the NASSCO and Southwest Marine facilities cover approximately forty-seven and seventeen

of NASSCO's and Southwest Marine's historic operations in the ship construction, repair, and maintenance industry.[27]

Although it is evident that elevated concentrations of pollutants in California's coastal bays present human health and aquatic-dependent wildlife risks[28] and threaten to cause pollution conditions that are harmful to designated "beneficial uses,"[29] the reality of the toxic cleanup challenge is that there is no simple solution to the problems created by contaminated sediments. Rather, remediation or cleanup[30] of contaminated sediments is a complicated problem.[31] At the technical level, the wide dispersion of sediments by hydrodynamic[32] and biological processes tends to expand the scope of cleanup operations, and controlling the input of contaminants can be difficult.[33] At the legal level, the selection of a meaningful, effective, and equitable cleanup standard is inherently difficult due to competing environmental and economic interests.[34] For example, environmentalists typically support a cleanup to "background" chemical concentrations, which, in practice, commonly requires that a remedial action leave a site with the same chemical concentration levels that existed prior to contamination.[35] On the other hand, dischargers

---

offshore acres, respectively). For the purposes of this Comment, "offshore" refers to the marine area located seaward of mean low tide, the seaward extent of the tidal range.

27. *See id.* at 11 (stating that the primary business of NASSCO and Southwest Marine has historically been ship repair, construction, and maintenance for the U.S. Navy and commercial customers).

28. *See* Fairey et al., *supra* note 9, at 1570–77. *See generally* FINAL REGIONAL BOARD REPORT, *supra* note 11 (assessing contaminant incidence, spatial patters, and spatial extent of toxicity in San Diego Bay).

29. In San Diego Bay, there are three primary categories of beneficial uses requiring protection: (1) aquatic life (i.e., the benthic community), (2) aquatic-dependent wildlife, and (3) human health. CAL. REG'L WATER QUALITY CONTROL BD., GUIDELINES FOR ASSESSMENT AND REMEDIATION OF CONTAMINATED SEDIMENTS IN SAN DIEGO BAY AT NASSCO AND SOUTHWEST MARINE SHIPYARDS 8 (2001), *available at* http://www.swrcb.ca.gov/rwqcb9/programs/shipyards/June%201%20Final%20Version%20of%20Sediment%20Guidelines.pdf.

30. For purposes of this Comment, "remediation" and "cleanup" are broad terms encompassing technologies, controls, and treatments designed to limit or reduce sediment contamination or its effects. "Controls" are practices that limit the exposure of contaminants such as health advisories. Technologies include containment removal and treatment approaches. "Treatment" refers to advanced technologies that remove a large percentage of contamination from sediments.

31. CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 16.

32. "Hydrodynamic" refers to "forces in or motions of fluids." THE RANDOM HOUSE COLLEGE DICTIONARY 649 (Jess Stein ed., rev. ed. 1984).

33. CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 16.

34. *See id.*; *see also* Peter M. Chapman, *Environmental Quality Criteria: What Type Should We Be Developing?*, 25 ENVTL. SCI. & TECH. 1353, 1353 (1991).

35. *See* Letter from Bruce Reznik, San Diego BayKeeper, San Diego Bay Council, to John Minan, Chairman, California Regional Water Quality Control Board, San Diego Region 2 (Aug. 21, 2001) (on file with author) (writing to the San Diego Regional Board out of concern that cleanup levels less stringent than the background levels standard

often argue that this background levels standard is inappropriate for sediment cleanup projects because they believe that a cleanup to background levels is unwarranted from a health effects standpoint and that the risk assessments underlying the background levels standard are overly conservative.[36] Likewise, there are sometimes toxic areas that have played no causal role in the contamination of sediments but that still require the dredging of bay bottom material due to high contaminant levels.[37] These areas are faced with a number of hurdles, including identifying and paying for space for the placement of contaminated dredged material (which is often a difficult task due to subsequent or ensuing environmental concerns) as well as many other regulatory, political, technological, and chemical challenges.[38] Consequently, proper management and remediation of contaminated sediments is rapidly becoming more complicated because environmental concerns increasingly both require and hinder[39] the removal of sediments from economically critical shipping areas and because rising numbers of toxic sites are being identified for remediation.[40]

II. ISSUES TO BE ADDRESSED

The primary purpose of this Comment is to analyze a number of important issues surrounding California State Water Resources Control Board (State Board) Resolution 92-49, "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304"[41] (Resolution 92-49), and the background levels

would result in adverse effects on the beneficial uses of San Diego Bay). In general, the background levels standard is based on the premise that a comparison of chemical concentrations in contaminated sediments with levels found in reference sediments will provide a measure of the degree of contamination. Peter M. Chapman, *Current Approaches to Developing Sediment Quality Criteria*, 8 ENVTL. TOXICOLOGY & CHEMISTRY 589, 590 (1989).

36. *See* Letter from John Robertus, Executive Officer, California Regional Water Control Board, San Diego Region, to Celeste Cantu, Executive Director, State Water Resources Control Board 2 (Oct. 31, 2001) (on file with author) (describing the position of dischargers with respect to cleanup levels).

37. *See* CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 16.

38. *Id.*

39. *See infra* notes 167–70 and accompanying text.

40. *See id.*

41. RESOLUTION NO. 92-49, *supra* note 19. Resolution 92-49 established statewide policies and procedures for investigation, cleanup, and abatement under section 13304 of the California Water Code. *Id.* Section 13304 of the California Water Code requires that:

standard for contaminated sediment cleanup. Although there is no question that section 13304 of the California Water Code (Water Code) authorizes each Regional Water Quality Control Board (Regional Board) with jurisdictional boundaries that extend to coastal waters[42] to require cleanup of waste that is discharged into the coastal waters of the state,[43] at issue is to what *degree* a discharger shall be required to clean up and abate the effects of past and future discharges.

First, this Comment will address whether Resolution 92-49 is relevant and applicable to establishing cleanup levels for contaminated marine bay bottom *sediments*. Resolution 92-49 was developed in the context of *groundwater pollution*, as opposed to bay and estuarine sediment cleanup, and sets forth the background levels standard as a measure for remediation or cleanup. Importantly, despite great controversy over the State of California's policies and procedures, the State Board has taken the position that, based on the legislative intent of section 13304 of the Water Code, Resolution 92-49 authorizes Regional Boards to require complete cleanup of all waste discharged and restoration of affected water to background conditions—the water quality that existed before the discharge.[44] In particular, the State Board has taken the position that Regional Boards have the discretionary authority under section 13304 of the Water Code to require dischargers to "clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable if background levels of water quality cannot be restored."[45] Furthermore, the State Board has taken the position that section 13304 of the Water Code requires Regional Boards to consider all potential "demands" on a given body of water and the "total values" involved.[46] Also, any approved

---

> [a]ny person who has discharged or discharges waste into the waters of this state . . . or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall . . . clean up the waste or abate the effects of the waste . . . .

CAL. WATER CODE § 13304(a) (West 1992 & Supp. 2003).

42. See Californa Environmental Protection Agency, *State Water Resources Control Board*, *at* http://www.swrcb.ca.gov/regions.html (last visited Jan. 21, 2003) (providing a graphical representation of the Regional Boards' jurisdictional boundaries).

43. CAL. WATER CODE § 13304(a) (West 1992 & Supp. 2003) (requiring cleanup or abatement upon order of the regional board).

44. RESOLUTION NO. 92-49, *supra* note 19, at pmbl. para. 4.

45. *Id.* at para. III.G.

46. *See id.* The considerations involved may be "beneficial and detrimental, economic and social, [or] tangible and intangible." *Id.* Also, California statute mandates that policies for carrying out a phased step-by-step investigation to determine the nature and extent of possible water and sediment contamination at a site are required to "recognize the dangers to public health and the waters of the state" posed by toxic

"alternative cleanup levels," such as those that are less stringent than the background levels standard, must "[n]ot unreasonably affect present and anticipated beneficial use[s]" of the waters of the state.[47] Opponents of the State Board's position argue that Resolution 92-49 was only intended to apply in the context of groundwater pollution and is being unlawfully and unjustifiably applied to sediment cleanup.[48] In other words, they believe that there is no authority for the proposition that section 13304 of the Water Code authorizes Regional Boards to require cleanup of sediment in accordance with Resolution 92-49's background levels standard.[49]

From a practical point of view, resolution of this issue is critical because it ultimately determines the scope of the sediment contaminant problem.[50] For example, resolution is necessary to accurately determine a party's respective responsibility or liability for a specified level of cleanup, the overall scale of remedial cleanup efforts, and the anticipated costs of cleanup.[51] Relatedly, from an environmental "systems" perspective,[52] resolution of this issue is important so that a reasonably consistent standard that properly characterizes and addresses existing levels of toxicity, and therefore correctly addresses the overarching public policy goal of protecting the health and welfare of the ecosystem, may be agreed upon.

Second, this Comment will address the boundaries of the Resolution's enforcement and the limitations (if any) that exist in its application, assuming that Resolution 92-49 does apply to marine sediment cleanup. For example, this Comment will address whether, in certain situations, Regional Boards have the discretionary authority to designate cleanup standards that are less stringent than background chemistry levels for the cleanup of bay bottom sediments.

---

discharges and the "need to mitigate those dangers while at the same time taking into account, to the extent possible, the resources, both financial and technical, available to the person responsible for the discharge." CAL. WATER CODE § 13307(d) (West 1992).

47. RESOLUTION NO. 92-49, *supra* note 19, at para. III.G.2.

48. Letter from John Robertus to Celeste Cantu, *supra* note 36, at 1–2.

49. *See id.* at 2.

50. That is, to what degree should regulatory and remedial actions be taken, or, in other words, how can sediment pollution be most effectively regulated? *See* Marcus, *supra* note 6, at 10021–22.

51. *Id.* at 10022.

52. "Systems" science refers to studies that incorporate a variety of multidisciplinary factors that affect a given environmental system. For example, a systems study aimed at looking at the effects of pollution on a coastal watershed would consider not only hydrologic factors, but also geological and biological factors. *See* CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 2–3, 34, 158.

Third, this Comment will address the following issue: What standards would apply as a basis for Regional Board cleanup level decisions for bay bottom sediments, assuming that Resolution 92-49 does not apply to marine sediment cleanup? In other words, this Comment will explore existing mechanisms that would allow Regional Boards to achieve the uncontroversial and overarching legislative and public policy goals of clean and healthy bays in California if Resolution 92-49 were deemed inapplicable to sediment cleanup.

Fourth, independent of whether Resolution 92-49 is applicable to marine sediment cleanup, this Comment will address whether the background levels standard is an *appropriate* legal standard for addressing the heterogeneous nature of sediments and the complexity of marine sediment cleanup. In particular, this issue is important because it hinges on various spatial, volumetric, and temporal complexities associated with marine sediments, as opposed to water. Such complexities include complex sediment flow patterns, including the mobilization, transport, and redepositing of sediment, the migration of toxic chemicals, and the disposal of dredged material.

Finally, this Comment will address the issue of recurring sediment contamination.

III. DISCUSSION

A. Is Resolution 92-49 Applicable to Establishing Cleanup Levels for Contaminated Marine (Bay Bottom) Sediments?

Although it is clear that the State Board has established policies and procedures for the investigation and cleanup of contaminated *water* under Resolution 92-49, at issue is whether these same polices and procedures are relevant and therefore applicable to marine *sediment* cleanup.[53] Furthermore, there is confusion within the regulatory community as to which baseline medium or media—sediments, water, or organic matter—should be tested to determine whether sediments are polluted.[54]

Environmental interest groups appearing before the San Diego Regional Board have taken the position that, under Resolution 92-49, the Regional Board *must* require cleanup of contaminated sediments to attain background sediment chemistry levels as defined by one or more off-site

53. *See* Letter from John Robertus to Celeste Cantu, *supra* note 36, at 1 (requesting official State Board legal review regarding the applicability of Resolution 92-49 to sediment cleanup).

54. Marcus, *supra* note 6, at 10022.

reference stations.[55] However, the dischargers, such as NASSCO and Southwest Marine, argue that Resolution 92-49 applies only to water quality and not to sediment quality.[56] Consequently, it is the position of the dischargers that attainment of background water quality conditions is not dependent on, and therefore may not require, restoration of background sediment quality conditions.[57] Furthermore, the dischargers argue that less stringent cleanup standards, as compared to the background levels standard, are sufficiently protective of the benthic environment, as well as the health and welfare of the public, and are more economically reasonable.[58]

Put simply, the relevance and legal applicability of Resolution 92-49 to sediment cleanup is highly dependent on whether the Resolution is interpreted from a formalistic perspective, such that great deference is given to the Resolution's express language and strict scientific principles, or from a broader perspective, in which deference is given to something other than the express language, such as the motivation or intent underlying the Resolution.

1. Interpreting Resolution 92-49 Formalistically

Based on a formalistic interpretation of the express language of Resolution 92-49,[59] it would appear that the Resolution is not relevant and is therefore inapplicable to sediment cleanup. Although Resolution 92-49 clearly states that Regional Boards are authorized to order the "complete cleanup of all waste discharged and restoration of affected water to background conditions," Resolution 92-49 expressly defines background conditions as "the *water quality* that existed before the discharge."[60] From a technical point of view, this definition of background conditions is crucial in determining the applicability of Resolution 92-49 to sediment cleanup because, as a matter of general scientific knowledge,

55. *See* Letter from Bruce Reznik to John Minan, *supra* note 35, at 1–3 (stating that cleanup levels less stringent than background levels will not adequately protect the beneficial uses of San Diego Bay). *See generally* FINAL REGIONAL BOARD REPORT, *supra* note 11.

56. Letter from John Robertus to Celeste Cantu, *supra* note 36, at 2–3.

57. *Id.* at 2.

58. *Id.* at 3.

59. *See* RESOLUTION NO. 92-49, *supra* note 19, at para. III.G. The Resolution also requires the Regional Board to "[e]nsure that dischargers are required to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable if background levels of water quality cannot be restored . . . ." *Id.*

60. *Id.* at pmbl. para. 4 (emphasis added).

water quality objectives[61]—acceptable chemical concentrations in water—should not be the primary or fundamental measure of whether sediment is contaminated and therefore should not exclusively be used to remediate sediment.[62] This is because water quality objectives are only intended to provide protection to organisms living within the water column itself, and environmental degradation often occurs in areas where water quality objectives are not being exceeded.[63] More specifically, research shows that aquatic organisms living in or adjacent to the surface of bay bottom sediments are being adversely affected, apparently from chemical contaminants that have adsorbed onto the surfaces of bottom sediments.[64] Thus, although water quality objectives are intended to protect aquatic organisms living within the water column itself, they are not intended to protect organisms associated with bottom sediments.[65]

In order to provide a realistic level of environmental protection, sediment quality objectives,[66] in addition to water quality objectives, must be used to assess whether chemical concentrations in sediments are within acceptable margins of safety.[67] According to Chapman, in

---

61. Under the California Water Code, "water quality objectives" are defined as "the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area." CAL. WATER CODE § 13050(h) (West 1992 & Supp. 2003).

62. *See* Chapman, *supra* note 35, at 589.

63. *Id.*

64. *Id.*

65. *Id.*

66. As previously stated, California Water Code defines "sediment quality objectives" as those "level[s] of a constituent in sediment which [are] established with an adequate margin of safety, for the reasonable protection of the beneficial uses of water or the prevention of nuisances." CAL. WATER CODE § 13391.5(d) (West 1992 & Supp. 2003); *see supra* note 3.

67. *See* Chapman, *supra* note 35, at 589. Chapman adds:

> Sediment quality criteria are necessary in order to provide for long-term management of contaminated sediments, including assessment of sediment quality, identification of problem areas for remedial action, designation of "acceptable" sediments for open-water disposal, and evaluation of disposal sites and options; to determine appropriate chemicals for focusing laboratory and cause-effect studies; to establish wasteload allocations, in particular for "new" chemicals; and to design and evaluate monitoring programs.

Id. The only scientifically defensible way to use water quality objectives with sediments is to compare water quality objective values to measured concentrations in sediment pore waters. *See* Marcus, *supra* note 6, at 10022–25; *see also* Chapman, *supra* note 35, at 589–92. This method, commonly referred to as the equilibrium partitioning approach, takes into account equilibrium partitioning between the solid phase of sediments and the water in sediment interstitial spaces. *Id.* at 591–92. Using this technique, it is theoretically possible to estimate the impact of sediment toxicity on water quality by multiplying the contaminant concentration in sediments by a partitioning coefficient. *Id.* However, although toxicological theory says the equilibrium partitioning approach should work well (that is, provide useful guidelines for identifying, regulating, and cleaning up polluted sediments), empirical evidence collected by environmental toxicologists and chemists does not support its use at this time. *Id*.

practical terms, sediment quality objectives are necessary in addition to water quality objectives because:

> (a) various toxic contaminants found in only trace amounts in the water column accumulate in sediments to elevated levels; (b) sediments serve as both a reservoir and a source of contaminants to the water column; (c) sediments integrate contaminant concentrations over time whereas water column contaminant concentrations are much more variable; (d) sediment contaminants in addition to water column contaminants affect benthic and other sediment-associated organisms; and (e) sediments are an integral part of the aquatic environment, providing habitat, feeding and rearing areas for many aquatic biota.[68]

Consequently, from a formalistic and scientifically defensible point of view, if the intent or motivation underlying Resolution 92-49 were that it applied to both water *and* sediment cleanup, the definition of background conditions should have been characterized as "the water *and/or sediment quality* that existed before the discharge," specifically (a) focusing on whether the underlying or motivating factor for cleanup is the remediation of water, sediment, or both, and (b) specifying the importance of distinguishing between water and sediment quality criteria.

In 1989, the California Legislature, in enacting section 13393 of the Water Code, recognized the importance of such a distinction by requiring the State Board to adopt sediment quality objectives based on scientific information for the purpose of providing "adequate protection for the most sensitive aquatic organisms."[69] However, the State Board has not yet fulfilled its legislative mandate. Instead of adopting sediment quality objectives, the State Board has relied on Resolution 92-49 as its interim response.[70] The principal problem is that Resolution 92-49 gives little regulatory guidance to Regional Boards for how to determine remediation strategies.

2. Interpreting Resolution 92-49 Broadly

Although the formalistic or technical distinction noted above is not to be flippantly disregarded, under a broader, intent-based interpretation of Resolution 92-49, there is little doubt that the motivation or intent

68. Chapman, *supra* note 35, at 589.
69. CAL. WATER CODE § 13393(a)–(b) (West 1992 & Supp. 2003).
70. *See generally* Letter from Craig M. Wilson, Chief Counsel, State Water Resources Control Board, to John Robertus, Executive Officer, Regional Water Quality Control Board, San Diego Region (Feb. 22, 2002) (on file with author) (describing the position of the State Board with respect to the applicability of Resolution 92-49 in setting cleanup levels).

behind the Resolution was for the background levels standard to apply to both water and sediment cleanup. Numerous sections of the California Water Code[71] are replete with provisions indicating that it is the intent of the legislature that the State and Regional Boards provide maximum protection for existing and future beneficial uses of the state's waters.[72] In addition, the U.S. Environmental Protection Agency's (EPA) interpretation of the Federal Water Pollution Control Act[73] (commonly known as the Clean Water Act) and State Water Resources Board policy further indicates that beneficial uses are to be extensively protected from impacts from contaminated sediments.[74]

The strongest authority supporting the view that Resolution 92-49 applies to sediment cleanup is found in section 13307 of the Water Code, the statutory mandate that led to the adoption of Resolution 92-49[75] and directed the State Board to establish policies and procedures for the investigation, cleanup, and abatement of hazardous discharges that create or threaten to create "a condition of contamination, pollution, or nuisance."[76] Additional authority is found in section 13142 of the Water Code, which sets forth statutory requirements for water quality control.[77] Under the Water Code, "contamination" is defined as "an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health" resulting from the "disposal of waste, whether or not waters of the state are affected."[78] In addition, the Water Code defines "pollution" as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects . . . [t]he waters for beneficial uses,"[79] and further provides that pollution "may include 'contamination.'"[80] Furthermore, section 13142 of the Water Code provides that state policy for water quality control shall consist of all or any of the following: "[w]ater quality principles and guidelines for long-range resource planning . . . [w]ater quality objectives . . . and [*o*]*ther principles and guidelines deemed essential by the state board for water quality control*."[81] Consequently, given that (a) section 13307 of the Water Code expansively defines contamination as applying to disposal

71. Porter-Cologne Water Quality Control Act, CAL. WATER CODE §§ 13000–14958 (West 1992 & Supp. 2003).
72. Letter from Craig M. Wilson to John Robertus, *supra* note 70, at 5.
73. 33 U.S.C. §§ 1251–1387 (2000); *see infra* note 91.
74. *See* Letter from Craig M. Wilson to John Robertus, *supra* note 70, at 3.
75. RESOLUTION NO. 92-49, *supra* note 19, at pmbl. para. 5.
76. CAL. WATER CODE § 13307(a) (West 1992 & Supp. 2003).
77. Letter from Craig M. Wilson to John Robertus, *supra* note 70, at 5 (citing CAL. WATER CODE § 13142 (West 1992 & Supp. 2003)).
78. CAL. WATER CODE § 13050(k) (West 1992 & Supp. 2003).
79. *Id.* § 13050(*l*).
80. *Id.*
81. *Id.* § 13142 (emphasis added).

sites that pose a hazard to the public whether or not the State's waters are affected, (b) section 13142 of the Water Code suggests legislative intent to protect beneficial uses from more than just water column effects, and (c) the Supreme Court of California has concluded that regulatory statutes should be construed broadly to accomplish the purposes of the statute and legislative intent,[82] it appears that little judicial discretion is needed to conclude that Resolution 92-49 applies to effects beyond the water column itself.[83]

Relatedly, as part of the "Bay Protection and Toxic Cleanup" legislation that the California Legislature added to Division 7 of the Water Code in 1989, section 13390[84] of the Water Code expresses pronounced legislative intent regarding the management of "toxic hot spots."[85] Specifically, under section 13390 of the Water Code, "[i]t is the intent of the Legislature that the state board and the regional boards establish programs that provide *maximum protection* for existing and future beneficial uses of bay and estuarine waters, and that these programs include a plan for remedial action at toxic hot spots."[86] Consequently, it would appear that the Regional Boards are obligated to have a presumptive cleanup goal of attaining background water *and* sediment quality conditions and must apply Resolution 92-49's background levels standard when setting cleanup levels for contaminated sediments so long as the following conditions are met: (a) such sediments threaten beneficial uses of the waters of the state, (b) the contamination is the result of a discharge of waste, and (c) it is technically and economically feasible to achieve cleanup to background levels.

It should also be noted that, under the State Board's "Consolidated Toxic Hot Spots Cleanup Plan" (Hot Spots Plan), which directs the

82. Harvey v. Davis, 444 P.2d 705, 710 (Cal. 1968) (explaining that "coverage" provisions in regulatory statutes "are broadly construed" to accomplish the legislature's purpose).

83. *See* Letter from Craig M. Wilson to John Robertus, *supra* note 70, at 3–5.

84. CAL. WATER CODE § 13090 (West 1992 & Supp. 2003).

85. "Toxic hot spots" are defined as:

> Locations in enclosed bays, estuaries, or any adjacent waters . . . the pollution or contamination of which affects the interests of the state, and where hazardous substances have accumulated in the water or sediment to levels which (1) may pose a substantial present or potential hazard to aquatic life, wildlife, fisheries, or human health, or (2) may adversely affect the beneficial uses of the bay, estuary, or ocean waters as defined in water quality control plans, or (3) exceeds [sic] adopted water quality or sediment quality objectives.

Id. § 13391.5(e).

86. *Id.* § 13390 (West 1992) (emphasis added).

Regional Boards to implement Resolution 92-49, the focus is on sediment remediation when identifying candidate and known toxic hot spots.[87] In particular, the Hot Spots Plan provides that "[c]andidate and known toxic hot spots are locations (sites in waters of the State) in enclosed bays, estuaries or the ocean."[88] Therefore, it was arguably the intention of the State Board that the term "waters of the state" include contaminated sediments that have been deposited or have settled along the bottom of bays, estuaries, and the ocean.[89]

Finally, although section 13393 of the Water Code expressly requires that the State Board adopt "sediment quality objectives" and seems to make a technical distinction between water quality objectives and sediment quality objectives for the purpose of providing protection to sensitive aquatic organisms, it appears that the legislature's ultimate concern under section 13391.5 of the Water Code in mandating the adoption of sediment quality objectives was the "reasonable protection of the beneficial uses of water" and "the prevention of nuisances."[90] As a result, it is reasonably clear that the legislature intended that sediment quality objectives be considered a subset of water quality objectives and that the State and Regional Boards have the power to regulate beyond the water column itself where necessary to protect the beneficial uses of the state's waters from the effects of contamination.[91]

B. If Resolution 92-49 Does Apply to Marine Sediment Cleanup, What Limitations, if Any, Exist in Its Application?

Although under a broad intent-based application of Resolution 92-49 it is reasonably clear that Regional Boards are obligated to have a presumptive cleanup goal of attaining background water and sediment quality conditions, Resolution 92-49 is flexible in that Regional Boards have considerable discretionary authority to establish cleanup levels less

87. *See* 1 STATE WATER RES. CONTROL BD., CONSOLIDATED TOXIC HOT SPOTS CLEANUP PLAN: POLICY, TOXIC HOT SPOT LIST AND FINDINGS 1-2, 12 (1999), *available at* http://www.swrcb.ca.gov/bptcp/docs/conplnv1.doc; s*ee also* Letter from Craig M. Wilson to John Robertus, *supra* note 70, at 6.

88. STATE WATER RES. CONTROL BD., *supra* note 87, at 12.

89. Letter from Craig M. Wilson to John Robertus, *supra* note 70, at 5–6.

90. CAL. WATER CODE § 13391.5(d) (West 1992 & Supp. 2003).

91. *See* Letter from Craig M. Wilson to John Robertus, *supra* note 70, at 5–6. Such an interpretation is reasonably consistent with that of the EPA. Under section 304 of the Clean Water Act, the EPA considers contaminated sediments to be contained in water to the *same degree* as a dissolved or suspended pollutant. *See* U.S. ENVTL. PROT. AGENCY, THE INCIDENCE AND SEVERITY OF SEDIMENT CONTAMINATION IN SURFACE WATERS OF THE UNITED STATES (1997), *available at* http://www.epa.gov/waterscience/cs/report/html (last updated June 20, 2002).

stringent than background levels if certain conditions are met.[92] Specifically, under title 23, section 2550.4 of the California Code of Regulations, Regional Boards are authorized to establish cleanup levels other than background water quality conditions if they determine that it is technologically or economically infeasible to attain background quality conditions and that the less stringent cleanup levels are protective of beneficial uses.[93] For example, if a Regional Board were to determine that background water quality conditions were not achievable due to limitations in dredging technology, the Board would then be permitted to select a cleanup level that is based on the lowest contamination levels that are technologically and economically achievable and that would not unreasonably affect present and anticipated beneficial uses of the particular coastal waters. However, Regional Boards must consider all potential "demands" on a given water body and the "total values" involved.[94] Likewise, "alternative cleanup levels"—those that are less stringent than the background levels standard—must "not unreasonably affect present and anticipated beneficial use[s]" of the state's waters.[95] Consequently, under the broader view of Resolution 92-49, it is not enough, for example, that aquatic organisms are protected from exposure to sediment-derived pollutants contained within the water column or sediment pore water; aquatic organisms, which can affect the health of humans and aquatic-dependent wildlife via bioaccumulated toxins, must also be protected from contaminants in, or on, sediment particles.[96]

C. If the Background Levels Standard of Resolution 92-49 Does Not Apply to Marine Sediment Cleanup, What Standards Would Apply as a Basis for Regional Board Cleanup Level Decisions for Bay Bottom Sediments?

If Resolution 92-49's background levels standard were deemed inapplicable to marine sediment cleanup, based on the formalistic distinction discussed earlier, there does not appear to be a specifically preferred or express standard that would apply as a basis for Regional

92. RESOLUTION NO. 92-49, *supra* note 19, at para. III.G; *see* CAL. CODE REGS. tit. 23, § 2550.4(a)(3) (2002).
93. CAL. CODE REGS. tit. 23, § 2250.5(c) (2002).
94. RESOLUTION NO. 92-49, *supra* note 19, at para. III.G.
95. *Id*. at para. III.G.2.
96. Chapman, *supra* note 35, at 589.

Board cleanup level decisions.[97] However, there are a multitude of empirically derived (quantitative) criteria or objectives, commonly known as "sediment quality guidelines" (SQGs), that Regional Boards could use to develop sound legal standards,[98] to set precedent for future sediment cleanup projects, and, most important, to achieve the legislative objective of protecting beneficial uses manifest in sections 13307, 13142, and 13390 of the California Water Code. SQGs can be of great use to regulatory and management agencies because they provide tools for identifying chemical concentrations that may present risks to the health and welfare of the public, benthic organisms, and aquatic-dependent wildlife.[99] Specifically, SQGs are widely used because they establish defined levels of a constituent in sediment within adequate margins of safety; in other words, SQGs are able to reasonably predict when chemical concentrations are likely to be associated with a measurable negative biological response.[100] Unfortunately, the ultimate problem in effectively applying SQGs to toxic sediment remediation and management projects has been that opposing sociopolitical concerns prevent the selection of reasonable threshold chemical concentrations.[101] Put simply, because environmentalists and dischargers throughout the United States define "risk" in vastly different terms, and therefore have differing opinions about what constitutes adequate protection of the environment, the process of selecting a reasonable legal cleanup standard in the absence of a statutorily mandated standard has been complex, muddied, and hard to come by.[102] Yet it has become increasingly clear that development of *effective* environmental quality guidelines requires that the guidelines be based on a definition of those "uses" of the environment that people want to protect,[103] the applicable geographical extent (spatial parameters) of the contaminated areas, and any unique geologic and hydrologic considerations that may exist at a particular contaminated site. This, in turn, will ultimately result in specific, rational criteria for measurement, assessment, and remediation.[104]

---

97. *See* RESOLUTION NO. 92-49, *supra* note 19, at pmbl. para. 4 (mentioning no standard other than background levels).

98. *See* Chapman, *supra* note 35, at 589–99; *see also* Russell Fairey et al., *An Evaluation of Methods for Calculating Mean Sediment Quality Guideline Quotients as Indicators of Contamination and Acute Toxicity to Amphipods by Chemical Mixtures*, 20 ENVTL. TOXICOLOGY & CHEMISTRY 2276, 2276 (2001).

99. *See* Fairey et al., *supra* note 98, at 2276.

100. *Id.*

101. *See* Chapman, *supra* note 34, at 1356, 1358.

102. *See id*.

103. *Id.* at 1358.

104. *Id*.

In addition, it should be noted that, in defining a reasonable or socially acceptable legal cleanup standard, the selection of a testing medium or media, such as sediments, water, or organic matter, is a crucial component of the selection process.[105] This is because a particular testing medium greatly influences the degree to which sediments are characterized as contaminated and largely determines whether remediation efforts must be site-specific or can be carried out regionally.[106] In addition, the particular testing medium is important in determining whether a test must be used for individual chemicals or chemical mixtures.[107] Thus, the various media that can be used to classify contamination thresholds complicate the regulatory and legal debate.[108]

Overall, and independent of the specific testing or investigative methodology that is employed, any legal cleanup standard should be geared toward the proper stewardship of coastal waters and sediments and must unequivocally focus on health effects. Ultimately, however, in order to be socially relevant and functional, any reasonable legal cleanup standard must strike a proper balance between the need to address adverse environmental effects and the high cost of the cleanup. As a result, a well-designed legal sediment cleanup standard will properly address the health and welfare of the public, benthic populations, and aquatic-dependent wildlife and will logically or reasonably incorporate commercial beneficial uses related to navigation and the shipping industry into the decisionmaking process. In addition, sediment remediation efforts should produce enough data or information to determine cause and effect relationships and make contamination and cleanup analyses valid.[109] Finally, scientific testing methods and the associated legal standards must be fit for the complex, heterogeneous, particulate, and site-specific nature of sediments.[110]

---

105. Marcus, *supra* note 6, at 10022.

106. *See id*. Note that sediment pollution can be defined in a variety of ways. For example, it can be defined as a function of pollutant concentrations in (a) sediments, (b) interstitial waters, (c) benthic flora and fauna, or (d) how the sediments impact biological populations. *Id*.

107. *Id.*

108. *Id.*

109. *See* Chapman, *supra* note 35, at 597 (stating that, instead of being arbitrarily collected and having little statistical significance, the data should be collected in a manner that is both geographically and volumetrically representative of the contaminated site); *see also* Chapman, *supra* note 34, at 1354.

110. *See* Chapman, *supra* note 35, at 595 (noting that treating contaminated sites uniformly and homogeneously, without accounting for the quantity of data required to

D. Independent of Whether Resolution 92-49 Is Applicable to Marine Sediment Cleanup, Is the "Background Levels" Standard an Appropriate Legal Standard for Addressing the Heterogeneous Nature of Sediments and the Complexity of Marine Sediment Cleanup?

According to the NRC, there are four principal reasons to manage and remediate contaminated marine water and associated marine sediments: (1) to identify and remediate threats to the health of the public, benthic populations, and aquatic-dependent wildlife;[111] (2) to satisfy established water and environmental quality standards;[112] (3) to identify and remediate contaminated areas that have the potential to cause greater environmental harm;[113] and (4) to ameliorate controversies regarding the selection of disposal sites for contaminated dredged spoils.[114] However, unlike the management and remediation of water, there are unique challenges presented by the management and remediation of contaminated sediments.[115] For example, whereas water is a relatively homogenous medium that can be treated in a relatively simple and essentially uniform manner, there are often high costs and technical difficulties involved in sediment characterization, contaminant removal, and treatment due to the complex, heterogeneous, particulate, and site-specific nature of sediments.[116] In addition, in many localities the difficulties inherent in sediment remediation are compounded by an inadequate understanding of the natural processes governing sediment dispersion, transport, and the bioavailability[117] of contaminants as well as of the adverse environmental side effects associated with dredging.[118] As a result, and independent of any particular sociopolitical belief, the selection of an appropriate sediment cleanup

---

spatially characterize the sites and the applicability of the testing methods to the range of chemicals and biota and fauna present, often results in continuing contamination and major expenditures).

111. CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at viii.

112. *Id.* at viii, 16–18 (discussing the driving forces for remediation, management of natural resources, and navigational needs).

113. *Id.* at viii, 84, 161–68 (discussing remediation technologies).

114. *Id.* at viii, 104–05 (discussing environmental dredging).

115. *Id.* at viii, 27–28 (discussing contaminated sediment management challenges).

116. *Id.* at 24, 27–28.

117. "Bioavailability" refers to "a site-specific assessment of the risk to human health and the environment from contamination, and remediation to the level necessary to return the site to its actual future use." Linda Malone, *Bioavailability: On the Frontiers of Science and Law in Cleanup Methodologies for Contamination*, 31 ENVTL . L. REP. 10800, 10800 (2001). Although there is some disagreement over the precise definition of "bioavailability," there is little disagreement in the scientific community as to its overall validity as a scientific guideline and methodology for risk assessment. *Id.* at 10800–01.

118. *See infra* notes 167–70 and accompanying text.

standard hinges on delineating a reasonable middle ground regarding basic considerations of science, technology, economics, social policy, and the environment. As noted by Chapman, "[w]e must structure research, monitoring, regulations, and management so that a 'level playing field' exists for human beings and for the environment."[119]

Three basic factors, each with its own group of subfactors, should be balanced in analyzing the appropriateness or acceptability of the background levels standard as a regulatory sediment cleanup measure: (1) the scientific or technical merits of sediment cleanup to background levels, (2) the economics of sediment cleanup to background levels, and (3) sociopolitical considerations, incorporating known and anticipated short- and long-term effects on the environment. In very simple terms, and from a risk-based perspective, the relationship between these factors may be illustrated by the following equation:

$$A = K_1TS + K_2E + K_3SP$$

Where: A is a measure of overall appropriateness or acceptability;
TS is a measure of scientific or technical appropriateness or acceptability;
E is a measure of economic appropriateness or acceptability;
SP is a measure of sociopolitical appropriateness or acceptability; and
K_1, K_2, and K_3 are constants weighting the importance of factors TS, E, and SP.[120]

Ultimately, in the case of contaminated sediment management, it is up to the State and Regional Water Boards, working together with expert, objective scientists, to weigh the importance of factors TS, E, and SP and to determine the respective values of constants K_1, K_2, and K_3. In some cases, depending on the relative importance of environmental and commercial beneficial uses, it may be appropriate to consider the risk factors of equal value (in other words, a value of one). However, in other cases, depending on the level of toxicity and its impact on the aquatic ecosystem, it may be equally justifiable to assign different values to K_1, K_2, and K_3. For example, if environmental risk is low, and if a cleanup to stringently set background levels is technologically unattainable

119. Chapman, *supra* note 34, at 1358.
120. *See* JOHN C. CHICKEN & TAMAR POSNER, THE PHILOSOPHY OF RISK 136 (1998) (discussing the variables associated with assessing risk acceptability).

and economically unreasonable, K_2 would be given the greatest weight, and a cleanup to less stringent levels would be appropriate. In contrast, where present and future impacts to the environment are well-defined and pronounced and it is technologically feasible and economically reasonable to remediate sediments to pristine background conditions, K_3 (especially) and K_1 would greatly outweigh K_2.

1. A Scientific Aspect

From a scientific perspective, there are both positives and negatives associated with sediment cleanup to background levels. On the positive side, because a cleanup to background levels is generally obtained by uniformly treating contaminated sediment to unbiased and well-defined chemical concentration levels based on off-site reference stations,[121] the background levels standard is relatively simple to apply, is easy to enforce, can be thorough in treatment, and offers sediment managers flexibility in defining background concentrations.[122] For example, the practical application of the background levels standard by definition results in the uniform remediation of contaminated sediments over a specified region[123] and provides a high degree of assurance that pollutants discharged will no longer adversely affect marine populations.[124] This standard can be implemented using available data on sediment contaminant levels and avoids the need to provide mechanistic chemical explanations or conduct elaborate studies to indicate the health of the benthic community at different sites.[125] In addition, a cleanup to background levels can greatly diminish the need to obtain large amounts of closely spaced, site-specific data and, consequently, can reduce the cost of detailed preliminary mapping and testing, which averages

121. *See* Chapman, *supra* note 35, at 590. In general, the selection of a particular background reference station depends on the chemical concentration levels the decisionmaker is trying to represent. Consequently, background levels can be either stringently set to represent preindustrial concentrations or less stringently set to reflect modern, postindustrial conditions. *See id.*

122. *See* Erin M. Sheridan, *How Clean Is Clean: Standards for Remedial Actions at Hazardous Waste Sites Under CERCLA*, 6 STAN. ENVTL. L.J. 9, 30 (1987–88).

123. *See id*. There can often be problems involved with the dredging of sediments in spatially restricted areas that are independent of the cleanup standard employed. For example, dredging in and around shipping piers is almost always a difficult task. Commonly, undredged portions of sediment near piers will slough off towards areas where material has been removed. This sometimes results in higher concentrations of contaminants for a short (recovery) time. Interview with Russell Fairey, Moss Landing Marine Laboratories, in Monterey Bay, Cal. (Jan. 9, 2002).

124. FINAL REGIONAL BOARD REPORT, *supra* note 11, at 31 (commenting that sediments that are remediated to background levels generally no longer present any serious anthropogenical derived contaminant impact).

125. Chapman, *supra* note 35, at 590.

approximately $5000 per testing site.[126] In contrast, site-specific remediation methods always require documentation of sediment chemistry at a multitude of field sites.[127] This is because without heavy, closely spaced or pinpointed documentation of sediment chemistry, the chances of accurately isolating and successfully remediating toxic areas are greatly reduced.[128] Similarly, it is sometimes easier to uniformly dredge and clean to background levels, at least over relatively small areas, than it is to isolate specific toxic hot spots.[129]

Furthermore, although it is often the case that large amounts of material must be dredged or contained in order to obtain pristine background conditions, the practical reality is that background reference levels can be specifically tailored or defined according to any level of biological risk. Put simply, the relevant inquiry is this: From a sociopolitical perspective, what are people, as a society, trying to represent?[130] For example, if public policy dictates a heavy presumption in favor of the environment, background conditions may be set stringently to mimic chemistry levels that occurred in pre-impact sediments—levels where there is no theoretical anthropogenically derived contaminant impact. In contrast, if public policy dictates that a pristine natural environment is either technologically unattainable or economically undesirable because of the reality of commercial beneficial uses, such as shipping and navigation (as is likely in the cases of San Diego Bay and San Francisco Bay), background conditions may be set more liberally to reflect clean, yet postindustrial or modern, conditions. What is most important, however, is that once a socially acceptable level of risk is settled upon, a well-defined and unbiased set of background reference criteria are developed and rigorously adhered to.[131] In other words, the overall goal of developing a background standard should be to maximize results. Specifically, the solution should meet all removal, containment, transport, and placement requirements while satisfying

126. Interview with Russell Fairey, *supra* note 123.
127. *See* Chapman, *supra* note 35, at 596–98.
128. Ultimately, the number of test sites chosen is a matter of economics. However, the science underlying sediment remediation projects would ordinarily be thought to be strengthened in proportion to the data upon which it rests.
129. Interview with Russell Fairey, *supra* note 123.
130. *See* Chapman, *supra* note 34, at 1356–58 ("The first step in halting changes that we do not want involves defining the uses to which we as human beings wish to put our environment for our benefit. By defining these, we also define what we want to persist through time.").
131. *See id.* at 1357.

environmental, economic, and social concerns.[132] Thus, as mentioned earlier, reference criteria should reflect the public policy question of "what is society trying to represent?"[133]

On the other hand, there is no question that the background levels standard has scientific flaws and associated regulatory problems.[134] The overarching problem with applying the background sediment chemistry approach is that the definition of generic—or even specific—reference sediments is fairly difficult.[135] For example, the temporal aspect of the analytical criteria is entirely arbitrary[136] and often limited by the availability of data on historical background levels of chemical concentrations.[137] Thus, the selection of a particular set of background chemical concentrations often represents only an educated guess of past chemical conditions.[138] In addition, the analytical criteria used to define the background levels approach are highly site-specific, being vastly dependent on the individual sites that are chosen to represent the background or reference stations.[139] Furthermore, the background sediment chemistry approach can be legally difficult to defend due to the lack of data on the biological response to contaminants. For example, in the case of anthropogenically derived or synthetic contaminants, such as PCBs, it is impossible to define natural chemical concentrations.[140] As a result, spatial analytical criteria must be based on concentrations already existing in polluted areas, without lucid baseline evidence of whether the analytical criteria adequately protect water quality, sediment quality, and the health of humans, benthic biota, and aquatic-dependent wildlife.[141] The reality of identifying and defining the suitability of a background standard is that it is largely a public policy matter. In the case of San Diego Bay, where shipping and navigation are highly important commercial beneficial uses,[142] pristine chemical concentration levels are not realistic and should not be expected, regardless of individual political, social, and environmental policy preferences.

---

132. CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 158.
133. *See supra* note 130 and accompanying text.
134. *See* Chapman, *supra* note 35, at 590; Marcus, *supra* note 6, at 10022–23; Sheridan, *supra* note 122, at 30–31.
135. Chapman, *supra* note 35, at 590.
136. *See id.* This is because the selection of background chemical concentrations typically only reflects an approximation of the chemical conditions that occurred at a given point in time.
137. *See id.*; Sheridan, *supra* note 122, at 31.
138. Sheridan, *supra* note 124, at 31.
139. Marcus, *supra* note 6, at 10022–23.
140. *Id.* at 10023.
141. *Id.*
142. *See generally* FINAL REGIONAL BOARD REPORT, *supra* note 11, at 1, 11–12.

Assuming that Resolution 92-49 should be interpreted formalistically, such that the background levels standard is limited to water quality only, some scientists and sediment managers argue that it is not a necessary corollary that background water quality conditions are dependent on, and therefore require, restoration of background *sediment* quality conditions.[143] Although the background levels standard is appropriate and works effectively for surface and groundwater remediation where there is a direct correlation between the amount of pollutant removed from the water column and associated improvements in water quality and the protection of beneficial uses, such is not necessarily the case when determining appropriate cleanup levels for marine bay bottom sediments. In fact, depending on the degree of flux or chemical movement between contaminated sediment and the adjacent water, it is possible that elevated concentrations of contaminants in bay bottom sediments can be unassociated with biological effects and poor water quality.[144] This is because a "wide range of physical, chemical, and biological factors influence the bioavailability of sediment contaminants and their potential to cause adverse biological effects on the benthic community."[145] These factors include aqueous solubility, pH, affinity for sediment organic carbon, sediment mineral constituents (for example, iron oxides, manganese, and aluminum), the quantity of acid volatile sulfides in the sediment, and the presence of chemical mixtures.[146] In addition, sediment grain size is particularly important because fine grained particles are highly susceptible to mobilization and transport[147] and because of the physical attraction between chemicals and fine grained particles.[148] In fact, most highly contaminated sediments, independent of the source of the contamination, tend to be fine grained materials deposited in low energy areas known as "sinks."[149] The strong chemical and physical binding of contaminants

143. *See* Letter from John Robertus to Celeste Cantu, *supra* note 36, at 2–3. Also, water quality objectives (acceptable chemical concentrations in water) should not be used exclusively to remediate sediment. Chapman, *supra* note 35, at 589.

144. *See id.* at 2.

145. *Id.*

146. *Id.*

147. *See* CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 24 (stating that mobilization and transport simply refers to the movement of sediment particles through the water column and along the shore).

148. *See id.* at 15. Chemicals tend to sorb to fine-grained particles because they offer a greater combined surface area for contaminant sorption than coarser particles. *Id.* at 23.

149. *Id.*

with sediment and their associated slow release "suggest that risks to humans and the ecosystem, both lethal and sublethal, are linked to long-term rather than transitory exposure."[150] Consequently, the "ability of sediments to retain contaminants over time makes it possible for sediments to have very elevated concentrations of pollutants with water column pollutant concentrations remaining well below applicable water quality objectives."[151] Accordingly, it has been argued that a legal cleanup standard based on attaining background sediment chemistry conditions may be overly stringent.[152]

2. An Economic Aspect

From an economic perspective, the background levels standard is often considered inappropriate for sediment cleanup projects because it is believed that its underlying risk assessments are overly conservative, excessively favoring environmental interests.[153] Dischargers argue that a cleanup to background levels requires greater cleanup expense than is necessary to provide a reasonable degree of protection to human health and the environment.[154] For example, the recently estimated costs associated with cleanup to background levels at the NASSCO and Southwest Marine sites are $17,299,530 and $8,508,845, respectively.[155] Should the San Diego Regional Water Board determine that cleanup to background levels is required, both NASSCO and Southwest Marine face significant risk, not only from the likelihood that shipping operations will be curtailed, but also from the possibility that the long-term or continued operational viability of the shipyards will be placed in jeopardy.[156] In contrast, the estimated cleanup costs associated with the cleanup of site-specific or localized hot spots and reduced levels of biological safety are approximately ten times lower.[157]

Conceptually, however, one of the primary problems with the background levels standard is that it lacks the necessary flexibility to insure that the hazard at a particular contaminated site corresponds with

---

150. *Id.*
151. Letter from John Robertus to Celeste Cantu, *supra* note 36, at 2–3.
152. *Id*. at 3.
153. *See id*. at 2–3; Sheridan, *supra* note 122, at 30.
154. This assumes that background levels are defined as the chemical concentrations that existed prior to dumping or discharge. *See* Sheridan, *supra* note 122, at 30.
155. FINAL REGIONAL BOARD REPORT, *supra* note 11, at 32.
156. CAL. REG'L WATER QUALITY CONTROL BD. SAN DIEGO REGION, RESPONSE TO COMMENTS: REGIONAL BOARD REPORT, SHIPYARD SEDIMENT CLEANUP LEVELS, NASSCO & SOUTHWEST MARINE SHIPYARDS, SAN DIEGO BAY 42 cmt. 7.08 (2001), http://www.swrcb.ca.gov/rwqcb9/programs/shipyards/February%2016%202001%20-%20Response%20to%20Comments.pdf.
157. *See* FINAL REGIONAL BOARD REPORT, *supra* note 11, at 35, 37.

its causal connections and the resources to clean it up.[158] For example, under some circumstances, a cleanup to background levels may be overly stringent or unnecessary to achieve the desired public policy goals of the protection of human health and the environment.[159] Under different circumstances, such as in an area that has been heavily polluted, a cleanup in excess of background levels may not provide adequate environmental and ecological protection.[160]

On the other hand, from a practical point of view, a cleanup to stringently set background levels can minimize future periodic cleanup needs because, once completed, there are no theoretical impacts from anthropogenically derived contaminants.[161] Furthermore, because sediments can be highly heterogeneous over very small areas, such as a few meters,[162] both vertically and horizontally, cleanup to background levels can also alleviate the need to carry out site-specific and expensive testing to locate toxic hot spots.[163]

3. An Environmental Aspect

In terms of environmental protection over both the short- and long-term, a cleanup to stringently set background levels is very appealing. In the wake of recent scientific research regarding the harmful effects of hazardous chemicals,[164] the background levels standard can effectively assure that a given site presents no unusual anthropogenically derived hazard to the health of humans or aquatic organisms.[165] In addition, the simplicity of the background levels standard makes site cleanup administration relatively uncomplicated and effective.[166]

However, even though dredging for the purpose of achieving background sediment conditions minimizes environmental risks from previously deposited bay bottom contaminants, from an environmental

158. *See* Sheridan, *supra* note 122, at 30.
159. *Id.*
160. *Id.*
161. *See* FINAL REGIONAL BOARD REPORT, *supra* note 11, at 31.
162. Interview with Russell Fairey, *supra* note 123.
163. *See* Chapman, *supra* note 35, at 590.
164. *See generally* BANDESBERY & HETZEL, *supra* note 10; CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5; Fairey, *supra* note 9; Robertson, *supra* note 21.
165. *See* FINAL REGIONAL BOARD REPORT, *supra* note 11, at 31. This assumes that background levels are defined in preindustrial terms or as chemical concentrations that existed prior to dumping or discharge.
166. Sheridan, *supra* note 122, at 30.

systems[167] or balancing perspective, the dredging of large quantities of contaminated sediments may not always amount to the best remediation solution, considering the environmental side effects of dredging large quantities of sediment.[168] Dredging itself can trigger adverse ecological and environmental effects, including benthic disturbances, water quality degradation, and contamination arising from the disposal of dredged material.[169] Furthermore, large volumes of fine grained and potentially toxic sediment can be resuspended into the water column and thereafter settle into uncontaminated areas or newly dredged areas.[170] Thus, dredging to achieve more localized or site-specific remediation of toxic hot spots may better serve the environment even though the overall cleanup may not be as stringent.[171] Consequently, it is important that designated cleanup levels strike a proper balance between the potential ecosystem health risks and the commercial beneficial uses causally associated with the contaminated sediment.

E. The Problem of Recurring Sediment Contamination

Although the challenges involved in the management of contaminated sediments are multifaceted, and although there has been little research specifically addressing the issue of how sediment quality standards may be enforced to control discharges and encourage remedial efforts,[172] it is clear that the underpinnings of any well-defined legal sediment cleanup standard designed to manage urban waters that receive large amounts of pollutants must address the problem of recurring or chronic sediment contamination. In defining a legal sediment cleanup standard, consideration should be given to the following questions: (a) If cleanup is successfully carried out to socially acceptable chemical concentration levels, how long will the sediment conditions remain at those levels?; (b) At what point will the discharge of chemicals once again evolve to an unsatisfactory state, such that cleanup efforts must resume?; (c) If cleanup efforts will be required in the future, what remediation technologies and strategies will be likely be used?; and (d) What regulatory protections and incentives to safeguard the public and the environment, if any, will be in effect?

---

167. For a general description of "systems" science, see CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 2–3, 34.

168. *See id*. at 109–11.

169. *See id.*

170. FINAL REGIONAL BOARD REPORT, *supra* note 11, at 31.

171. *See generally* CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 109–11. The premium is on the health of benthic organisms, which are at the bottom of the food chain. Large-scale dredging could irreparably harm the local benthic environment and then begin to work its way up the ladder. *See id*.

172. *See* Marcus, *supra* note 6, at 10025.

Although it would appear that a cleanup to stringently set, preindustrial background levels provides the greatest level of environmental or ecosystem protection and therefore eliminates the need for relatively frequent intermittent cleanup projects, from a practical point of view, in order to realistically prevent recurring sediment contamination problems, tradeoffs must be made between the environmental effectiveness of cleanup methods and the cost to the discharger. If cleanup levels are set stringently and uniformly at great expense to dischargers, without particular regard to specific or tangible biological effects, dischargers will have little incentive to monitor, manage, or inhibit the discharge of pollutants. Not surprisingly, according to the EPA, management policies that provide incentives to dischargers and encourage greater compliance with laws and regulations that protect human health and the environment are often the most effective.[173] Dischargers must be convinced to "buy in" to the credibility of a particular legal cleanup standard,[174] and it is essential that sediment cleanup decisionmakers involve all relevant parties early on in the decisionmaking process to ensure the effectiveness of a management plan.

IV. CONCLUSION

As stated by Chapman, it is "neither controversial nor arguable" that "ecosystem health" is the objective of most environmental quality standards.[175] However, the development of appropriate and effective legal cleanup standards that are geared towards the proper stewardship of coastal waters and sediments and that strike a proper balance between adverse environmental effects and high costs of cleanup is not easy. Although the applicability of Resolution 92-49 to sediment cleanup is highly dependent on whether the Resolution is interpreted from a formalistic perspective or from a broader, intent-based perspective, it appears that, based on the legislative intent behind sections 13307, 13142, 13390, and 13393 of the Water Code and State Water Resources Board policy, the broader view is the correct one. However, there is no doubt that, from a formalistic and scientifically defensible point of view, if the intent or motivation underlying Resolution 92-49 was for it to

173. *See generally* Ronald A. Sarachan & Charles A. DeMonaco, *Environmental Protection Agency: Incentives for Self-Policing: Discovery, Disclosure, Correction and Prevention of Violations*, *in* CORPORATE COMPLIANCE: AFTER CAREMARK (PLI Corporate Law & Practice, Handbook Series No. 995, 1997), *available at* WL 995 PLI/Corp 897.

174. *See* CONTAMINATED SEDIMENTS IN PORTS AND WATERWAYS, *supra* note 5, at 55.

175. Chapman, *supra* note 34, at 1354.

apply to both water and sediment cleanup, the legislature should have defined background conditions as "the water or sediment quality that existed before the discharge," specifically focusing on and specifying (a) whether the underlying or motivating factor for cleanup is the remediation of water or sediment or both, and (b) the importance of distinguishing between water and sediment quality criterion.

However, because it is reasonably clear that Resolution 92-49 was intended to apply to sediment cleanup as well as to the effects of contamination on the water column, it would appear that the Regional Boards are obligated to have a presumptive cleanup goal of requiring cleanup to attain background water *and* sediment quality conditions. Consequently, Regional Boards must apply Resolution 92-49's background levels standard when setting cleanup levels for contaminated sediments if such sediments threaten beneficial uses of the waters of the state, the contamination is the result of a discharge of waste, and a cleanup to background levels is technologically and economically feasible. However, Regional Boards are authorized to establish cleanup levels other than background water quality conditions if they determine that it is neither technologically nor economically feasible to attain background quality conditions and that the less stringent cleanup levels are protective of beneficial uses.

In addressing the general appropriateness of the background levels standard to sediment remediation, the primary consideration is the *functionality* of the standard, as defined by a balancing of scientific or technical, economic, and sociopolitical considerations. More specifically, the appropriateness of the background levels standard, as applied to sediment cleanup, depends on two fundamental questions: (a) Is the standard based on a definition of those beneficial uses of the environment that people, as a society, want to protect?; and (b) Is the standard structured so that a level playing field exists for human beings and the environment? The answers to these questions, in turn, will establish a firm, legally defensible starting point that will eventually lead to specific, rational endpoints for regulatory purposes.

In the case of Resolution 92-49, although it is expressly clear that special importance must be given to the health of the public, benthic populations, and aquatic-dependent wildlife,[176] as a practical and societal matter, it is also clear that specific consideration should be given to commercial beneficial uses. Therefore, in terms of qualitatively applying the risk based equation noted earlier,[177] requiring cleanup to

176. *See* RESOLUTION NO. 92-49, *supra* note 19, at para. III.G.2; *see also* CAL. WATER CODE §§ 13390, 13393 (West 1992 & Supp. 2003).

177. *See supra* note 120 and accompanying text.

stringently set, preindustrial background levels, and thereby giving great weight or preference to the environmental component of the equation, appears to be inappropriate. Although industrial or commercial uses, such as those associated with the shipping industry, have the potential to adversely affect water and sediment quality, they also serve an important societal role. On the other hand, given the overarching goal of clean coastal bays and ecosystem health, allowing cleanup levels to be set so that considerably less cleanup would occur is also highly problematic because of the potential for adverse biological responses. Accordingly, when applying the risk based balancing approach and incorporating various technical, economic, and sociopolitical factors, it appears that the most appropriate sediment cleanup standard strikes a middle ground. The preciseness or exactness of this standard should be developed by expert and unbiased environmental toxicologists, together with the State and Regional Water Boards. The standard should be set at levels less stringent than preindustrial background levels, where no theoretical anthropogenically derived contaminant impact exists, but significantly more stringent than levels above which statistically significant effects always occur, such as with the apparent effects threshold standard.[178] Even under a liberal interpretation of Resolution 92-49's applicability to sediment cleanup, such an approach would be consistent with the discretion designated to the State and Regional Water Boards. This approach would both recognize that the presence of a chemical or substance does not necessarily result in an adverse environmental effect related to contamination and allow for the prediction of environmental problems before they become acute and when they are most reversible. Ultimately, the development and preservation of Chapman's "level playing field" is not unobtainable.

BENJAMIN BENUMOF

178. *See* Chapman, *supra* note 35, at 594 (discussing the apparent effects threshold approach, which is used to determine the concentration of a particular contaminant above which statistically significant biological effects are always expected).