Report on the
Adequacy of the Investigation/Remediation of the Brisbane Baylands UPC Property Contamination Relative to Development of this Property

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Summary of Findings

Overview of Report Content

The purpose of this review is to provide an independent assessment of the adequacy of past studies of the pollutants in soil, water, and gaseous releases, to adequately define the presence and public health/environmental quality implications of potentially hazardous chemicals in each of the major areas of the UPC Brisbane Baylands area (Brisbane Landfill, OU-1 (former Schlage Lock facility and the Southern Pacific area), and OU-2 (railyard)), that may impact the development of the Baylands area and the Guadalupe (Brisbane) Lagoon. Also considered was the information available on the Kinder Morgan pollution as it may impact the Brisbane Landfill area.

The focus was the adequacy of the past studies' definition of the current pollutant occurrence, of potential releases of those pollutants from current locations, and of the potential impacts of those pollutants on public health and the environment associated with future development of the Brisbane area by UPC. We have, in addition, discussed issues that need further and ongoing review in connection with the remediation of the various areas and their development.

Our report includes a discussion of recommendations for hazardous chemical monitoring prior to, during, and following the development of an area by UPC. It also includes discussion of the need for, and a suggested approach for funding of, independent, third-party monitoring and analysis associated with the development of the Brisbane Baylands area to enable the BBCAG and others to continue to actively participate in detailed technical review of the ongoing remediation and development of the Brisbane area by UPC.

We have also provided comments on the specific issues raised by BBCAG that should be included in our review.

General Findings

Inadequate Monitoring and Regulatory Programs. Currently allowed hazardous chemical monitoring and regulatory programs for hazardous chemical sites investigation/remediation consider only a small number of potentially hazardous chemicals that can be present in waste disposal areas that received a complex mixture of waste materials/chemicals. It should not be

assumed that because the monitoring of surface water runoff, groundwater, or airborne gaseous emissions does not reveal exceedances of current regulatory limits or are reported as "non-detect" by the analytical methods used that the hazardous chemicals in an area no longer represent a threat to public health or environmental quality. Ongoing monitoring programs that consider newly recognized or identified pollutants should be conducted to better examine the potential for hazardous chemical releases from a hazardous chemical site.

Need for Independent Third-Party Review. Deficiencies in regulations and regulatory agency support, as well as the advocacy of interested parties, result in the public's need for its own overseer and advocate for protection of public health and environmental quality in matters of investigation and remediation. The party(ies) responsible for the pollution/ remediation/ development of a site should be required to fund the public's hiring of qualified, independent, third-party experts to conduct independent monitoring and oversight review of the pre- and post development of a hazardous chemical site to assist the public and future property owners/users in understanding the adequacy of site investigation/remediation and ongoing monitoring.

Overview Summary of Specific Findings

- *Landfill Gas Emissions*. The Brisbane Landfill appears to have been largely stabilized with respect to landfill gas emission rates. However, methane and other gaseous emissions of hazardous chemicals including VOCs are still being released at a slow rate from this landfill through the landfill gas collection system and landfill cover. Because that release will continue in the future, it will be necessary for building structures developed on the landfill surface to incorporate appropriate measures to prevent the entrance of landfill gas and other volatile chemicals into the buildings. Measures such as protective barriers and adequate venting of gaseous emissions under the building to the atmosphere are typically incorporated for this purpose and should be evaluated for their adequacy for structures on this site. Also, the lower levels of the buildings atop the landfill should be periodically monitored for methane and VOCs to ensure that the protective/gas diversion systems are working properly.

Independent, third-party monitoring of the Brisbane Landfill gas collection and treatment system needs to be developed and implemented to better ensure the public that the systems function, and continue to function, to adequately and reliably collect and treat the landfill gas that is still being generated at the landfill, for the protection of public health and interests.

- *Hazardous Wastes in the Brisbane Landfill*. The BBCAG has been concerned about whether the Brisbane Landfill received what are now classified as "hazardous wastes." A consulting firm that examined this issue on behalf of BBCAG concluded that there is no evidence that "hazardous wastes" have been deposited in this landfill. However, as discussed in this report, the fact that a waste was not classified as "hazardous waste" does not mean that the waste did not contain hazardous or otherwise deleterious chemicals. Further, the fact that a chemical is not included on a particular regulatory list (such as that which classifies wastes as "hazardous") or that its concentration is "below detection," or that a waste was not classified as "hazardous" is not tantamount to the chemical's or the waste's not posing a threat to public health or environmental quality. Whatever the classification assigned to the wastes deposited in the landfill, a review of the composition of Brisbane Landfill leachate and landfill gas emissions

shows that hazardous chemicals that are typically associated with hazardous wastes are present in the landfill and are being released from it.
The primary issue of concern is that this landfill is currently releasing hazardous chemicals that are a threat to public health and the environment. Therefore, great care needs to be taken in developing this property to ensure that these releases are adequately monitored/controlled to protect public health and the environment for as long as the wastes remain on the property.

- *Groundwater Pollution by the Brisbane Landfill*. The monitoring of groundwater under the Brisbane Landfill and in seeps of leachate found along the perimeter and in the interior drainage channel of the landfill shows that the Brisbane Landfill is polluting groundwaters with hazardous chemicals that are a threat to public health and the environment.

The San Francisco Regional Water Quality Control Board required that all known seeps of leachate discharging polluted groundwater to Brisbane/Guadalupe Lagoon be intercepted and the waters transported to a local sanitary sewerage system for treatment. While that requirement for interception of known seeps has apparently been met, there could still be subsurface discharges of leachate-polluted groundwater to the lagoon that were not/are not presently "known" but that have the potential to adversely affect aquatic life in the lagoon. The monitoring that has been done of the water in the lagoon has not reported measurable levels of measured hazardous chemicals from the landfill leachate-polluted groundwater. However, as discussed in our report, the monitoring of the lagoon has not been adequate in depth or scope to properly address the concern. For example, aquatic life in the lagoon has not been evaluated for the bioaccumulation of chemicals that are a threat to the health of people and other animals who consume them. Because there could readily have been, and could still be today, discharges of hazardous chemicals that have or can be bioaccumulated in edible aquatic life in the lagoon and pose a threat to human health and aquatic life, edible aquatic life in the lagoon need to be monitored for bioaccumulatable chemicals of concern. If one or more such chemicals are found, the source of the chemicals needs to be determined, with particular reference to current discharges from the landfill.

- *Stormwater Runoff Water Quality Monitoring*. Compared with the US EPA guidelines requirements for water quality monitoring of stormwater runoff at hazardous chemical sites in California, the nation as a whole, and at the Brisbane Landfill, in particular, are significantly deficient. The water quality monitoring of stormwater runoff during the development of the Brisbane Baylands area should be significantly expanded to enable a reliable determination of the extent to which development activities result in the mobilization of hazardous chemicals into the runoff waters.

- *OU-1(Former Schlage Lock and Southern Pacific Sites)*. The groundwater and soil of the former Schlage Lock facility area of the OU-1 site are polluted with volatile organic compounds (VOCs), primarily trichloroethylene (TCE) and perchloroethylene (PCE). Other contaminants present at the area include metals such as arsenic, chromium, cadmium, lead, and nickel.

There is VOC-contaminated groundwater underneath the Southern Pacific area of the OU-1 site that originates from the groundwater contamination beneath the former Schlage Lock area. The

soil in the railyard area is contaminated with metals (including chromium, lead and arsenic) and petroleum by-products.

The California Department of Toxic Substance Control (DTSC) is the regulatory agency responsible for overseeing the investigation/remediation of the OU-1 site. At this time DTSC is conducting pilot studies to evaluate the potential for treatment of VOC contamination in OU-1 site groundwater/soils by in situ injection of chemicals that can interact with and remove the VOCs. The ability and efficacy of that approach for removal of all of the VOCs from these areas have not been demonstrated at this time.

DTSC has not yet developed an approach for remediation of the heavy metals that pollute the soils of the former Schlage Lock and railyard areas. The approach for and degree of remediation of the heavy metal pollution will likely depend on the types of land use that could potentially be allowed on the redeveloped property. Once the development plans are proposed and DTSC has defined the approach and requirements for cleanup that will be required, the implications of the proposed remediation for the protection of public health and environmental quality from the heavy metals at the site should be evaluated and addressed.

It has been reported that stormwater runoff water quality monitoring conducted at the OU-1 site in the mid-1990s indicated that heavy metals and organics were not found in detectable concentrations. However, at this time the reports that offered those finding are not available from UPC; thus the foundation for and reliability of that conclusion and its implications for site development cannot be evaluated. It may be necessary to conduct additional, comprehensive monitoring of stormwater runoff from the OU-1 area that includes monitoring of the first, and several additional, storms events per year, including sampling at the outset and at several times during each runoff event, using appropriate analytical methods for a full range of potential pollutants in the runoff.

- *OU-2 (Former Bayshore Railyard)*. The OU-2 (former Southern Pacific railyard) area is polluted with petroleum hydrocarbons including diesel fuel and Bunker C oil, metals, and semi-volatile organic compounds (SVOCs). Chlorinated solvents have also been detected in the soil and groundwater at that site. Rather than the excavation and removal of the polluted soils and groundwaters, the revised site development plans call for the "placement of a thick soil layer, ranging from 7 to 10 feet thick, across the entire site to facilitate storm water management." UPC consultants claim that the Bunker C oil and heavy metals at that site are not mobile and thus that protection of public health and the environment can be achieved by capping the area. Because of the mobility of halogenated VOCs, the remediation of the areas contaminated with VOCs will be conducted by excavation and removal of all HVOC-contaminated soils.

We agree with BBCAG that several aspects of the Regional Board's approved remediation plan for OU-2 are of concern with respect to their ability to provide full and reliable protection of public health and environmental quality from pollutants at that site.

Overall, the OU-2 area is known to be highly contaminated with Bunker C oil, VOCs, and lead. The SFRWQCB has adopted a remediation plan, proposed by UPC, that includes containment of the hazardous chemicals Bunker C oil and lead on-site under a soil cover. However, it does not

appear that adequate consideration has been given to other potentially hazardous and otherwise deleterious chemicals, known, unrecognized, and yet-to-be-identified, that may be associated with the complex mixtures of chemicals at that site, or the fact that other such chemicals may exhibit migration characteristics significantly different from the Bunker C oil. A proper containment approach can reduce the hazards of the chemicals left on-site to public health and environmental quality provided that the groundwater and surface water runoff from the area receive adequate monitoring to ensure that neither the known pollutants nor other, yet-to-be identified pollutants do not migrate from the site for as long as the residual waste materials remain at the site, and provided that appropriate deed restrictions are enforced on future owners/users of the property.

• *Kinder Morgan*. The Kinder Morgan Brisbane fuel terminal/distribution area is a bulk petroleum storage and distribution terminal that provides aviation fuel to San Francisco Airport as well as gasoline and diesel fuel to various retail stations. The eastern portion of that facility is on the closed Brisbane municipal landfill; the western portion is situated on a bedrock outcrop. Investigations of the pollution at the Kinder Morgan area showed that gasoline, diesel, and aviation fuels, including fuel additives (benzene, toluene, ethylbenzene, xylene (BTEX), and methyl-tertiary butyl ether (MTBE)) have been detected in groundwater beneath various portions of the facility. There is evidence that groundwaters beneath the Brisbane Landfill are being polluted by chemicals derived from the Kinder Morgan site.

The Kinder Morgan site is a threat to cause further pollution of groundwater and surface waters of concern to BBCAG in the Brisbane Baylands area. The SFRWQCB's current remediation Order is a major step in the appropriate direction to begin to control the Kinder Morgan on-site and off-site pollution. With regard to BBCAG's primary issue of concern, there will need to be ongoing, independent review of the progress made to stop further off-site pollution from the Kinder Morgan site with pollutants transported in surface and groundwater. Particular attention should be given to assessing the adequacy of the currently adopted off-site-transport trigger levels for eventually stopping all off-site transport of identified and yet-to-be-identified pollutants from the Kinder Morgan site.

The stormwater monitoring program for the Kinder Morgan area appears to be adequate for the parameters being measured. However, there may well be other, potentially significant chemicals associated with that site that are not currently being measured. Special-purpose monitoring should be conducted to investigate that possibility, and should be continued periodically in the future as new and newly-recognized pollutants come to light.

• *Development Plans*. At this time UPC's proposed development plans for the Brisbane Baylands area have not been made public. Once its plans have been made available and reviewed by the city of Brisbane, regulatory agencies, and the public, it will be possible to begin to review the adequacy of the remediation plans for each of the areas of the UPC property. BBCAG should continue to be active in reviewing the proposed development plans relative to the finalized regulatory agency requirements for remediation of area pollutants. In order to participate as a full partner in the review of the proposed development plans and remediation requirements, BBCAG will need technical assistance to independently review the adequacy of

the investigations and proposed remediation approaches for protecting public health and environmental quality during development as well as after development has been accomplished.

- *Specific Issues Raised by BBCAG*. Presented below is a brief summary of our responses to the specific issues raised by BBCAG as part of our contract.

1*.) Are the presently proposed remediation systems adequate for,*
a.) Unregulated dirt fill vs. clay caps (Title 24?).
Clean dirt fill should be adequate to protect public health and the environment from the identified pollutants.

b.) Stockpiling heavy metals under parks and streets (with claims they don't move or impact ground water)
We have found no evidence that the stockpiling of heavy metals under parks and streets is contemplated at the Brisbane Baylands area. All areas in which heavy metals are found in soils should be monitored to be certain that the metals are not migrating.

c.) Plastic geo-tech liners as caps and barriers vs. other technologies
Because some of the wastes in the landfill are already in contact with groundwater, attempting to prevent the infiltration of water into the wastes with lined caps is pointless. Therefore, plastic sheeting liners and caps are not needed for the landfill and other waste management areas on this site. Suitable barriers and monitoring should, however, be used to prevent the migration of landfill gas and other VOCs into buildings constructed on the landfill surface.

d.) natural attenuation for VOC's (wetlands), natural remediation's (fungi and bacteria) for the TCE/PERC contamination.
Natural attenuation has a role in the remediation of polluted groundwater. However, contaminants in groundwater must be carefully monitored to alert those responsible of further migration of the polluted waters.

2.) Is the methane control system adequate?
There have been some problems reported with the maintenance of the landfill gas emission control at the landfill. There is need to improve maintenance of that system to improve its operation. Also, third-party independent monitoring of the landfill gas collection and treatment system is needed.

3.) Is the leachate management system adequate?
The surface discharge of landfill leachate in known seeps appears to be adequately controlled. However, there could be subsurface discharges of leachate-polluted groundwater into the Brisbane/Guadalupe Lagoon that could be adverse to lagoon aquatic life.

4.) What recommendations should be made for long-term monitoring?
Throughout the report we present recommendation of long term including independent monitoring and review by third-parties. Toxicity and bioaccumulation of chemicals in aquatic life in the Brisbane/Guadalupe Lagoon should be monitored as long as there are wastes present on the site.

5.) How will the landfill respond to a violent earthquake/tsunami?
NOAA predicts that a tsunami with a wave height of approximately 13 feet could occur in San Francisco Bay. A tsunami of that magnitude could have significant destructive impacts on some structures developed on the Baylands area and on the waste management systems developed as part of remediation of the UPC developed area.

Based on USGS review of plausible earthquakes in the San Francisco Bay area, earthquakes of sufficient magnitude to be disruptive to the monitoring and containment in waste management areas of the Brisbane Baylands area are likely to occur.

Following a major tsunami or earthquake, detailed inspection of each of the waste containment areas and monitoring features should be conducted and where necessary repaired.

It is our conclusion that the development of the Brisbane Baylands area can and should be done cautiously and with the understanding that there are substantial amounts of known hazardous and otherwise deleterious chemicals, and likely presently unrecognized and yet-to-be-discovered hazardous chemicals at various locations at the site that represent a threat to public health and environmental quality. Those areas and chemicals will need to receive proper containment/treatment/removal and proper monitoring in surface waters, groundwaters, ambient air, and air within structures for as long as the chemicals remain onsite for the protection of public health and environmental quality.

Acknowledgements

Several individuals contributed to the development of this report by providing materials for review. Cris Hart, Chair BBCAG, and Clara A. Johnson, Remediation Subcommittee Chair BBCAG were our primary contacts for the project review; they provided many of the reports and much of the background information on the Brisbane Baylands project area. Dana Dillworth with BBCAG was responsible for the initial contact that led to our becoming involved in the site review.

Virginia Lasky, DTSC Project manager and Wayne Hagen DTSC Public Information Officer for the OU-1 site, V. Pal with the SF Bay Regional Water Quality Control Board staff responsible for overseeing OU-2, and A. Karpowicz of the Regional Water Board's case mangers responsible for overseeing the investigation of the Kinder Morgan area provided information on their respective sites. Kenneth Johnson, Associate Planner with the city of Brisbane Planning & Community Development department, provided background information on planning for Brisbane's open-space requirements for the Brisbane Baylands area.

Howard R. Pearce, Engineering Project Manager for UPC, provided several of the reports that we reviewed and answered questions about the area during the site tour. Jason Lin, UPC Director of Engineering, Krzysztof S. Jesionek, an associate with Geosyntec Consultants, and Tom Graf of Jordan & Graf also participated in the site tour and provided answers to our questions during the site tour.

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We greatly appreciate the assistance provided by these individuals and the comments that we received on our draft report by various reviewers.

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Abbreviations and Definitions

bgs	below ground surface
BMPs	best management practices
BAAQMD	Bay Area Air Quality Management District
BBCAG	Brisbane Baylands Community Advisory Group
BSD	Bayshore Sanitary District
CDC	central drainage channel
CDM	consulting firm that worked for the Brisbane
CRWQCB	California Regional Water Quality Control Board
COC	constituents of concern
DCE	dichlororethane
DTSC	California Department of Toxic Substance Control
EIR	environmental impact report
ERD	enhanced reductive dechlorination
ESLs	environmental Screening Levels
Geosynthec Consultants Inc	consulting firm doing studies for UPC
HVOC	halogenated volatile organic chemicals
IDC	interior drainage channel
IDL	interim drainage ditch
IPLs	intrawell prediction limits
IRM	interim remedial measure
ISCO	in situ chemical oxidation
Jordan & Graf	Consulting firm doing studies for UPC
LFG	Landfill Gas
LFR, Inc.	consultant to SFRWQCB
LMP	Leachate Management Plan
Lowney Associates	consultant to UPC on stormwater runoff monitoring
LSCTS	leachate seep collection and transmission system)
LFR Inc.	a ARCADIS Company
MCL	maximum contaminant level
OVA	organic vapor analyzer
OU-1	Operable Unit 1 – former Schlage Lock facility and the Southern Pacific area)
OU-2	Operable Unit 2 – Former Bayshore Railyard
PCE	perchloroethylene
PERC	perchloroethylene, tetrachloroethylene
PPCPs	Pharmaceuticals and Personal Care Products
ppm	parts per million
RAO	Remedial Action Objectives
RAP	Remedial Action Plan
RL	regulatory limits
RLMP	revised LMP
RWQCB	Regional Water Quality Control Board
Sf	square feet
SFPP, L.P.,	Operating Partnership of Kinder Morgan Energy Partners,

Abbreviations and Definitions (continued)

SFRWQCB	San Francisco Regional Water Quality Control Board
SLERA	screening-level ecological risk assessment
SPTC	Southern Pacific Transportation Company
Sunquest Properties, Inc (Sunquest)	Former name of Universal Paragon Corporation
SCS	consulting firm conducting studies for UPC
SVOCs	semi-volatile organic compounds
TCE	trichlorethlyene
TMDL	total maximum daily load
Test America	commercial laboratory conducting water analysis for UPC
UPC	Universal Paragon Corporation
US EPA	US Environmental Protection Agency
VOC	Volatile organic chemical
WDRs	Waste Discharge Requirements

Introduction

The Universal Paragon Corporation (UPC) (formerly Sunquest) acquired a former municipal landfill and industrial properties near Brisbane, CA for the purpose of developing the properties, now collectively called the Brisbane Baylands area, for commercial/possible residential use. However, those properties contain a variety of chemicals that are a threat to public health and the environment. The Brisbane Baylands Community Advisory Group (BBCAG) requested that we conduct a review of previous studies on the degree of contamination of the Brisbane Baylands area and the potential public health and environmental quality problems that could be associated with the development of the area. This report presents the findings of our review. Our expertise and qualification for making this evaluation includes extensive academic and professional experience in public health, environmental health, and investigation and remediation of contaminated sites. A summary of our expertise and experience is appended to these comments.

BBCAG specifically asked us to consider the following:

"1.) Are the presently proposed remediation systems adequate for

a.) Unregulated dirt fill vs. clay caps (Title 24?)

b.) Stockpiling heavy metals under parks and streets (with claims they don't move or impact ground water.)

c.) Plastic geo-tech liners as caps and barriers vs. other technologies

d.) natural attenuation for VOC's (wetlands), natural remediation's (fungi and bacteria) for the TCE/PERC contamination

2.) Is the methane control system adequate?

3.) Is the leachate management system adequate?

4.) What recommendations should be made for long-term monitoring?

5.) How will the landfill respond to a violent earthquake/tsunami?"

The overall approach we followed in conducting this review was to examine the information available that addressed the potential existence and release of hazardous and otherwise deleterious chemicals in the soil, groundwater, and surface waters associated with the Brisbane Landfill and other nearby sources including the OU-1 area (former Schlage Lock facility and the Southern Pacific area), the OU-2 area (railyard), and the Kinder Morgan Petroleum Distribution Facility (Kinder Morgan). Focus was on parameters that could be adverse to the public health and the environment of the developed landfill and other properties. We also considered how the existing information was obtained and discussed approaches needed to better-define the potential hazards associated with the releases from the wastes at the landfill and nearby properties. We also made recommendations on developing monitoring programs to assess the adequacy of the remediation measures taken and to identify future releases of hazardous chemicals from the landfill and other properties.

In addition to our review of various documents that have been developed on the Baylands area contamination, we participated in a site visit to the area on July 23, 2010, guided by Howard R. Pearce, Engineering Project Manager for UPC. He was accompanied by Jason Lin, UPC Director of Engineering, Krzysztof S. Jesionek, an associate with Geosyntec Consultants, and Tom Graf of Jordan & Graf. Cris Hart, Chair BBCAG, and Clara A. Johnson, Remediation Sub Committee Chair BBCAG also participated in the site visit.

In this report we have quoted sections of UPC consultants', and regulatory agency and other reports that are pertinent to reviewing the background information on the Brisbane Baylands area contamination, and the current approaches for remediation of the area; the quotation is followed by our assessment of the adequacy of current degree of investigation and proposed approaches for remediation of the area relative to developing the area for commercial, residential and public open space uses. We have included information on issues and features of monitoring programs that are important for the reliable protection of public health and environmental quality associated with the developed properties. Where possible we have provided URLs (links) to Internet sources of additional information on the topics discussed.

BBCAG issued the "Baylands Report 2010" that summarized key issues of concern to the BBCAG with respect to site investigation and remediation. That report is available at
http://www.bbcag.com/BBCAG%20Packets/2010%20Packet/Packetfor3-16-10meeting/BBCAG%20Baylands%20Report%202010.pdf
It states,
"Our mission statement: The purpose of the Brisbane Baylands Community Advisory Group is to provide an open forum and community based input from the communities of Brisbane, Daly City and San Francisco and to advise the agencies charged with the remediation actions on three contiguous sites commonly referred to as the Brisbane Baylands.

Our purpose is related to human and environmental health that may be threatened by the toxic contamination from the sites on the Baylands. We make recommendation intended to safeguard people and the environment. We do not make land use recommendations unless it is related to the safeguarding of human health or the health of the wildlife, soil, air and water quality.

Our sole focus is toxic contamination, planned remediation, how to get the highest level of clean-up to best protect people, now and in the future. We seek and gather information from the public and try to educate the public about the contamination and remediation."

In the BBCAG "Baylands Report 2010" discussion of *"What is the Baylands?"it was stated*:
"The subject of our inquiry is the areas of toxic contamination on the land known as the Brisbane Baylands. It is primarily owned by one owner, Universal Paragon Corporation and its Subsidiaries, and includes over 600 acres of land and lagoon. The land is located adjacent to the border of San Francisco on the north side, an important fact for several reasons. One of them is that the source of some of the contamination in the northern railyard in Brisbane originates from the closed Schlage Lock facility in San Francisco on that border.

All of The Baylands were underwater until the 20th century. It is filled land. It is barely above sea level. It has been the home to industrial uses and wetland and wildlife and it is the area that drains two sides of a mountain watershed from San Bruno Mountain. The Baylands was used, in part, as a Railyard on the north and west sides where its border follows Bayshore Blvd and as the San Francisco Municipal Landfill 1932-1967 which was located on the east side contiguous to Highway 101. The southside of the Baylands is the Brisbane Lagoon, a part of the Bay that was never filled.

The inquiries that we have made have included comments on the planned remediation of Schlage Lock in San Francisco and the clean-up orders issued for the Kinder Morgan Petroleum Distribution Facility and the underground pipelines that enter and leave it. These two facilities are beyond the scope of our Mission Statement but they are either within the Baylands or have contaminated it. The cumulative and overlapping nature of different forms of contamination have been of great concern to us."

An aerial diagram of the area is presented in Figure 1, and an annotated aerial photograph of the area is presented in Figure 2. Both are after: Pal, V., "Baylands OU-2 Status Presentation," Presentation of Project Manager, State Water Resources Control Board San Francisco Bay Region, to BBCAG, June 16 (2009).

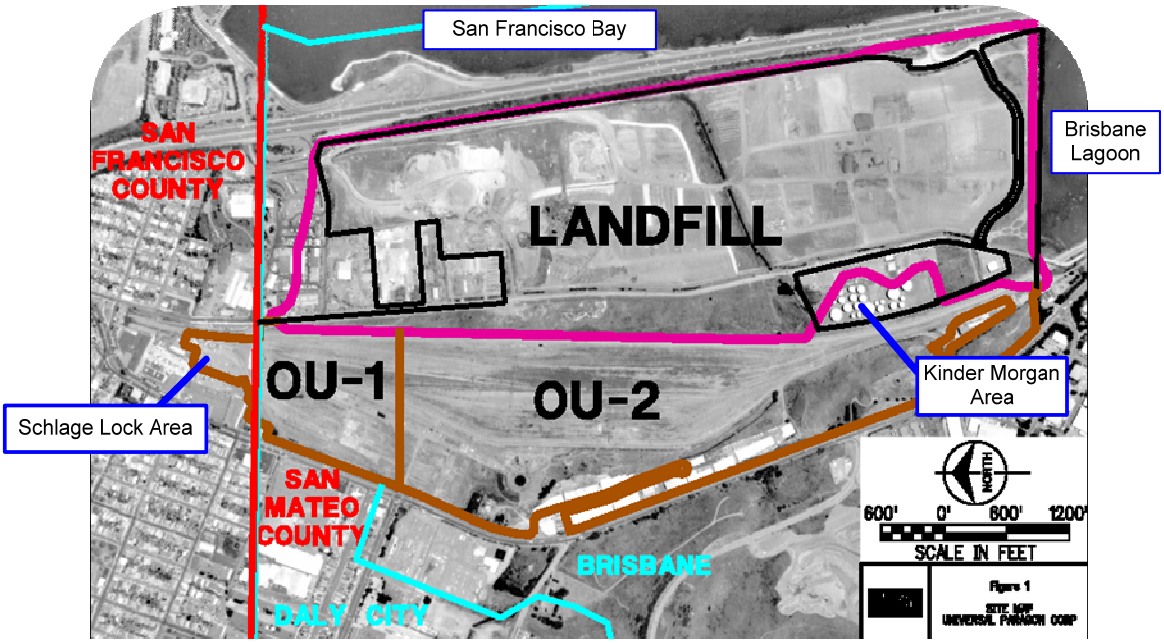

Figure 1. Aerial Diagram of Brisbane Baylands Area (after Pal, 2009)

Figure 2. Annotated Aerial Photograph of Brisbane Baylands Area (after Pal, 2009)

General Background to Comments

Presented in this section is background information to aid the reader's understanding of the comments made on previous site-specific studies of the waste management units in the Brisbane Baylands area.

One of the issues that can cause confusion is the characterization of chemicals as "hazardous wastes" or "hazardous chemicals," and the differentiation between "hazardous" and "non-hazardous" materials. "Hazardous chemical" is a general term used to label chemicals that, either alone or in combination with other chemicals, can be toxic (poisonous) to humans or wildlife. Few of the chemicals in use today that can be hazardous to humans or wildlife are subject to environmental regulation. "Hazardous wastes" represent a small group of hazardous chemicals that the US EPA defined as such in the 1970s associated with defining waste disposal sites and requirements. The differentiation between "hazardous" and "non-hazardous" waste is a regulatory one; a "non-hazardous" waste can, in fact, be deleterious. A discussion of these issues is presented beginning on page 51 in the Lee and Jones-Lee Flawed Technology review,

> Lee, G. F., and Jones-Lee, A., "Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste," Report of G. Fred Lee & Associates, El Macero, CA, December (2004). Updated June (2010).
> http://www.gfredlee.com/Landfills/SubtitleDFlawedTechnPap.pdf

as well as in several issues of Drs. Lee and Jones-Lee's "Stormwater Runoff Water Quality Newsletter" devoted to Unrecognized Pollutants, NL 7-3, 8-5, 9-3, 10-7, 11-7/8, 11-11, 12-6, and 13-1 and pharmaceuticals and personal care products (PPCPs) 7-3, 8-5, 10-7, 11-7/8, and 13-1. (available on their website, www.gfredlee.com, at http://www.gfredlee.com/newsindex.htm). As discussed in those writings, typical hazardous chemical monitoring programs focus on 100 to 200 or so chemicals (primarily those on the list of "Priority Pollutants") of the many thousands of chemicals that can be present in wastes. Every year new hazardous chemicals are found in wastes and the environment that have been there for many years but have not been detected by the limited-scope monitoring programs that have been and are continuing to be used today.

An example of a group of unrecognized unregulated hazardous chemicals that has existed in wastes and in the environment for many decades is the polybrominated diphenyl ethers (PBDEs), which have characteristics similar to PCBs. PBDEs are used as flame retardants on furniture, curtains, and many other products. The US Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ASTDR) (2004) developed a fact sheet (ToxFAQs™) for PBDEs (available at http://www.atsdr.cdc.gov/tfacts68-pbde.html) that provides information on the nature, occurrence, toxicity, etc. of PBDEs. Information on that group of chemicals is available on the Internet by searching PBDEs and in the Lee and Jones-Lee Stormwater Newsletters NL 7-3 NL 9-3 (available at http://www.gfredlee.com/Newsletter/swnewsV7N3.pdf) and NL 9-3 (http://www.gfredlee.com/Newsletter/swnewsV9N3.pdf).

As discussed in the literature, PBDEs have been found in aquatic organisms in many parts of the world, including San Francisco Bay. Studies have shown that PBDEs have been bioaccumulating in archived human breast milk for several decades. As summarized in NL 7-3,

according to McDonald (2003) of California Environmental Protection Agency, Office of Environmental Health Hazard Assessment:
"Approximately 75 million pounds of PBDEs are used each year in the U.S. as flame retardant additives for plastics in computers, televisions, appliances, building materials and vehicle parts; and foams for furniture. PBDEs migrate out of these products and into the environment, where they bioaccumulate. PBDEs are now ubiquitous in the environment and have been measured in indoor and outdoor air, house dust, food, streams and lakes, terrestrial and aquatic biota, and human tissues. Concentrations of PBDE measured in fish, marine mammals and people from the San Francisco Bay region are among the highest in the world, and these levels appear to be increasing with each passing year."

Despite their widespread presence and accumulation in organism tissue, and the concern for their impacts on organisms, PBDEs are not subject to environmental regulation through water quality standards. The environmental pollution by PBDEs is but one example of the significant deficiencies in conventional water quality monitoring for detecting the wide range of hazardous chemicals that are in wastes and in their leachates.

Perchlorate is another unregulated/unmonitored chemical that has long been, and continues to be a widespread environmental pollutant that is a public health hazard that is highly mobile in groundwaters. An important source of environmental pollution by perchlorate is its use in roadside safety flares. "Wikipedia" provides some background information on its use in flares (pyrotechnic) in http://en.wikipedia.org/wiki/Flare_(pyrotechnic).

As discussed in our Stormwater Runoff Water Quality Newsletter NL 7-available at http://www.gfredlee.com/Newsletter/swnewsV7N3.pdf:
"*Silva (2003) of the Santa Clara Valley Water District, has discussed the potential for highway safety flares to be a significant source of perchlorate (ClO-4-) contamination to water, even when the flares are 100-percent burned.*"

Silva pointed out, "*More than 40 metric tons of flares were used/burned in 2002 alone in Santa Clara County.*"

> Silva, M. A., "Safety Flares Threaten Water Quality with Perchlorate," Report of Santa Clara Valley Water District (2003).
> http://www.valleywater.org/Water/Water_Quality/Protecting_your_water/_Lustop/Perchlorate.shtm

The US EPA website [http://water.epa.gov/drink/contaminants/unregulated/perchlorate.cfm] under Perchlorate, contains information on perchlorate as an environmental pollutant.

While the pollution of the environment by perchlorate has been occurring for many decades and has been known for about one decade, perchlorate is still not on the list of hazardous chemicals that are monitored at hazardous chemical sites, including the Brisbane Baylands area.

It should never be assumed that leachate from landfills (even "nonhazardous" municipal solid waste landfills) or other complex mixtures of wastes, represents no threat to human health or the environment on the basis of the reporting that all the chemicals measured in the characterization of a waste are below detection limits or below current regulatory limits.

In addition, the Brisbane Landfill area contains a variety of chemicals such as salts and organic that can cause tastes and odors in water, fish, and wildlife, etc. While those materials and their tastes/odors may not necessarily be toxic, they are detrimental to water quality/organism quality. Thus, consideration of "impact" extends beyond measured chemicals that are labeled "hazardous." In this review of potential impacts of releases from the Brisbane Landfill, such "non-hazardous" chemicals are referred to as "detrimental chemicals." The adverse impacts would be primarily to wildlife in the Brisbane/Guadalupe Lagoon.

Thus, it is important to understand that hazardous chemical sites such as the Brisbane Baylands UPC property can contain a wide variety of hazardous and otherwise deleterious chemicals that are not necessarily regulated or monitored, that are not adequately regulated, and/or that are not presently known or recognized as potentially hazardous to public health or environmental quality.

The typical approach taken for evaluating the potential threat of a hazardous chemical site such as a closed landfill is to monitor the concentrations of potential pollutants (i.e., those regulated chemicals that can be a threat to public health and/or the environment); the concentrations found in the waters of concern are compared to a list of water quality criteria/standards and drinking water maximum contaminant levels (MCLs). (While domestic drinking water is not now an issue for the Brisbane Landfill area, there is concern about the potential for chemical releases from the landfill to be toxic to aquatic life and/or to bioaccumulate in edible organisms (fish/shellfish) in the Brisbane/Guadalupe Lagoon.) If none of the analyzed chemicals exceeds a regulatory limit, the water is presumed to be "safe" to drink and to not be adverse to aquatic life or to higher trophic level organisms that use the aquatic life as food. While this is the approach typically used, it by no means ensures protection of public health or environmental quality. Lee and Jones-Lee have discussed the unreliability of trusting US EPA drinking water MCLs as being necessarily protective of human health in their report:

> Lee, G. F., and Jones-Lee, A., "Monitoring Pollutants in Stormwater Runoff from Superfund Sites and Other Locations," Report of G. Fred Lee & Associates, El Macero, CA, November 5 (2009).
> http://www.gfredlee.com/HazChemSites/MonitorRunoffSuperfund.pdf

Factors other than cancer risk, such as the cost to remove a chemical from drinking water, are used to establish MCLs. An example of the implications of that approach is the MCL for arsenic. The US EPA arsenic MCL is about 500 times the normal cancer risk of 1×10^{-6} used for developing MCLs for many other chemicals. The US EPA established the non-protective MCL for arsenic in order to not cause domestic water utilities to have to treat the water to remove arsenic to the cancer risk of 1×10^{-6}. 1×10^{-6} represents a cancer risk of one additional cancer in a population of 1 million people who consume 2 liters (0.5 gallon) per day for a life time.

Similar problems exist in relying on some of the aquatic life criteria for ensuring protection of aquatic life from toxic chemicals. Some aquatic life water quality criteria ignore the toxicity of the chemical to zooplankton, which are important as fish food. Thus while meeting such criteria may protect fish from direct harm by toxicity, it may not provide protection for their food source, a condition that could adversely affect the fish population.

We have been involved in the development, evaluation, and appropriate use of water quality criteria and standards since the mid-1960s. This experience includes Dr. G. F. Lee's serving as: an invited peer reviewer for the National Academies of Science and Engineering "Blue Book" of Water Quality Criteria developed in 1972, a member of the American Fisheries Society Water Quality Section Review Panel for the US EPA "Red Book" of Water Quality Criteria of 1976, and an invited peer reviewer for the development approach and several criterion documents of the US EPA 1987 "Yellow Book" of Water Quality Criteria. He is therefore familiar with how water quality criteria and drinking water MCLs are developed. Drs. Lee and Jones-Lee have published a number of papers on these issues, including:

> Lee, G. F., and Jones-Lee, A., "Clean Water Act, Water Quality Criteria/Standards, TMDLs, and Weight-of-Evidence Approach for Regulating Water Quality," Water Encyclopedia: Water Law and Economics, Wiley, Hoboken, NJ, pp 598-604 (2005). http://www.gfredlee.com/SurfaceWQ/WileyCleanWaterAct.pdf
>
> Lee, G. F. and Jones-Lee, A., "Appropriate Use of Numeric Chemical Water Quality Criteria," *Health and Ecological Risk Assessment*, **1**:5-11 (1995). http://www.gfredlee.com/SurfaceWQ/chemcri.htm

It is not uncommon for those with limited understanding of how water quality criteria and standards are developed to mechanically use them to judge if a water is "safe" or not; if none of the criteria is exceeded, the water is considered "safe." That approach can readily lead to both under- and over-protection of the beneficial uses of a water. First, water quality criteria have been developed for only a very few of the many thousands of chemicals that are present in wastes and that have the potential to be adverse to public health and the environment. Second, the current approach for developing water quality criteria does not consider even known additive and synergistic properties of mixtures of chemicals; the toxicity of a mixture of such chemicals is greater than the sum of toxicity caused by each chemical alone. Third, as noted above, some water quality standards, such as MCLs for drinking water, incorporate factors outside of the potential impacts on public health and environmental quality, such as treatment costs.

Another area of concern in regulating some chemicals is their effecting changes in "biomarkers" in organisms, as evidenced by changes in biochemical cycles within the organism. While it has been known for more than four decades that those types of changes occur, the significance of such biomarker responses to a particular organism, much less a population of organisms, is generally not understood.

The potential for landfill gas and volatile organic chemicals (VOCs) to be emitted from the existing wastes and soils is another area of concern in the development of the UPC property. Such emissions can cause hazardous conditions to develop in buildings overlying the areas where the emission occurs. While HDPE layers can help to reduce the entrance of volatile chemicals into structures, there is need to develop a system to collect any volatile emissions in the area between the floor of the structure and the HDPE or other suitable barrier layer and to treat the volatile emissions as necessary before release to the atmosphere. Further, there should be ongoing periodic monitoring of the volatile chemicals in the buildings and in the vapor exhaust ventilation system.

During the presentation of this report to the BBCAG on October 19, 2010, R. Oremland of the USGS raised the issue of the toxicity of hydrogen sulfide. The following has been added to our report to address this issue.

In its draft "Guidebook: Hydrogen Sulfide Prevention & Control at Construction and Demolition Debris Disposal Facilities," the US EPA (2005) discussed the toxicity of hydrogen sulfide relative to its threshold odor concentration. Hydrogen sulfide can be readily smelled before it is toxic to humans.

> US EPA, "Guidebook: Hydrogen Sulfide Prevention & Control at Construction and Demolition Debris Disposal Facilities," Draft Report of the USEPA Region 5, Waste, Pesticides, and Toxics Division, Chicago, IL, December (2005).

Jean Bogner and Doug Heguy Present4ed the following with regard to hydrogen sulfide odor and toxicity, "Hydrogen Sulfide from Landfill Construction and Demolition Debris, When and How," MSW - March/April 2004
"*The odor threshold for H2S is extremely low (0.05 to 0.10 parts per million by volume, or ppmv), and levels of H2S above 10 ppmv are considered toxic, exceeding the threshold limit value. Moreover, levels of H2S above 1,000 ppmv in a breathing zone can rapidly lead to unconsciousness and death. Thus, worker health and safety issues might require special attention at sites with high H2S. It should perhaps be pointed out that there are other odorous reduced sulfur gases that might be present in LFG, including dimethyl sulfide, ethyl mercaptan, i-propyl mercaptan, t-butyl mercaptan, methyl n-propyl disulfide, dimethyl trisulfide, and thiophene; these typically are found in lower concentrations than H2S but are also generated under anaerobic conditions*."

ATSDR Toxic Substances Portal - Hydrogen Sulfide reports states,
"*How can hydrogen sulfide affect my health?*
Exposure to low concentrations of hydrogen sulfide may cause irritation to the eyes, nose, or throat. It may also cause difficulty in breathing for some asthmatics. Brief exposures to high concentrations of hydrogen sulfide (greater than 500 ppm) can cause a loss of consciousness and possibly death. In most cases, the person appears to regain consciousness without any other effects. However, in many individuals, there may be permanent or long-term effects such as headaches, poor attention span, poor memory, and poor motor function. No health effects have been found in humans exposed to typical environmental concentrations of hydrogen sulfide (0.00011–0.00033 ppm)." http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=388&tid=67

Oremland stated in follow-up comments, "*The nose cannot distinguish well between low (safe) concentrations and high (toxic) concentrations of H2S. That's why people can die from exposure to this gas. Also, the sense of smell weakens with exposure to sulfides and sulf-hydryl groups. I know this personally, having conducted research on this and other nasty compounds, like methyl mercaptan and dimethylsulfide*."

This is true; if hydrogen sulfide is smelled, it is prudent practice to leave the area and investigate the source.

An issue that is frequently raised, especially by the public and other groups concerned about the adequacy of a hazardous chemical site remediation, is whether a site should be remediated to the point of "clean closure," i.e., removal of all the known hazardous chemicals from the site, prior to development. A clean closure approach was followed in the excavation of the VOC-polluted areas at the OU-2 area. By contrast, the remediation approach adopted for several other sites in the Brisbane Baylands area has been to leave known and yet-to-be-identified hazardous/ deleterious chemicals on the property and establish procedures to try to control the releases from the polluted areas by containment or by collection and treatment. The primary approach that is being used for remediation of those Brisbane Baylands areas that UPC plans to develop is the capping of the wastes at the site. As an example of collection and treatment is that seepage of leachate from the Brisbane Baylands Landfill is being collected and transported to the local domestic wastewater treatment plant for treatment.

In principle, a "clean closure" provides the greatest protection of public health and environmental quality for the site provided that all hazardous and otherwise deleterious chemicals are, in fact, removed from the site. However as discussed in the paper cited below, providing "clean closure" is not straightforward as all concerned grapple with the issue of "how clean is clean?"

> Lee, G. F. and Jones-Lee, A., "Does Meeting Cleanup Standards Mean Protection of Public Health and the Environment?," IN: Superfund XV Conference Proc., Hazardous Materials Control Resources Institute, Rockville, MD, pp. 531-540 (1994). http://www.gfredlee.com/HazChemSites/hmcrstd.htm

The typical approach taken for "clean closure" is to address the removal of hazardous chemicals that are included in the list of conventionally measured pollutants. While such an approach can provide a sense of protection, it cannot be relied upon to ensure protection of public health or environmental quality at the site. As discussed in the paper referenced above, as well as noted herein, complex chemical sites at which a large number of a variety of hazardous chemicals are likely to be present, often also contain other, unmeasured and/or unregulated chemicals that were disposed of at the site or that were formed through transformation of other chemicals at the site. Therefore, it should never be assumed that a contaminated site – even one that underwent a so-called "clean closure" – no longer represents a threat to public health and the environment.

Remediated sites that incorporate structures relied upon for waste/chemical containment for protection of public health and the environment (such as a cap) need to carry land-use restrictions that protect the integrity and functioning of the containment system; land-use activities allowed need to be compatible with and support the containment system, and not facilitate breaches, which that can lead to release of hazardous chemicals to structures and/or the environment. Of particular concern is excavation for utilities and development structures, and deep-rooted plants that can bring hazardous chemicals to the surface. It is important to understand that hazardous chemicals contained on a site will be a threat effectively forever; they do not necessarily become innocuous over time, and as the containment systems deteriorate, the containment diminishes. Therefore, a key to long-term protection of public health and environmental quality associated with "remediated" sites will be the effectiveness and reliability of the implementation of the restrictions on land-use activities at the site that could lead to release of hazardous chemicals. Enforcement would need to be continued even if after a few

years, decades, or longer during which time no release of chemicals have been revealed. As long as hazardous chemicals are present on the site, proper land-use restrictions, as well as systems and water quality maintenance and monitoring must be continued. All of these issues should be understood by those interested in the remediation/development of the UPC Brisbane Baylands area and addressed in formulating the plans for developing this area.

Third-Party Independent Monitoring and Review of the Developed Properties

An issue that has occurred at some hazardous chemical sites is that once the regulatory agency adopted a remediation approach it may be difficult to get the agency to reopen the site for further study even though the new evidence strongly supports the need for additional study. Typically regulatory agencies do not have adequate resources to revisit a site, especially when there are other sites that require examination. This situation provides justification for third-party, independent monitoring and review of a site with reporting to a citizen/agency board overseeing the site.

The proposed development of the UPC property does not include removal of all contaminants; rather, known and yet-to-be-identified hazardous/deleterious chemicals would be left on the property. In order to provide a higher degree of public health and environmental protection, the properties owners, initially UPC and then the future owners of the properties, should provide and maintain sufficient funds through a "property owners' association" to enable third-party, independent monitoring of the property for hazardous/deleterious chemicals that are a threat to public health and the environment. This monitoring, which would need to be continued indefinitely, should be done by a contractor who is hired by a citizens/regulatory agency board and report at least annually to that board. The amount of funding should be adequate to periodically monitor all potential pathways for release of hazardous/deleterious chemicals, and be sufficient to enable expansion of the scope of monitoring should new chemicals be identified as chemicals of concern.

Further, periodic reviews should be conducted, such as the five-year reviews delineated in the US EPA Superfund regulations, to ascertain whether new information has been developed that should prompt reopening of the site investigation and remediation. As with the independent monitoring, these periodic reviews should be done with full public participation in which the public is provided independent, third-party technical assistance to review the adequacy of the periodic review. As part of closure of a site, even if it considered to be a "clean closure," funding should be made available by the responsible parties or the regulatory agency to enable the public to actively participate in site review such as suggested herein, with independent, third-party technical assistance.

Review of Previous Investigations

Brisbane Baylands Landfill

As presented in various reports discussed below, studies on the degree of contamination of the Brisbane Baylands area have been conducted since the 1960s. In 2005, Camp, Dresser & McKee, Inc. (CDM) issued its "Final Report of Findings, Environmental Engineering Peer Review, Baylands Remediation Efforts" to the city of Brisbane. That report provided a review of many aspects of the degree of contamination of the Baylands area, and it discusses a number

of remediation issues pertinent to the development of this area. In the Executive Summary of its report, and in its presentation of findings to the city of Brisbane, CDM summarized key issues in the site investigation and remediation. Some of the findings CDM presented, along with our comments, are discussed below. With respect to the Brisbane Baylands Landfill CDM stated,

- CDM concluded that the human health and ecological risk assessment for the area is *"incomplete"* and added, *"Final assessment pending development plan."*

We find that the 2005 CDM assessment of the degree of human health and ecological risk associated with the contamination at the Baylands area has been conducted in accord with normal hazardous chemical site investigations used today by consulting firms employed by site owners and regulatory agencies. However, as discussed in the "background information" provided in this report, such a level of investigation does not preclude the possibility that there are unrecognized, unmonitored hazardous chemicals that pose a risk to public health and environmental quality at the site. Future investigations associated with development of the property could, if adequately conducted, reveal other hazardous chemicals at the site that have not been identified thus far. It would be inappropriate to conclude that all of the site investigations needed for developing this property have been conducted. Investigation well-beyond the minimum needed for site investigation should be conducted as plans are made for developing the site.

A possible approach to provide for more than the minimum required by regulatory agencies for site investigation relative to proposed development of hazardous chemical sites would be to appoint an independent advisory panel of experts to conduct ongoing reviews of development plans and further public health and ecological assessments. That expert panel should be composed of individuals highly knowledgeable and experienced in the issues pertinent to public health and environmental protection issues associated with hazardous and municipal wastes, but who do not gain employment from hazardous chemical site responsible parties. This expert panel should be funded by the developers and future owners of the properties.

Status of Landfill Stabilization

- CDM concluded that the majority of the organic wastes are decomposed with respect to landfill gas releases and recommended the re-initiation of landfill gas monitoring.

The SCS report, September 08 LF gas monitoring Operation, Monitoring, and Maintenance of the Landfill Gas (LFG) Migration Control Facilities at the Closed Brisbane Landfill, Brisbane, California, includes information on the operations of the landfill gas collection system for the Brisbane Landfill, which includes monitoring of the blower flare station (BFS) weekly, monitoring and adjustment of the extraction well field monthly, and component emissions monitoring quarterly. According to the SCS report,

"As of the dates of our testing, the LFG control facilities appeared to be operating satisfactorily and generally meeting the operational criteria, with the exception of several age deteriorated components discussed in subsequent sections of this report. All accessible LFG extraction wells were observed to be receiving adequate vacuum during this reporting period."

That report stated that the blower only operates intermittently due to low methane concentrations. This means that there can be low rates of release of uncollected landfill gas through the landfill cover. According to the SCS report,
"Visual observation of the landfill surface along the extent of the LFG extraction system is also performed on a monthly basis. Observations for erosion, surface cracks (that might allow LFG to escape or promote air intrusion) and settlement around wells, laterals, and pipelines are conducted."

"During our monitoring events, SCS has been unable to locate the following wells: HW-A01, HW-A08, HW-A14, VW-A07 and VW-A15. ***SCS continues to recommend that these wells, which are currently out of compliance with the permit to operate, be replaced in accordance with the drawing previously submitted to the BAAQMD, or be reported as abandoned/destroyed by SCS Engineers and removed from the permit to operate conditions."***

On the basis of the SCS report, it is evident that the maintenance on the landfill gas collection and destruction system has not been adequate. This is another reason that independent, third-party monitoring of the landfill gas collection and destruction system should be conducted.

Geosyntec's "Landfill Gas Emission Evaluation Brisbane Landfill Brisbane, California" letter report to UPC June (2006) states that Geosyntec performed an evaluation of landfill gas (LFG) surface emissions at the Brisbane Landfill in June 2006. While walking the site, Geosyntec personnel were to monitor LFG using the organic vapor analyzer (OVA) and record any locations of, and readings that were 500 parts per million (ppm) (by volume) expressed as methane or more above background. On 6 and 7 June 2006 a Geosyntec technician monitored LFG surface concentrations along the entire perimeter of the Brisbane Landfill and along a pattern that traversed the landfill at 30-m (100-ft) intervals using an OVA calibrated for methane. The LFG surface emission survey indicated no detection of LFG along the perimeter of the landfill or within the boundary of the landfill.

No data were reported for these measurements in the version of the Geosyntec report provided to us. Therefore we do not know how close some of the readings were to the 500 ppm limit. The escape of landfill gas through a landfill cap depends on the condition of the cap, including cap moisture, temperature, etc. The barometric pressure also influences the rate of landfill gas emission through a landfill cap. A single measurement of this type is not necessarily adequate to conclude that there will not be, at other times, release of landfill gas or, for that matter, other volatile organics, from the landfill that would pose a threat to humans and wildlife. Near-surface landfill gas monitoring needs to be done over several seasons to properly measure the release of landfill gas.

Additional information on landfill gas emissions from the landfill was provided by Golder Associates, Inc., in its 2006 report discussed below. Overall, there is concern about the public health and environmental impacts of regulated and unregulated chemicals in landfill gas emissions that must be considered in any development plans for the area.

Hazardous Waste Deposition Issues

Golder Associates, Inc., issued a letter report entitled, "Characterization Study, Brisbane Landfill," in December 2006. That report was requested by BBCAG to enable it to better understand the hazardous waste characteristics of that landfill. According to Golder,

"*The BBCAG Remediation Subcommittee is interested in obtaining additional information regarding whether hazardous wastes may have been disposed in the Brisbane Landfill. Subsequently, BBCAG contracted Golder to perform a characterization study to determine if there was evidence that hazardous waste may have been disposed in the Brisbane Landfill. Golder's scope of work involved the following tasks: Document review, Historic aerial photograph review, and Landfill gas evaluation Report.*

During our review of documents provided to us, it became apparent that there was no evidence of specific instances of hazardous waste having been disposed at the Brisbane Landfill. Based on this, we did not review historic aerial photographs, as we believed it was unlikely the photographs would provide any evidence of hazardous waste being disposed."

With respect to evaluating whether a landfill such as the Brisbane Landfill has received what are now classified as hazardous wastes is difficult to ascertain after the fact. The wastes in a landfill as a result of contact with water, produced leachate, which contains hazardous chemicals. The initial leachate produced from contact with the wastes is diluted by precipitation infiltration through the landfill cover and mixing with the elevated groundwaters due to the high groundwater table in the area. While the concentrations of hazardous chemicals in that diluted leachate do not necessarily exceed regulatory limits for the classification of a waste produced in the waste-classification testing procedures, as "hazardous," that leachate can, in fact, still be highly hazardous to public health and the environment.

The issue of whether what can be regulatory classified as "hazardous waste" had been deposited in the Brisbane Landfill, while of concern to BBCAG, is not a real or significant issue of concern with respect to the hazards that the existing waste releases represent to those who use the developed area or to the environment of the area. As discussed in the "Background" section of this report, the determination of whether a waste is "hazardous," as defined at the federal and state levels, focuses on the results of operationally-defined testing of a waste prior to deposition in the landfill. Those testing procedures were not developed to evaluate whether the releases from a landfill represent deposition of hazardous waste in that landfill. The Golder review of whether "hazardous waste" had been deposited in the Brisbane Landfill focused on examining the composition of releases from the landfill. Golder states,

- *"Available data indicate that the refuse consisted of household and commercial waste and construction debris. No evidence of the disposal of hazardous or toxic wastes was found, although records are incomplete or unavailable."*

Golder also states,

"The findings in the WDRs state that the Brisbane Landfill was used for the disposal of primarily non-hazardous solid wastes comprised of domestic, industrial, and shipyard wastes, sewage, and rubble."

While Golder states that there is no evidence for classified hazardous waste's having been deposited in the landfill, there can be little doubt that some hazardous waste, as defined under current federal and state regulations, was deposited in this landfill from industrial and domestic sources. As discussed elsewhere in this report, the federal and state definitions of "hazardous waste" exempt some waste sources that contain the same chemicals that would cause other wastes to be defined as "hazardous waste" and thereby allow them to be deposited in municipal solid waste landfills. Further, there are, without question, hazardous and otherwise deleterious chemicals that are disposed of in municipal solid wastes. The real issue of concern is whether the chemicals being released from the Brisbane Landfill at this time, or that can be expected to be released from the landfill at some time in the future, represent a significant threat to public health and/or the environment associated with the developed area. In the Golder report there is evidence that the monitoring data that have been collected thus far at the landfill show that the leachate is a potential threat to public health and the environment. Further, as discussed in the background information above, in addition to those measured substances, there could readily be other hazardous chemicals, alone or in combination with other chemicals, that represent a public health and environmental hazard.

The Golder report states with respect to releases of hazardous chemicals,

- *"Comparison of chemical data with limits established by the Environmental Protection Agency indicates that several metals were present at concentrations in excess of those established to protect saltwater aquatic life. These include nickel, and arsenic (both widespread) with fewer occurrences of silver, lead, and zinc."*

* * *

- *"Concentrations of several metals (nickel, arsenic, and beryllium) were detected either in surface waters or in the perimeter monitoring wells at concentrations above the recommended four-day average of the EPA National Ambient Water Quality Criteria to Protect Saltwater Aquatic Life."*

* * *

"(Note: Since the supplement screening-level risk assessment was issued in August 2005, the ESLs for arsenic, 1,4-dichlorobenzene, methylene chloride, MTME, and naphthalene have been reduced by the RWQCB. As a result, the average seep, annual median, maximum detected, and maximum estimated surface water concentrations for arsenic would now exceed the ESL for arsenic.)"

* * *

"The water quality monitoring reports present analytical data from approximately 2002 to 2008 for groundwater, leachate, leachate seeps in the interior drainage channel, and surface water. There is evidence that VOCs, present in leachate or leachate seeps, are also present in downgradient groundwater. This is consistent with the findings from the SWAT investigation."

* * *

"Municipal waste is known to commonly contain small quantities of hazardous waste, primarily household hazardous waste, and this may be the source of the hazardous waste constituents identified in groundwater, leachate, and leachate seeps. Alternatively, the industrial or shipyard wastes that were identified in the WDR findings may be the source. However as noted in the SWAT investigation findings, records related to wastes disposed at the Brisbane Landfill are incomplete or unavailable."

Golder conducted a limited study of the composition of landfill gas at the Brisbane Landfill. According to the Golder report,
"Six VOCs and hydrogen sulfide were detected in the landfill gas sample." The report further states,
"As can be seen from Table 2, the calculated emission rates, in general, are several orders of magnitude less than the trigger levels. It should be noted the calculated emissions rates are very conservative because it is assumed the flow rate is constant and that there is no destruction of toxic air contaminants by the landfill gas flare. In actuality, the landfill gas flare does not operate continuously. Additionally, the landfill gas flare can be expected to destroy a minimum of 98 percent of the VOCs."

The Golder review on landfill gas indicates that, based on limited analysis of the composition of the gas during this one sampling event, there were monitored chemicals in the landfill gas emissions that are of concern with respect to human health. This would be of particular concern to occupants of buildings constructed on the landfill area.

Overall, it may be concluded that the Brisbane Landfill contains wastes that are emitting chemicals that are a threat to public health and the environment, and therefore that the development of this property must be done in such a way as to fully protect public health and the environment from existing and potential future releases of hazardous and otherwise deleterious chemicals. In addition, third-party, independent, monitoring of the pathways for release of hazardous and deleterious chemicals should be conducted for as long as such releases can occur, which will likely be, essentially, forever.

- CDM concluded in its 2005 Peer Review Findings that groundwater quality was adequately characterized.

That CDM conclusion is based on a limited-scope evaluation/monitoring of the groundwaters associated with the Brisbane Landfill. From a conventional hazardous chemical site investigation perspective, there appears to be adequate monitoring to characterize the degree of pollution of the groundwaters by the landfill. However, as discussed in the "Background information" section of this report, there can readily be unmonitored and unregulated chemicals derived from the landfill present in groundwaters, and other waste/sources of contamination in the area that are not now identified.

- CDM concludes that leachate "seeps" to surface and groundwaters have been adequately characterized.

Geosyntec conducted a number of studies on the characteristics of the seeps (surfacings) of leachate-polluted groundwater and their impact on the water quality in Brisbane/Guadalupe Lagoon. The Geosyntec (2003) report presents the results of a screening-level ecological risk assessment of the impact of the landfill seeps on the Brisbane/Guadalupe Lagoon. While there were visible leachate-containing seeps that entered the surface waters of the lagoon at the time of that study, there were also likely subsurface seeps of polluted groundwater entering the lagoon.

The Geosyntec (2004) report focused on the potential for ammonia in the seep water to cause toxicity to benthic organisms in the lagoon. On the basis of that study and a surface water monitoring study of the lagoon waters that it conducted in 2003, Geosyntec concluded that the seeps are not adversely impacting lagoon water quality. From the studies that have been conducted by Geosyntec, it appears that the chemicals in the seeps are not causing a readily measurable impact on water quality. However, there could be adverse impacts to aquatic life in the lagoon due to unmeasured chemicals, as well as to additive and synergistic impacts of measured and unmeasured chemicals.

V. Pal, WRCE, of the San Francisco Bay Regional Water Quality Control Board, made a presentation entitled, "Leachate Seep Management for Brisbane Landfill," at the November 17, 2009 BBCAG meeting. Slides for that presentation are available on the BBCAG website (http://www.bbcag.com/agenda_minute_packet.html) at
[http://www.bbcag.com/BBCAG%20Documents/Final%2011_17_09%20BBCAG%20SEEPS%20MANAGEMENT%20PRESENTATION.pdf]
That presentation summarized the Regional Board's approach to controlling the water quality impacts of Brisbane Baylands landfill leachate seeps.

Because of the potential for landfill seeps to have yet-undetected adverse impacts on aquatic life in the Bridsbane/Guadalupe Lagoon, the San Francisco Regional Water Quality Control Board, under WDR Order No. 01-041, required installation of a system of extraction wells at known surface seeps to collect the leachate-polluted groundwater and transport it to a Bayshore Sanitary District sewerage system. That extraction/collection system began operation in 2009.

Beginning in the winter-spring 2010, Geosyntec began reporting on the cumulative monitoring of the collective seeps from the collection pipeline just before discharge to the Bayshore Sanitary District (BSD) sewer line.

The Bayshore Sanitary District issued a letter report, April-June 2010 Quarterly Report, Brisbane Baylands - Sunquest Properties, Leachate Seeps Collection and Transmission System. The VOCs chorobenzene and 1,4-dichlorobenzene were detected at concentrations from 1 to about 6 µg/L in the samples of the leachate discharged to the sanitary sewer. Organics, as measured by diesel and motor oil tests, were found to be 1,400 to 1,700 µg/L. Metals tested included barium, cobalt and lead; those were present in concentrations from non-detect to 0.015 mg/L for barium.

Overall, the chemical characterization of the seep water discharged to the sanitary sewer is limited. However, the data that have been collected show that it contains appreciable organics and readily measurable VOCs, which indicates that the landfill is polluting groundwaters, and that the leachate-polluted groundwater has been transported to the lagoon surface waters where it has the potential to adversely affect aquatic life. A much more comprehensive monitoring program, including aquatic life toxicity testing, would be needed to assess the extent to which leachate-polluted groundwater discharged to the lagoon via subsurface discharges is or could be adversely affecting aquatic life.

The Geosyntec Winter-Spring (February) 2010 Semiannual Discharge Monitoring Report for the Brisbane Landfill submitted to the San Francisco Regional Water Quality Control Board contains

a comprehensive discussion of the monitoring data that Geosyntec has collected over the years on the groundwater and some surface water runoff and seeps. The Geosyntec "Compliance Evaluation Summary" includes the following statements.

"During the Winter-Spring (February) 2010 semiannual monitoring event, volatile organic compounds (VOCs) were detected above the RLs in all but two (i.e., (SFC)MW-6 and MW-36A) of the shallow monitoring wells. In the four (4) shallow upgradient monitoring wells, only MTBE was found above the RLs at concentrations ranging from 0.51 µg/L (MW-10A) to 3.3 µg/L (MW-4A). Given the general direction of Zone A groundwater flow in the area (Figures 3 and 5), it appears that the source of the MTBE and likely other compounds in the shallow upgradient monitoring wells is from an off-site source(s)."

"In the nine (9) shallow detection (downgradient) monitoring wells (i.e., MW-31A, MW-33A, MW-34A, MW-36A, MW-37A, MW-39A, MW-40A, MW-42A, and MW-44A), a number of VOCs were detected above the RLs at concentrations ranging from 0.57 µg/L (toluene in MW- 39A) to 22 µg/L (chlorobenzene in MW-31A). (The primary Maximum Contaminant Level (MCL) for chlorobenzene is 70 µg/L [CRWQCB, 2007b]). Additionally, several VOCs were detected at trace concentrations in the shallow downgradient monitoring wells. Since shallow downgradient monitoring wells MW-33A, MW-36A, MW-37A, MW-39A and MW-40A are located within the landfill footprint, the detected compounds indicate their presence in landfill leachate."

"The un-ionized fraction of ammonia (i.e., NH3) was calculated using sample temperature and pH at a time of sampling. The CRWQCB water quality objectives for ammonia [CRWQCB, 2007a] are for the un-ionized ammonia fraction. Since the Brisbane Landfill is located within the Lower Bay, two criteria may be relevant: (i) annual median of 0.025 mg/L; and (ii) maximum of 0.4 mg/L. The median value of un-ionized ammonia for the nine (9) shallow (Zone A) detection (downgradient) monitoring wells tested during the February 2010 monitoring round is 0.083 mg/L. The median value of un-ionized ammonia, for the four (4) deep (Zone B) detection (downgradient) monitoring wells tested during the February 2010 monitoring event, is 0.023 mg/L. The maximum concentration of un-ionized ammonia in all shallow wells was found in MW-34A (2.49 mg/L), and in all deep wells in MW-38B (0.115 mg/L). During the February 2010 event, 3 out of 9 samples obtained from shallow downgradient monitoring wells at the Brisbane Landfill had un-ionized ammonia concentrations detected above the maximum criterion of 0.4 mg/L for receiving waters."

"On 17 November 2009 and 16 February 2010, Geosyntec performed standard and facility monitoring observations for the perimeter and interior stations at the Brisbane Landfill. Generally, the inspections indicated no evidence of cover erosion, daylighted refuse, odor detection or liquid leaving the site."

Overall, the Geosyntec 2010 summary report for groundwater monitoring shows that the landfill is polluting groundwaters with chemicals that can be adverse to public health and the environment.

Stormwater Runoff Monitoring at the Landfill Area

In its Peer Review Findings for the Brisbane Landfill area, CDM did not address the adequacy of

the stormwater runoff monitoring from this area. In general, federal and state of California requirements for stormwater runoff monitoring at active and closed landfill areas are significantly deficient for adequately characterizing the presence of chemicals in runoff waters that could be adverse to water quality in waters receiving runoff. This deficiency was found in the monitoring of stormwater runoff at the Brisbane Landfill.

The State of California Water Resources Control Board recently significantly expanded its Construction Storm Water Program to improve the water quality monitoring of areas where construction is taking place. Information on that program is available at http://www.swrcb.ca.gov/water_issues/programs/stormwater/construction.shtml.

According to H. Pearce, Engineering Project Manager, UPC, the city of Brisbane will be issuing a permit for a new stormwater runoff monitoring program for the Brisbane Landfill area; that permit is expected to be available in the near future. The conditions of that permit will need to be critically examined to determine if the monitoring of potential pollutants required would be expected to be sufficient to protect the water quality of Brisbane/Guadalupe Lagoon and other surface waters of the area. Particular attention should be given to requirements for aquatic life toxicity testing in the runoff waters.

Burns and McDonnell has issued a series of bi-monthly stormwater runoff sampling reports for approximately 260 acres of the Brisbane Landfill site, for example,
Burns and McDonnell, "March-April 2008 Bi-Monthly Report, Earthwork Observation and Testing Services & Storm Water Sampling and Observation, Brisbane Landfill, Brisbane, California," Burns and McDonnell, South San Francisco, CA (2008).

The focus of those Burns and McDonnell reports is stormwater runoff from the Ryan Engineering, Inc. and Brisbane Recycling Co., Inc. recycling operations at the Brisbane Landfill. According to the March-April Burns and McDonnell report, those companies act as *"depository locations of inert waste materials from excavation and demolition projects off-site."* Basically, those recycling operations consist of grinding concrete rubble to form a soil-like material, a considerable part of which is then deposited on the surface of the Brisbane Landfill. According to the information provided by H. Pearce of UPC, no other construction and demolition wastes are accepted at the facility. The Burns and McDonnell report states,
"Burns & McDonnell visited the Site periodically between March 21 and April 18, 2008 to observe and identify locations of stockpiles, determine materials in each stockpile, collect stormwater samples and evaluate stormwater Best Management Practices (BMPs) on the Site."

According to their report, the focus of the stormwater BMPs is the collection, in sedimentation basins, of sediments in stormwater runoff from the stockpiles of recycled material. Figure 4 in that report shows the stormwater sampling locations at the site; the sampling sites focus on the Interior Drainage Channel (IDC), which is a channel that bisects the landfill area. The Burns and McDonnell (2008) report also provides historical data on stormwater monitoring, which shows that monitoring parameters are restricted to pH, total suspended solids (TSS), specific conductance, and oil and grease. There is no monitoring of stormwater runoff for potentially hazardous chemicals associated with the concrete rubble recycling or the landfill surface. This

limited monitoring program highlights the grossly inadequate federal and state requirements for stormwater runoff monitoring programs for landfill areas. This issue is discussed further below.

According to the Geosyntec February (2010) report,
"Shallow groundwater flow in the vicinity of Brisbane Landfill is likely controlled by the location of two nearby surface water bodies: San Francisco Bay to the east of the site and Guadalupe Lagoon south of the site. Additionally, it appears that the Interior Drainage Channel (IDC), which crosses the landfill in the east-west direction, also influences shallow (Zone A) groundwater flow. Therefore, beneath the landfill, shallow groundwater appears to be recharged from the west and north and flows towards the IDC, Guadalupe Lagoon and San Francisco Bay, with a local component of westward flow along portions at the west boundary."

Also according to Geosyntec (2010),
"Section 20415(c)(1) of Title 27 requires that "The discharger shall establish a surface water monitoring system to monitor each surface water body that could be affected by a release from the Unit." Initially, two surface-water stations, SR-1 and SR-2, were established at the Brisbane Landfill to meet this requirement. Both stations are located along a tidally influenced interior drainage channel (IDC) that bisects the landfill. Surface-water station SR-1 is located in the western portion of the landfill near Tunnel Avenue and SR-2 is located on the eastern boundary of the landfill, near Highway 101 (Figure 2). Station SR-0, established in September 2006 to replace SR-1, is located outside the waste limit and to the west of the landfill (Figure 2). Approximate locations of IDC seeps (monitored in February 2005 and June 2005) are also shown on Figure 2."

The Geosyntec February (2010) report also presents a summary of the monitoring of the IDC. According to the report,
"The results of the IDC seep sampling and screening-level ecological risk assessment (SLERA), performed to evaluate a potential impact of the IDC seeps on the environment, indicate no significant impacts to IDC surface water and the San Francisco Bay are expected to result from the IDC seeps."

"The two surface-water locations, i.e., SR-0 and SR-2, were sampled in February 2010 and the results are summarized in Table 11.
No VOCs were detected in the surface-water IDC samples. In accordance with Table 3 (Note 3) of the WDRs [CRWQCB, 2001], the surface-water monitoring stations were not analyzed for semi-VOCs, PCBs and organochlorine pesticides during the Winter-Spring 2010 monitoring event. Both stations will not be analyzed for semi-VOCs, PCBs and organochlorine pesticides through the August 2012 event [Geosyntec, 2007].
Only one metal, barium, was found in both samples (0.49 mg/L at SR-0 and 0.03 mg/L in SR-2). Lead (0.0067 mg/L) was detected in the SR-0 sample. No other dissolved metals were detected at or above the laboratory RLs."

One of the problems with the way the data are presented in the Geosyntec (2010) report is that the concentrations reported for many of the potentially hazardous chemicals measured are "ND" (i.e., not detected). The implication of a parameter's being "not detected" depends entirely on the lowest level that can be reliably detected in the analysis, i.e., the lower analytical detection

limit, and the lowest concentration that can have public health or environmental quality significance. While information is presented in another section of that report concerning the characteristics of the analytical procedures used, such as reporting limits, it would be far more informative if the tables presenting the data actually included a "less than" concentration, rather than "ND." Further, it has been our experience that some laboratories develop a generalized table of reporting limits that are not necessarily applicable to the data that are generated on a particular sample. This is important, especially in the analysis of samples containing complex mixtures of chemicals, the presence of certain chemicals or conditions can interfere with the suitability and reliability of particular analytical methods; such interferences can cause the reporting limit/detection limit developed under other conditions to be unreliable for the particular sample. When the actual detection limits for each sample are presented in a table of data, those examining the table can readily determine if the analytical methods used for a particular sample are sufficiently sensitive to measure the concentrations at levels that are of concern to public health and/or the environment.

As noted above, and discussed in the following reports, it has been our experience that the California Regional Water Quality Control Boards do not require adequate stormwater runoff monitoring programs for active and closed landfill areas, and other hazardous chemical sites.

> Lee, G. F., and Jones-Lee, A., "Monitoring Pollutants in Stormwater Runoff from Superfund Sites and Other Locations," Report of G. Fred Lee & Associates, El Macero, CA, November 5 (2009).
> http://www.gfredlee.com/HazChemSites/MonitorRunoffSuperfund.pdf
>
> Lee, G. F., and Jones-Lee, A., "Issues in Monitoring Hazardous Chemicals in Stormwater Runoff/Discharges from Superfund and Other Hazardous Chemical Sites," Journ. Remediation 20(2):115-127 Spring (2010).
> http://www.gfredlee.com/HazChemSites/MonitoringHazChemSW.pdf

We have found that the monitoring approach prescribed for stormwater runoff from landfill areas is often the same as that used for monitoring runoff from urban streets; collection of a single grab sample at some time during each of several storm water runoff events per year is typically required. That approach, however, is neither adequate nor in keeping with programs prescribed by the US EPA (1992) for monitoring stormwater runoff from industrial sites. Landfill areas are industrial areas and should be monitored as such. The US EPA recommended stormwater runoff monitoring program is described in

> U.S. Environmental Protection Agency (U.S. EPA). (1992). NPDES Stormwater Sampling Guidance Document (EPA/833/B-92/001)" for implementing the Agency NPDES stormwater management program.
> [http://yosemite.epa.gov/R10/WATER.NSF/NPDES+Permits/SW+guidance+&+fact+sheets+-+Region+10/].

The monitoring program recommended by the US EPA for industrial sites involves collecting samples of true first-flush runoff as well as samples of runoff at several times during the runoff event. Further, a sufficient number of events must be so-monitored each year to properly characterize the hazardous chemical content of the stormwater runoff. The parameters that are to be monitored include a fairly comprehensive suite of chemicals that could potentially be present

in stormwater runoff from the area. This is the type of monitoring that should be conducted at the Baylands Landfill area during and following the development of the property.

One of the issues of particular concern with regard to stormwater runoff from hazardous chemical sites/landfills is the potential for the transport of chemicals from the site to nearby waterbodies where the chemicals bioaccumulate in edible organisms. While there has been some monitoring of seeps and groundwater for the release from the landfill of chemicals that could bioaccumulate such as PCBs, that monitoring has not employed sufficiently sensitive analytical procedures to detect the chemicals at levels that could be of concern for bioaccumulation in edible organisms. As discussed by Lee and Jones-Lee (2010) in their report on stormwater runoff from hazardous chemical sites referenced above, the edible flesh of aquatic organisms in waters near hazardous chemical sites/landfills should be monitored for the chlorinated hydrocarbon legacy pesticides (such as DDT), PCBs, polybrominated biphenyl ethers (PBDEs), mercury, and other chemicals that tend to bioaccumulate in edible organisms. If that monitoring shows that those chemicals are not present in organism tissues in concentrations of potential concern, then it could be reasonable to conclude that the current and recent activities at the hazardous chemical site are not contributing those chemicals to the surface waters. If, however, the concentrations of such chemicals in edible organisms are found in levels of concern to human health or to other aquatic life/terrestrial life that use aquatic life as food, then studies need to be done to determine if the hazardous chemical site is the source of those chemicals.

An example of significant deficiencies in current stormwater runoff monitoring at the Brisbane Landfill area, as well as of the reality of presently unrecognized pollutants, is seen in connection with the current processing of crushed concrete on the site. Caulk is the pliable sealant that is used to seal around joints in buildings and concrete/masonry. PCBs were used in caulk beginning the 1950s through the 1970s. The demolition of buildings as part of renovation can result in the release of PCBs that was present in the buildings/structures. It is becoming recognized that there is a potential for PCBs to be present in caulk associated with concrete recycling such as that which is being conducted as part of processing the demolition debris at the Brisbane Baylands site. The SFRWQCB has adopted a TMDL to control the excessive bioaccumulation of PCBs in some Bay area fish in an effort to protect the health of those who use those fish for food. In November 2006, the State Water Resources Control Board awarded the Association of Bay Area Governments/San Francisco Estuary Project a Proposition 50 Coastal Nonpoint Source Pollution grant that included funds to advance the implementation of the TMDL for the control of PCBs used in historic buildings. Based on an October 26, 2010 conference call devoted to reviewing the progress being made in the "PCBs in Caulk Project," there is a potential that the crushed concrete that is piled on the Brisbane Landfill contains PCBs that could be present in stormwater runoff from this area. A fact sheet entitled, "PCBs in Bay Area Building materials," covering this project is available at http://www.sfestuary.org/userfiles/PCBsinBuildingMaterialsFact%20Sheet%2012-08.pdf.

According to this fact sheet, The San Francisco Bay PCBs TMDL Project Report,
San Francisco Bay Water Board (2004). PCBs in San Francisco Bay, TMDL Project Report, January 8, (2004)
That fact sheet states,
"report that urban runoff was one of the major sources of PCBs loads to the Bay and concluded

that controlling PCBs sources in urban runoff was one of two top priorities for TMDL implementation. Based on this recommendation, the Clean Estuary Partnership (CEP) evaluated available data on sources of PCBs in urban runoff and recommended approaches for addressing two potentially significant sources, past PCBs releases that have contaminated soil and sediments and PCB-containing historic building materials, specifically uncontained materials like sealants, caulking and paint. When the building materials fail or buildings are remodeled or demolished, PCBs may be released onto the ground and can be washed off by urban runoff."

Additional information on the San Estuary Project is available in the document, "Taking Action for Clean Water — PCBs in Caulk Project,"
[http://www.sfestuary.org/projects/detail.php?projectID=29

Past issues of the Stormwater Runoff Water Quality Newsletters (4-2, 6-4, 7-4, 7-6/7, 9-3, 9-4, 11-7/8, 12-3, 12-7/8), available at [http://www.gfredlee.com/newsindex.htm] provide information on PCBs as environmental pollutants and sources of PCBs, including caulk used to seal joints in buildings and structures.

G. F, Lee has been involved in investigating PCB pollution of water and excessive bioaccumulation in fish for about five decades; he was among the first, if not the first, to identify PCBs as widespread contaminants in water and fish. A summary of that experience is presented in,

> Lee, G. F., "Experience in Working with PCB Pollution Issues," Report of G. Fred Lee & Associates, El Macero, CA (2006).
> http://www.gfredlee.com/HazChemSites/PCBExperience.pdf

Lee and Jones-Lee have also published extensively on their work on PCBs as environmental pollutants including:

> Veith, G., and Lee, G. F., "A Review of Chlorinated Biphenyl Contamination in Natural Waters," Water Research 4:265-269 (1970).
> http://www.gfredlee.com/HazChemSites/Veith-Lee-ReviewPCB.pdf
>
> Lee, G. F. and Jones-Lee, A., "Progress toward Remediation of the Sydney Tar Ponds: A Major Canadian PCB/PAH 'Superfund' Site," Journal Remediation 17(1):111-119 (2006). http://www.gfredlee.com/Landfills/STP-Remediation-pap.pdf
>
> Lee, G. F., and Jones-Lee, A., "Update of Organochlorine (OCl) 'Legacy' Pesticide and PCB Concentrations in Delta and Central Valley Fish," Report of G. Fred Lee & Associates, El Macero, CA, September 10 (2007).
> http://gfredlee.com/SurfaceWQ/UpdateLegacyPestCVFish.pdf
> Lee and Jones-Lee have repeatedly observed that monitoring of storm
>
> Lee, G. F., Jones-Lee, A., and Ogle, R. S., "Preliminary Assessment of the Bioaccumulation of PCBs and Organochlorine Pesticides in Lumbriculus variegatus from City of Stockton Smith Canal Sediments, and Toxicity of City of Stockton Smith Canal Sediments to Hyalella azteca," Report to the DeltaKeeper and the Central Valley

Regional Water Quality Control Board, G. Fred Lee & Associates, El Macero, CA, July (2002). http://www.gfredlee.com/HazChemSites/SmithCanalReport.pdf

Lee and Jones-Lee have repeatedly found that the monitoring for PCBs in stormwater runoff from hazardous chemical sites and other areas in which PCBs have contaminated soils is grossly inadequate compared to that needed to adequately define the presence of PCBs that can bioaccumulate in receiving water fish and other aquatic life. They have discussed this inadequacy in:

Lee, G. F., and Jones-Lee, A., "Issues in Monitoring Hazardous Chemicals in Stormwater Runoff/Discharges from Superfund and Other Hazardous Chemical Sites," Journ. Remediation 20(2):115-127 Spring (2010). http://www.gfredlee.com/HazChemSites/MonitoringHazChemSW.pdf

One of the difficulties in monitoring for PCBs in runoff is inadequacies in analytical methods used compared to those needed to measure PCBs in concentrations below US EPA water quality criteria for PCBs bioaccumulation in receiving water fish. Unfortunately, based on the discussions at the October 26 meeting of the PCB in Caulk Project, this analytical deficiency problem will not be remedied in the recommendations evolving from this project. This could cause the reporting of PCB concentrations in stormwater runoff as "non-detect" by municipalities yet having sufficient PCBs in the runoff waters to cause excessive bioaccumulation of PCBs in receiving water fish with emphasis on the larger predatory fish which tend to bioaccumulate PCBs to the greatest extent.

At the October 26, 2010 meeting of the PCBs in Caulk Project mention was made that building/structure demolition wastes containing PCB-laden caulk was of particular concern as a source of PCBs. The piles of the crushed concrete present at the Brisbane Baylands concrete recycling operation could be releasing PCBs to the stormwater runoff from this area that either enters San Francisco Bay or Brisbane/Guadeloupe Lagoon. The stormwater runoff from that area is not monitored for hazardous chemicals such as PCBs. Runoff from the crushed waste concentrate should be properly monitored for PCBs in concentrations in water life that could contribute to excessive PCBs bioaccumulation in fish in the waters of the area. The focus of the monitoring should be on fish and other aquatic life.

OU-1 (Former Schlage Lock and Southern Pacific sites)

OU-1 (see maps on pages 13 and 14) is the area of the Brisbane Baylands adjacent to the Brisbane Landfill that consists of the former Schlage Lock and Southern Pacific sites. The Department of Toxic Substances Control (DTSC) is the regulatory agency overseeing investigation and remediation activities at those sites. In August 2008 DTSC issued a "Fact Sheet" on environmental investigation activities at the former Schlage Lock and Southern Pacific railyard OU-1 sites located east of Bayshore Boulevard in San Francisco and Brisbane. Those areas are of concern to the BBCAG because they are part of the UPC property that is planned for development. The following are excerpts from the August 2008 DTSC Fact Sheet.

"*Schlage Lock manufactured door hardware and lock parts from 1926 to 1999. As part of their manufacturing process, Schlage Lock used chlorinated solvents resulting in soil and groundwater contamination."*

"Environmental investigations have been conducted at this site since 1982. Results of these

investigations indicate that volatile organic compounds (VOCs), primarily trichloroethylene (TCE) and perchloroethylene (PCE) are the main contaminants found in soil and groundwater. Other contaminants present at the site include metals such as arsenic, chromium, cadmium, lead, and nickel. Soil removal and cleanup actions have been conducted at this site since 1994 and groundwater is sampled quarterly to monitor the movement and levels of chemicals."

"There is VOC contaminated groundwater underneath the Southern Pacific OU-1 site that originates from the groundwater contamination at the Schlage Lock site. As a result, the cleanup will include soil contamination on the Schlage Lock site and groundwater contaminated with VOC's at both the Schlage Lock and Southern Pacific OU-1 sites."

"*Southern Pacific OU-1 Site was used by Southern Pacific Transportation Company for major railcar rehabilitation and maintenance operations from 1914 to 1960. As a result of almost fifty years of railcar operations, the soil is contaminated with metals (such as chromium, lead and arsenic) and petroleum by-products. Soil and groundwater cleanup have been conducted at the site since 1994.*"

The Burns & McDonnell, "Soil Sampling Summary Report – Universal Paragon Corporation – San Francisco and Brisbane, California," Report on Project no. 41071 to Universal Paragon Corporation San Francisco and Brisbane, CA, Prepared by Burns & McDonnell Engineering Company, Inc., South San Francisco, CA, January (2006) provides information on the contamination of OU-1.

"*The 3.1 Soil Data Summary from the Burns & McDonnell report states that four metals, arsenic, cadmium, lead and mercury exceeded the respective screening level or background level. Arsenic was most frequently detected above the published background level at locations across OU-1. Cadmium was detected at three locations exceeding the published background level. Lead exceeded background at six locations in shallow soil (1-2 ft bgs) and at one location in deeper soil (5-6 ft bgs). There was one isolated occurrence of mercury exceeding the screening level at Boring B-13.*

"*Groundwater samples were collected from six locations. Eight VOCs were noted in the samples (acetone, 1,1-dichloroethane, cis-1,2-DCE, ethylbenzene, total xylenes, toluene, TCE and PCE). TCE was detected in three of the seven samples. PCE was detected in two of the seven samples. In Borings B-5 and B-6, concentrations of TCE and PCE were above their respective maximum contaminant level (MCL), but these locations are within the current groundwater plume and will be captured by the groundwater extraction system."*

In 2008 DTSC initiated a pilot study at the Schlage Lock site to determine the best method to clean up VOCs in the soil and groundwater. According to the DTSC site Fact Sheet,
"*Based on the results of the samples collected, a series of injection points will be installed to inject chemicals for the two methods of groundwater cleanup that are being evaluated in the pilot study. One cleanup method is called in situ chemical oxidation (ISCO). The other cleanup method is called enhanced reductive dechlorination (ERD). These two methods cause the VOCs in groundwater to break down into non-toxic components. Periodic sampling and testing will determine the best method for lowering VOC levels in the groundwater."*

Information on the recent activities at OU-1 is available on the DTSC EnviroSTOR website under SCHLAGE LOCK COMPANY (38340157) at,
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=41490037.
Virginia Lasky, DTSC Project manager, indicated (personal communication August 2010) that the groundwater remediation approach involving injection of an oxidizing agent is still being evaluated. At this time DTSC has not developed a remediation plan for the heavy metal pollution of the OU-1 soils.

It has been our experience that in situ remediation of VOC contaminated groundwater can be successful at some locations where the subsurface strata are fairly homogenous. However for some sites high degrees of removal of VOCs may not be achieved using that approach.

The remediation of the heavy metal pollution noted will likely depend on the types of land use that could potentially be allowed on the redeveloped property. An evaluation of this situation can be made when the area development plans are proposed and DTSC then defines the approach that will be required to protect public health and the environment from the heavy metals that are present at the site that could be a threat to human health and the environment.

The Burns & McDonnell June 2010 report, "2009-2010 Annual Stormwater Discharge Monitoring Report Brisbane Reclamation Site Brisbane, California WDID# 2-41I010694," states,
"*The first round of stormwater monitoring and sampling conducted at the Site was performed by Lowney Associates in 1994. Stormwater monitoring and sampling was conducted from 1995 until 1998 by SCS Engineers. Burns & McDonnell has conducted stormwater monitoring from 1998 to the present. Stormwater sampling is conducted twice annually, during the first two storm events of the wet season.*

"*In 1994 and 1995, composite stormwater samples were collected and analyzed for total petroleum hydrocarbons (TPH) as gas and diesel; benzene, toluene, ethylbenzene, xylenes (BTEX); ethylene glycol; semi-volatile organic compounds (SVOCs); and metals. Analytical results during those years indicated that organic compounds and metals were not detected, or were detected at low concentrations. Subsequently, testing of these parameters was discontinued."*

It is somewhat surprising that no heavy metals were reportedly found in concentrations of concern in stormwater runoff from the OU-1 area in which high levels of several heavy metals have been found in the surface soils. To examine the appropriateness and reliability of that assessment it is necessary to examine the details of the stormwater runoff monitoring conducted by Lowney Associates and SCS Engineers. To date UPC has been unable to provide a copy of the report to us that would enable us to determine if the analytical methods used in the subject studies were adequate to reliably determine whether there were organics, heavy metals, or other pollutants in stormwater runoff in concentrations that could be a threat to public health and the environment. It may be necessary to conduct comprehensive stormwater runoff monitoring from the OU-1 area that includes monitoring several storms per year, including sampling the first storm of the year and the outset and at several times during the runoff event, using appropriate analytical methods for a full range of potential pollutants in the runoff.

In the "Summary of Findings-OU-1" in its 2005 Final Peer Review Findings report, CDM described the status of the "Risk Assessment" for Human Health and Ecological as "Evaluation Incomplete." We agree that that condition still exists today. CDM states that Surface Water has been "Adequately Characterized." We do not agree with that assessment with respect to the reliable evaluation of the potential impact of stormwater runoff-associated pollutants from OU-1.

CDM describes the status of the Remedial Approach at OU-1 as "Evaluation incomplete." At this time the remediation approach for the VOC-polluted groundwater is still under evaluation. The current approach may not be effective for removing the VOCs to desired levels.

OU-2 (Former Bayshore Railyard)

Burns and McDonnell developed a report covering the final revised Remedial Action Play (RAP) for the OU-2 area of the Brisbane Baylands site entitled, "Revised Remedial Action Plan – Southern Area of the Former Bayshore Railyard Site Brisbane, California February 2002," Final Revised Remedial Action Plan (Revised RAP Southern Portion of the Former Bayshore Railyard (OU-2), Brisbane, California (2002). Following are excerpts from that report.

According to section *"1.5 Site History"* of that report,

"Southern Pacific Transportation Company (SPTC) owned the site from 1896. About that time the project site area was part of the San Francisco Bay waters and began to be filled in beyond the original eastern land margin, which roughly followed what is now Bayshore Boulevard and Sunnydale Avenue. Reportedly, material used to fill in this portion of the Bay included rock blasted from a nearby roadcut through Visitacion Point, and rubble from the 1906 earthquake. SPTC's major railroad operations began in 1914, which resulted in the construction of numerous railroad facilities, oil storage tanks, and an area in the southern portion of the railyard designated as a 'disposal site.' Between 1896 and prior to 1935, the eastern limit of artificial fill had advanced to approximately the present location of Tunnel Avenue."

"1.7 Remedial Action Objectives (RAOs)
Site specific RAOs were established for suspected contaminants of concern in the railyard and were presented in the General RAP. These contaminants of concern included total petroleum hydrocarbons as diesel fuel and Bunker C, metals, and semi-volatile organic compounds (SVOCs)."

According to the report, chlorinated solvents have been detected in the soil and groundwater at the site.

"*the former Bayshore Railyard area is underlain by Bunker C oil and metals in the soils. The originally proposed remediation plan called for excavation of all soil with concentration of Bunker C oil that exceeds the 46,000 mg/kg remedial action objective (RAO) imit. "The revised remedial action plan proposes to cap all soils at the site, rather than attempt to excavate soil with Bunker C concentrations exceeding 46,000 mg/kg RAO limit."*

According to the Burns and McDonnell report, the revised remedial approach of capping the polluted areas is substantially less costly than the originally proposed excavation and removal approach. The revised site development plans call for the "*placement of a thick soil layer,*

ranging from 7 to 10 feet thick, across the entire site to facilitate storm water management. The thick soil layer will prevent future site occupants from contacting the soil. The thick soil layer has the added benefit of protecting site construction and maintenance workers since most utilities will be placed within the new, clean fill."

With respect to ecological impact of the migration of the capped Bunker C oil, the report claims, "*The Bunker C oil at the site has, a pour point of 92 degrees °F and viscosity exceeding 40,000 centistokes when heated to 130 degrees °F. The Bunker C oil is therefore immobile since it is too viscous to flow and migrate in the subsurface.*"

"*The Bunker C oil has a very low solubility and has generated only a relatively small plume with maximum dissolved oil concentrations of 9.2 mg/L. The dissolved plume is stable temporally and spatially, and does not pose a risk of migrating.*"

"*Metals (primarily lead) are tightly sorbed to soil, and have not leached to groundwater."*

"*Site-specific plans for human health protection will be developed in the future if final site development plans call for the placement of human-occupied structures above the highly contaminated area. Additional remediation may be required if' residual concentrations following excavation exceed these human health objectives."*

"*The soil capping alternative proposed in the Revised RAP is fully protective of human health and the environment. The decision-making process used to select this alternative is technically sound and is hilly supported by scientific data.*"

"*Understandably, the RWQCB has significant concerns with this revised approach. Concerns regarding this approach include technical concerns regarding the potential risk to human health and the environment, and political concerns regarding the regulatory requirement to remove free product to the extent practicable.*"

In 2005 Burns & McDonnell issued a report entitled, "Interim Remedial Measure Workplan Southern Area of the Former Bayshore Railyard Site (OU-2) Brisbane, California" that states,
"*The primary objective of this IRM Workplan is to present general remedial implementation procedures for soil impacted by contaminants from previous site operations at the Railyard. This IRM Workplan will implement the remediation strategy presented in the Final Revised Remedial Action Plan (Revised RAP), dated February 2002. The Revised RAP presents an innovative on- site management solution that is protective of human health and the environment by blocking the exposure and migratory pathways for the contamination."*

"..the Revised RAP, the contaminants in OU-2 include:

- *Bunker C Petroleum impacted soil and water*
- *Heavy Metals, primarily lead, in surface soil*
- *Halogenated Volatile Organic Compounds (HVOCs) in soil and groundwater"*

"*1.5 Remediation Approach*
"As previously discussed, OU-2 is impacted with Bunker C, heavy metals and HVOCs in soil. Figure 4 shows the distribution of the various constituents exceeding RAOs. Based on work presented in the Revised RAP, protection of human health and ecological receptors can be achieved by contaminant removal (for soil impacted with HVOCs) and by soil capping (for soil impacted with Bunker C and heavy metals). Soil capping is proposed because it is protective of human health and the environment."

This report also states, "*Sunquest* (UPC) *will have appropriate use restrictions placed in the property deed. The language will specify that regulatory concurrence would be required to modify the use restrictions."*

The soil remediation plan section states,
"2*.6.1 Removal / Excavation of Soil Containing HVOCs*
Information obtained from the numerous investigations at OU-2 has identified approximately 900 cubic yards of soil containing HVOCs. The lateral limits of this impacted soil are shown on Figure 4. As previously discussed, capping is not a recommended option for this soil due to the potential mobility of HVOCs in soil and impact to groundwater and human exposure due to soil vapor migration. Therefore, the soil identified as containing HVOCs above the RAOs developed for this site will be removed by excavation. For a discussion of the determination of the RAOs see the Revised RAP."

The proposed remediation plan states,
"2.7.1 Interim Drainage Ditch
The details of the interim drainage ditch are presented in the Remedial Grading Plan (see Attachment 2). The Interim Drainage Ditch in the southeast corner of the Site collects the majority of the flow from the Site through a series of ditches constructed along the perimeter and in the fill areas in the northern portion of the Site, and flows into the proposed culvert and central drainage channel (CDC). The proposed culvert and CDC are scheduled for construction either simultaneously or prior to the construction of the Interim Drainage Ditch."

BBCAG developed a statement entitled, "BBCAG May 19, 2009 revised, What Do We Know and What Do We Need to Know? Subject: The Baylands Contamination and Remediation Emphasis OU-2," the text of which is available at
[http://www.bbcag.com/BBCAG%20Packets/2009%20Packets/Materials%20for%206-16-09%20meeting/BBCAG%20What%20we%20Know%20and%20Need%20to%20Know%200509%20May%2019.pdf]. That statement summarizes areas of concern to BBCAG with respect to remediation of the OU-2 area, provides several recommended revisions to the remediation plan for that area, and identifies a number of issues that should be considered in the draft EIR for the remediation of the area. We agree with BBCAG that several aspects of the Regional Board's approved remediation plan for OU-2 are of concern with respect to providing full protection of public health and environmental quality from pollutants at that site.

At the June 16, 2009 meeting of the BBCAG Committee, V. Pal, WRCE, SF Bay Regional Water Quality Control Board made a presentation entitled, "Remediation Update Operable Unit OU-2, A Regulator's Perspective" in which he discussed the current status of

investigation/remediation of the OU-2. The PowerPoint slides he used in his presentation are available at BBCAG website at, when posted at,
http://www.bbcag.com/agenda_minute_packet.html.

Pal's presentation includes information on the areas of OU-2 in which the soils contain elevated concentrations of Bunker C oil, lead, and VOCs. It also includes an area grading plan to provide clean soil cover for the polluted areas, and the location of groundwater monitoring wells for the VOCs. Pal's slides summarize the current status of remediation of OU-2 as follows:

"OU-2 area requires filling to accommodate future development Site,
Grading (filling) can be phased to accommodate remedial requirements for the area contaminated with VOCs ,

Surface water will be managed to prevent flooding and sediment erosion and contact with Bunker C- affected Soils,

EIR issues and Interim and Final Grading Plan."

"*Lead is primary metal of concern.*
Lead in soil at the site is not a source of contamination to groundwater.
Lead-affected areas are not currently considered to be threat to environment or human health.
Majority of high-concentration lead samples are encountered in site fill at depths greater than 3 feet below existing ground surface."

"*Bunker C considered immobile and a 'semi-solid,*
Bunker C solubility is limited and not considered to be a threat to groundwater,
Bunker C areas are not currently considered to be threat to environment or human health,
Bunker C- affected area shown to be stable and not migrating."
Capping of Bunker C-affected area soil is an approved method remediation approach."

"Existing in very limited area (7,000 sf surface area),
Remediation of VOC area will be initiated after approval of EIR <u>and before completion of site filling or development</u>
Site filling program will not interfere with remediation of VOC-impacted area
VOC –affected area shown to be stable and not migrating"

Clara Johnson stated in personal communication to G. Fred Lee on August 2010:
"*It is true that there is an ongoing EIR process but the City will not release any EIR reports until the draft EIR is published. UPC has not submitted its revised Specific Plan. Howard Pearce says it will probably do so by October 15th. It will then take as long as a year for the impacts to be assessed of the different alternatives. The draft EIR will be presented at that time. The City of Brisbane has a website and an extensive Baylands section. The address is: www.ci.brisbane.ca.us. It won't have the EIR reports*."

She also stated her opinion: "*It sounds as though there may be a lack of detail and specificity in the "Specific Plan" which will make it difficult or impossible to assess the impacts without more information.*"

It is clear that the potential impact of residual pollutants that will be left at the OU-2 site after remediation needs further evaluation. Potential impacts of residual pollutants will require ongoing evaluation by regulatory agencies and concerned citizens as site-specific details of the planned development of the area become known.

A PowerPoint presentation [available at http://www.bbcag.com/BBCAG%20Documents/CAG-EIRandHazards-FINAL%20011508.ppt] that discusses issues regarding the development of an EIR for remediation of the Brisbane Baylands area, including OU-1 and OU-2. Many of the issues raised by BBCAG in that presentation need to be considered in the ongoing monitoring of the OU-2 site.

It has been our experience that in general, EIR project consultants that develop EIRs for proposed developments of hazardous chemical areas cannot be relied upon to present a comprehensive disinterested discussion of the potential problems with and deficiencies of the project. It will be important for BBCAG to be provided with a high level of technical assistance in reviewing the draft and final EIR for the development of the UPC property.

Overall, the OU-2 area is highly contaminated with Bunker C oil, VOCs, and lead. The SFRWQCB has adopted a remediation plan, proposed by UPC, that includes containment of the hazardous chemicals Bunker C oil and lead on site under a soil cover. A proper containment approach can reduce the hazards of those contaminants to public health and environmental quality provided that the groundwater and surface water runoff from the area receive adequate monitoring to ensure that neither those chemicals nor other, yet-to-be identified pollutants do not migrate from the site for as long as the residual materials remain at the site, and provided that appropriate deed restrictions are enforced on future owners/users of the property.

There are several aspects of the waste containment approach that may not have been adequately addressed in the investigation of this site. One of the most important is that Bunker C oil and other petroleum products are complex mixtures of a variety of chemicals that are not identified in the study of the bulk product. While those properties of Bunker C oil that were measured are reported to be non-mobile, there can be components of that mixture that are mobile and pose a threat to public health and environmental quality. A much more comprehensive study/investigation program is needed to better-define whether this is an issue at the OU-2 site.

The remediation approach for the VOCs polluted areas appears to be in the appropriate direction since VOCs are known to be highly mobile. A key to the success and reliability of this remediation approach is the removal of the VOCs by excavation of the contaminated soils such that all VOCs and any transformation products that are a threat to public health and the environment to future users of the UPC developed properties and nearby areas, are also removed.

In its summary comments on OU-2 and in its review of other parts of the Brisbane Baylands area, CDM states, "*Interim approach consistent with industry practice.*" CDM also states with

regard to OU-1, "*Overall proposed approach consistent with industry practice.*" While this may well be the case for one or more of the waste management areas at the Brisbane Baylands area, it is our experience that "consistency with industry practice" does not ensure protection of public health and environmental quality. As discussed in the "Introduction" section of this report, there is a variety of factors not adequately addressed in hazardous chemical site investigations/ remediation that can lead to long-term problems caused by hazardous chemicals left at a site as part of regulatory agency allowed "industry practice." This situation provides additional justification for comprehensive independent, third-party monitoring and remediation oversight.

Kinder Morgan Distribution Facility

The Kinder Morgan Brisbane fuel terminal/distribution area has contributed hazardous chemicals to the groundwater and surface water of the Brisbane Baylands area. Information on the Kinder Morgan area is available in the "Revised Tentative Order Adoption of Updated Site Cleanup Requirements for: SFPP, L.P., An Operating Partnership of Kinder Morgan Energy Partners, L.P. for the SFPP, L.P. Brisbane Terminal Brisbane, San Mateo County." That SFRWQCB order provides details of the currently adopted cleanup requirements for this area, as well as the following information on that site.

"Site Location: The SFPP, L.P. Brisbane Terminal (herein referred to as the facility or the site) is located at 950 Tunnel Avenue in the City of Brisbane, just west of Highway 101."

"*Site Description: The facility is a bulk petroleum storage and distribution terminal that provides aviation fuel to San Francisco Airport as well as gasoline and diesel fuel to various retail stations. The eastern portion of the facility is located upon the closed Brisbane municipal landfill while the western portion is situated on a bedrock outcrop. Twenty one aboveground storage tanks (ASTs) reside on the western portion of the facility underlain by bedrock. Gasoline, diesel, and aviation fuels are brought to the facility via pipeline and are stored in the ASTs. The gasoline and diesel fuel stored in the ASTs is pumped into tanker trucks via five loading racks at the facility for distribution to Bay Area gasoline stations. Aviation fuel is piped directly from the facility to San Francisco Airport."*

"Adjacent Properties: The Union Pacific Railroad tracks located to the west of the facility are part of an active railroad corridor. The closed Brisbane municipal landfill, which underlies the eastern portion of the facility and extends northward and eastward from the facility, is currently used for light industrial purposes associated with materials recycling, rock crushing, and soil stockpiling. A City of Brisbane corporation yard is located immediately south of facility and is used for vehicle maintenance. A wetland is located immediately adjacent to the northern facility boundary. A stream channel runs through the wetland and is culverted with a timber box. This "timber-lined" channel is tidally-influenced and drains 2,100 feet eastward across the Brisbane Landfill to San Francisco Bay. Northwest of the facility is the former Brisbane Railyard, which is undergoing environmental assessment and cleanup overseen by the Board and the California Department of Toxic Substances Control. Both the railyard and the Brisbane Landfill are owned by Universal Paragon Corporation, which is considering future development of the properties for commercial and open space use. The City of Brisbane is lead agency for environmental review of redevelopment plans for these properties pursuant to the California Environmental Quality Act."

"Several investigations to evaluate soil and groundwater conditions at the facility have been conducted since the early-1990s. The results of these investigations indicate that gasoline, diesel, and aviation fuels, including fuel additives - benzene, toluene, ethylbenzene, xylene (BTEX) and methyl-tertiary butyl ether (MTBE) - have been detected in groundwater beneath various portions of the facility. Contamination related to those impacts has potentially migrated beyond the facility boundary toward the Brisbane Landfill and the timber-lined channel."

"Purpose of Order: The SFPP Brisbane Terminal has discharged petroleum fuel hydrocarbons, including MTBE, to soil and groundwater underlying the facility and potentially off-site. The petroleum fuel hydrocarbons have exceeded applicable water quality objectives for groundwater and could potentially threaten surface water quality in the adjacent timber-lined channel. The purpose of this Order is to require remediation of soil and groundwater contamination caused by releases from the facility, to a level protective of human and environmental health and beneficial uses of water resources considering current and reasonable future land and water uses. This Order establishes appropriate cleanup standards and requires 1) performance monitoring to demonstrate remedial action effectiveness, 2) removal of separate-phase liquid hydrocarbons to the extent practicable, 3) trigger levels for potential off-site impacts, 4) completion of a contingency plan should additional remedial measures become necessary, and 5) a monitoring program to provide an ongoing assessment of groundwater conditions and impacts from potential new releases at the facility."

This SFRWQCB staff report provides information on the surface and groundwater hydrology at and near the Kinder Morgan site and the transport of pollutants including stormwater runoff from the Kinder Morgan site to off-site areas. The staff report states,
"*14. Risk Assessment: Human and ecological health risks from exposure to impacted soil, groundwater, or associated vapors were assessed by comparison of contaminant levels to the Board's Environmental Screening Levels (ESLs) based on the current land use of the facility and surrounding properties. This risk evaluation is presented in the June 2007 Remedial Action Plan (RAP). This type of "tier 1" screening level risk assessment is appropriate for the facility because ESLs are conservative indicators considered safe for human and environmental exposure. Specific potential exposure pathways and/or receptors considered include 1) groundwater contamination potentially discharging to and affecting water quality within the adjacent timber-lined channel, 2) groundwater contamination volatilizing and potentially affecting indoor air within the facility's control room, and 3) direct facility worker contact with soil contamination. Findings indicate there are currently no unacceptable risks for these potential exposure pathways based on the current land use."*

"*An updated and/or more detailed human and/or ecological health risk assessment will be required 1) if data indicate that reasonable potential human or ecological exposures exist as determined by the discharger or Board staff, 2) upon presentation of a credible, specific reuse/redevelopment plan to Board staff and the discharger by the property owner for areas immediately adjacent to the site where potential offsite impacts exist, or 3) upon any actual or proposed material change to the facility as determined by the discharger or Board staff. The purpose of the risk assessment would be to identify risks to potential human or ecological receptors posed by petroleum fuel hydrocarbons discharged from the facility both onsite and offsite, when applicable."*

"*c. Basis for Groundwater Cleanup Standards: The groundwater cleanup standards for the site are based on applicable water quality objectives. Although no current groundwater use has been identified, there is potential for future groundwater use in the vicinity, including for drinking water from deeper water-bearing zones. The current shallow groundwater contamination at the facility could affect this potential future use. Therefore, applicable water quality objectives include drinking water standards, which are the more stringent of U.S. EPA and California primary maximum contaminant levels (MCLs). Cleanup to this level will protect all existing and potential future beneficial uses of groundwater."*

"*17. Future Changes to Cleanup Standards: The goal of this remedial action is to restore the beneficial uses of groundwater underlying and adjacent to the site. Results from other sites suggest that full restoration of beneficial uses to groundwater as a result of active remediation at this site may not be possible. If full restoration of beneficial uses is not technologically or economically achievable within a reasonable period of time, then the discharger may request modification to the cleanup standards or establishment of a containment zone, a limited groundwater pollution zone where water quality objectives are exceeded. Conversely, if new technical information indicates that cleanup standards can be surpassed, the Board may decide that further cleanup actions should be taken."*

In March 2008, Clara Johnson, then Chair of the BBCAG, provided comments on what was then the proposed Kinder Morgan tentative Order remediation plan presented in that report. BBCAG's fundamental comment on that proposed remediation plan was,
"*Nonetheless, we still believe that the use of natural attenuation that is monitored is not going to clean-up the contamination to legal standards quickly enough."*

BBCAG also provided a set of comments on specific issues including one noting that the proposed stormwater runoff management plan was not adequate. To that comment, SFRWQCB responded:
"'Storm Water Management is not adequate…' This is a good point. We believe that this may be true and are therefore revising the order to require continued monitoring of storm water twice per year to determine the potential threat to surface water receptors. In addition, we are including a task requiring evaluation of best management practices (BMPs), including filtering and other appropriate measures for minimizing sediment and fuel hydrocarbon transport in storm water beyond the facility boundary. Furthermore, we intend to request the Terminal seek coverage under the State Board's general storm water permit."

The SFRWQCB staff also responded to that concern:
"*1-12-12: Including storm water quality limits in the RTO is premature as we are still evaluating the potential threat posed by the storm water discharges. Furthermore, exceedance of any such limits would trigger improvement of storm water BMPs, which is our current strategy (see response to comment P4-1)."*
The staff report provides a set of 2008 and future "Compliance Dates" for developing specific steps for compliance with this order. On August 29, 2010 A. Karpowicz, the SFRWQCB case manager for the Kinder Morgan site, stated,
" *In regards to the Brisbane Terminal's compliance dates set in our updated SCR's in 2008, all of the required reports have been submitted on time, and I have issued conditional or final*

approval in each case. All of the required documents, as well as my responses, can be found at: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL372271174.
I believe the information you are looking for can be found in documents entitled "Trigger Levels for Potential Off-Site Impacts" and "Commingled Plume Evaluation".

The Geotracker website, Date: March 25, 2009, Subject: Approval Of Trigger Levels For Potential Off-Site Impacts, SFPP, L.P., Brisbane Terminal, 950 Tunnel Avenue, Brisbane, San Mateo County, states:
"Water Board staff has reviewed and hereby approves the subject Trigger Levels for Potential Off-Site Impacts for the Brisbane Terminal. The report, dated January 30, 2009 and prepared by LFR, Inc., presents a summary of proposed concentration limits for site specific contaminants of concern (COCs) detected in groundwater at off-site locations. This plan was submitted in accordance with Task 6 of the Updated Site Cleanup Order No. R2-2008-0019 (Order)."

"*If the proposed trigger levels for any COC are exceeded during future groundwater monitoring events, relevant wells will be re-sampled and analyzed to confirm the exceedance; a review of recent and historic COC concentrations in nearby on-site and off-site monitoring wells will be performed; and a review of site petroleum storage and transport infrastructure will be performed to assess the possible cause of increased COC concentrations. Groundwater monitoring will also be increased as needed (for one year) for the relevant well until COC concentrations drop below the proposed trigger levels for three consecutive sampling events. If the COC concentration continues to exceed the proposed trigger level for any 3 of 6 consecutive sampling events, a contingency plan for additional remedial activities will be developed per Task 7 of the Order."*

It is our assessment that the Kinder Morgan site is a threat to cause further pollution of groundwater and surface waters of concern to BBCAG in the Brisbane Baylands area. The SFRWQCB's current remediation order is a major step in the appropriate direction to begin to control the Kinder Morgan on-site and off-site pollution. With regard to BBCAG's primary issue of concern, there will need to be ongoing independent review of the progress being made to stop further off-site pollution by the Kinder Morgan site with pollutants transported in surface and groundwater. Particular attention should be on adequacy of the currently adopted off-site transport trigger levels for eventually stopping all off-site transport of identified and yet-to-be-identified pollutants from the Kinder Morgan site.

Information on the current surface water stormwater runoff monitoring program at Kinder Morgan has been provided by A. Karpowicz of the SFRWQCB staff. He indicated that the stormwater runoff from that area is being monitored at four discharge points (i.e., sampling locations) at which stormwater is sampled twice per wet season (first storm and one subsequent event). A review of the data collected during the winter 2010 shows that several potentially hazardous chemicals are being monitored with typically used analytical methods. All but one of the measured parameters were reported as "non-detect" in the runoff waters. While the stormwater monitoring program for this area appears to be adequate for the parameters being measured, as discussed above, there may well be other potentially significant chemicals associated with this site that are not being measured. Special-purpose monitoring should be

conducted to investigate that possibility, and continued periodically in the future as new and newly-recognized pollutants come to light.

Need for Development Plans

As noted by CDM, a key deficiency in its evaluation of the adequacy of the human health and ecological risk assessment is the lack of definitive plans for site development. It has now been five years since CDM developed its report, and still (based on discussions with H. Pearce, UPC Engineering Project Manager during our site tour on July 23, 2010) plans for developing the site have not been finalized/made public.

According to the city of Brisbane Agenda Report, "Baylands Community Alternative," for the Meeting of July 20 (2009), the Public Space Master Plan for this area has been developed and endorsed by the City Council. In 2001 the Brisbane Open Space & Ecology Committee, developed the "Open Space Plan for the City of Brisbane," Report prepared for Brisbane City Council; approved by Brisbane City Council, Brisbane, CA, August 27 (2001).

That report states,

"This document offers a vision for a comprehensive and integrated open space system for the city and is intended to be a flexible, working tool to guide the City Council in implementing specific environmental policies and programs from the 1994 Brisbane General Plan. Program 93h of the 1994 Brisbane General Plan states, 'for reference and assistance in establishing open space priorities, prepare a comprehensive map of vacant lands on the planning area and update the map annually'. This report fulfills this requirement and explains the analytical process that the Open Space & Ecology Committee took to arrive at its conclusions. The recommendations within this plan reflect the opinion of the Open Space & Ecology Committee as to the most significant natural and open space resources in the City of Brisbane. This plan establishes overall guidelines and/or criteria for decision making. It is important that policies identifying open space potential be founded on soundly documented criteria. This is one of the purposes of this plan."

"This plan is not meant to declare the city's intent to acquire any parcels or to override current land use regulations. This document does not in any way recommend that the areas identified as containing valuable natural resources be rezoned to an open space or similar district or made subject to land use restrictions that would preclude any reasonable development and take or damage private property for public use without just compensation."

A factor that can influence the future development of the Baylands area is the proposed plan for land use in the Baylands area. It is unclear at this time how the UPC proposed development of the Baylands area will fit into this Master Plan. Evidently such issues will be addressed in the forthcoming EIR for the development of the area. Information on the development of the EIR is presented in another section of this report.

The "Baylands Information" section of the city of Brisbane's website [www.ci.brisbane.ca.us] presents information on the Baylands area including information on a recently updated project description for the UPC development of this area: UPC Alternative for Study: Updated Project

Description. Presented to: Brisbane City Council May 24, 2010. Presented by: Jonathan Scharfman, Project Sponsor, UPC Jim Stickley, Project Planner, WRT

That presentation includes information on the current contamination of the area and the need to coordinate the remediation of the area with the development plans and the use of funds from the development of the area for area remediation.

The details of how the site is planned to be developed and deeds restricted, will be an important factor in evaluating the potential public health and environmental hazards associated with the hazardous and otherwise deleterious chemicals that will be present at the site after development. For example, if the site is to be developed with "big box" stores with sound deed restrictions limiting future use to those types of stores, the degree of remediation needed to protect public health and the environment may be somewhat less than if the area, or part of the area, is to be developed with residential housing, public park land, or other uses that would result in potential exposure of the public, especially children, to hazardous chemicals remaining at the site. According to the 1994 Brisbane General Plan Policy 330.1 residential housing is prohibited at the Brisbane Baylands area. C. Johnson (personal communication) has indicated that the "*Housing Element of the must be consistent with the General Plan*."

Specific Issues Raised by BBCAG

BBCAG asked that we address a number of specific issues. The questions/issues are identified in italics and responded to below.

1.) Are the presently proposed remediation systems adequate for,

a.) Unregulated dirt fill vs. clay caps (Title 24?).

Because leachate generation in a dry tomb landfill can be delayed only as long as the wastes are kept dry, and because hazardous and otherwise deleterious chemicals in such a landfill remain a threat for as long as they remain in the landfill, the integrity of a landfill cap is critical to the prevention of leachate generation. Well-designed and installed clay caps (often combined with plastic sheeting in Subtitle D landfills as discussed below) for landfills can, especially at the time of construction, be effective in reducing the rate of infiltration of moisture through the cap and thereby serve to aid in the delay leachate generation that would otherwise be promoted by moisture from infiltration. However, as discussed in Lee and Jones-Lee's "Flawed Technology" review referenced above, many factors affect the integrity and hence functionality of even a well-designed and installed clay cap. These factors are largely related to cover inspection, maintenance, and repair, as well as to surface activities. For example, as discussed beginning on page 20 of the "Flawed Technology" review, such caps typically develop cracks, which can serve as pathways for major moisture infiltration into the wastes. Thus, in practice, over a relatively short period of time clay caps begin to lose effectiveness in preventing moisture/rainfall from entering the landfill; cracks that can impair the effectiveness of the cap can be difficult to detect and adequately repair.

Since apparently at least a portion of the wastes in the Brisbane Landfill are below the water table, even effective prevention of infiltration of moisture through the cover will not stop leachate generation. From the information available, the major pathway for leachate releases of hazardous and deleterious materials from the landfill has been defined; those releases, to a considerable extent, are being collected and treated through the seep control program. Overall, considering the water table issue, a final cover for the Brisbane Landfill constructed of clean fill material will likely be adequate. However, the cover material should be properly tested to be certain that it will not leach chemicals that are a threat to public health or the environment.

b.) Stockpiling heavy metals under parks and streets (with claims they don't move or impact ground water)

The monitoring of groundwater, including seeps, has only identified barium, cobalt, and lead as metals of concern; the issue of the potential presence of other, unregulated or unrecognized hazardous/deleterious chemicals has not been adequately addressed. That said, it appears that the groundwater pathway for leaching of heavy metals and other contaminants has been identified and that pathway of heavy metal leaching being controlled. It does not appear that the stockpiling of heavy metals under parks and streets is a major issue at this landfill.

c.) Plastic geo-tech liners as caps and barriers vs. other technologies

While the typical Subtitle D landfill cover includes a plastic sheeting layer as part of its system for reducing the rate of moisture infiltration into the landfill and thereby reducing leachate generation, over time such a plastic sheeting layer will deteriorate and its effectiveness in

preventing entrance of moisture into the buried wastes through the cover diminished. Since that layer is beneath the clay/soil cover layer, it is not amenable to thorough inspection and repair/replacement as needed. However, since the pathway for leachate migration from the landfill and pollution of the groundwaters appears to be associated at least in part with the high water table, there appears to be little justification for including a plastic sheeting layer in the final cover of the Brisbane Landfill.

d.) natural attenuation for VOC's (wetlands), natural remediation's (fungi and bacteria) for the TCE/PERC contamination.

TCE and PERC (PCE) are degraded under anaerobic conditions by bacterial action in soils and groundwater. There is concern, about such degradation's leading to the formation of vinyl chloride, which is a potent carcinogen. It is our understanding that the TCE/PERC-polluted groundwaters are being treated by enhanced biodegradation or reaction with injected chemicals, in which an organic chemical is being introduced into the groundwater polluted by these chemicals. Whatever method is used to remove TCE/PCE, a comprehensive monitoring program must be incorporated in the treatment protocol to ensure that the removal is accomplished without the formation of other hazardous or otherwise deleterious chemicals.

2.) Is the methane control system adequate?

As discussed in this report, there have been problems with adequate monitoring and control of landfill gas emissions and maintenance of the gas collection system at the Brisbane Landfill. It is unclear at this time if all of those problems have been adequately resolved. This is an area in which ongoing, independent third-party review of landfill gas emission control at the Brisbane Landfill is necessary.

3.) Is the leachate management system adequate?

Overall, considerable attention has been given to leachate releases from the Brisbane Landfill, via surface seeps along the edge of the Brisbane/Guadalupe Lagoon and into the IDC. The collection system that has been developed for seeps that used to discharge to the surface of Brisbane/Guadalupe Lagoon seems to be adequately controlling monitored chemicals from that source. From the monitoring of the lagoon waters it appears that subsurface seeps that are occurring are not discharging pollutants at a sufficient rate to cause measureable concentrations of identified pollutants in the lagoon waters and are not causing toxicity due to ammonia in the lagoon sediments. Additional testing for potential toxicity within the lagoon is warranted.

4.) What recommendations should be made for long-term monitoring?

Throughout this report we have made a number of recommendations for additional monitoring needs. Of particular importance is our recommendation for independent, third-party monitoring. It has been our experience that, in addition to regulatory attention, there is need for independent public review of monitoring programs. This can significantly enhance the degree of public health and environmental protection for known and yet-to-be-identified pollutant releases from the Baylands area.

5.) How will the landfill respond to a violent earthquake/tsunami?

The National Oceanographic and Atmospheric Administration published the following report that discusses the potential magnitude of tsunamis in the San Francisco Bay area:

Burak Uslu, B.; Arcas, D.; Titov, V. V. and Venturato, A. J., "PMEL Tsunami Forecast Series: Vol. 3, A Tsunami Forecast Model for San Francisco, California," NOAA OAR Special Report, National Oceanographic and Atmospheric Administration, Washington, D.C., March (2010). [http://nctr.pmel.noaa.gov/forecast_reports/final_reports/03_SanFranciscoCA_3342_web.pdf]

The "Results and Discussion" section of that report states:
"The 1964 Great Alaska Earthquake tsunami was measured at the Presidio tide gauge with a maximum amplitude of approximately 1 m. Borrero et al. (2006) predict that this maximum amplitude could potentially be as much as double if an earthquake were to occur along a different segment of the Aleutian-Alaska- Cascadia subduction zone. Model results on simulated tsunamis obtained in this work suggest that a wave amplitude as large as 4 m is possible dependent upon the specific source region, posing a significant hazard to San Francisco Bay area."

Further information on the characteristics of tsunami projections is provided in the NOAA report. A tsunami with a wave height of approximately 13 feet could have significant destructive impacts on some structures developed on the Baylands area. It would be important to consider this situation in developing plans for this area. According to CDM in its Peer Review Findings, November 2007, for the City of Brisbane, the Remedial Approach for the Brisbane Landfill includes a soil cap 15 to 20 feet thick relative to existing ground surface. Therefore, a maximum predicted tsunami could cover at least part of the landfill cap. It is likely that some impacts on the integrity of the landfill cap could result from such a tsunami; those impacts could result in short-term release of waste-derived constituents. It would be important to inspect the integrity of the landfill cap and any landfill containment structures and waste management/monitoring facilities for damage following a tsunami and make appropriate repairs to minimize release of pollutants from the area.

R.. Breault, Director of Public Works/City Engineer, Director of Emergency Services and Floodplain Administrator for the City of Brisbane, CA provided the following comment on the potential impact of a tsunami on the Brisbane Baylands area:
"*page 46 of possible impacts to the Baylands Project Area from a tsunami. "The Interactive Tsunami Inundation Map prepared by ABAG as part of their Bay Area Local Hazard Mitigation Plan with a link at, http://gis.abag.ca.gov/Website/Tsunami-Maps/viewer.htm "shows no flooding anywhere in Brisbane west of US101 (it helps to select "view legend" to understand what areas are designated as flooded). The ABAG site indicates this map was prepared in collaboration with USGS and utilizing a NOAA model. I assume this model predicted some attenuation of the wave height as it spread to the east and south across the bay, and this resulted in a height that did not overcome the US101 causeway (which was built in the Bay in this area in the late 1950s."*

"I imagine you will want to review the possibility of inconsistency between your report's implication that some portion of a 13-foot tsunami wave height would impact structures on the Baylands against the ABAG map which indicates no amount of flooding due to a tsunami west of US101 in Brisbane."

Based on this information it appears that the Brisbane Baylands area is not subject to flooding by a tsunami in San Francisco Bay.

With regard to the potential impacts of an earthquake on the integrity of the landfill, the US Geological Survey issued two reports fairly recently concerning earthquakes and their impacts in the San Francisco Bay area:

> USGS, "Bay Area Earthquake Probabilities," US Geological Survey, US Department of the Interior, Washington, DC, December (2009).
> http://earthquake.usgs.gov/regional/nca/wg02/index.php
>
> USGS, "San Francisco Bay Area Earthquake Loss Estimation," US Geological Survey, US Department of the Interior, Washington, DC, December (2009).
> http://earthquake.usgs.gov/regional/nca/wg02/losses.php

R. Anderson, formerly of the California Integrated Waste Management Board (IWMB) and now CalRecycle, reviewed impacts of earthquakes on California landfills in:

> Anderson, R., "Earthquake Related Damage and Landfill Performance" ASCE Geotechnical Special Publication No. 54, "Earthquake Design and Performance of Solid Waste Landfills," American Society of Civil Engineers, New York, NY, pp 1-16 (1995).

Anderson reported that the containment systems of many of the landfills inspected following earthquakes showed damage that was attributed to the earthquake. He reported,
"*Damage to landfills observed by the IWMB staff is categorized into four groups: 1. cracking of daily, intermediate, or final covers; 2. damage to liners; 3. damage to environmental collection and control systems; and 4. damage to infrastructure such as water tanks and on-site structures."*

His review included a discussion of each of those categories. In addition to visual damage to the exposed liners, there can be subsurface damage to the leachate collection system, liners, and other components that may not become apparent for many years. Such hidden damage is of particular concern at minimum-design, single-composite-lined, Subtitle D landfills. The Brisbane Landfill does not contain a landfill liner system and, therefore, a leachate collection system that could be damaged by an earthquake. However, strong earthquakes could be disruptive to the landfill cover, groundwater monitoring wells, and the landfill gas collection system. Of particular concern, since this landfill is constructed on Bay fill, is additional damage that could be done to the landfill containment due to liquefaction of the area under the landfill. Following any major earthquake, detailed inspection of the landfill containment/monitoring structures would need to be conducted to assess damage and make appropriate repairs.

At the January 20, 2010 BBCAG meeting L. Siegel presented, "A Stakeholder's Guide to Vapor Intrusion dated November 2009." That guide is available on the BBCAG at, http://www.bbcag.com/agenda_minute_packet.html

Also available on the Internet is "U.S. EPA 2002 Draft Vapor Intrusion Guidance
OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)

http://www.epa.gov/osw/hazard/correctiveaction/eis/vapor.htm

R. L. Breault, M.S.E., P.E., Director of Public Works/City Engineer city of Brisbane stated the following about earthquake faults in the Brisbane Baylands area. "*The link will take you to the map ABAG used for their "earthquake shaking maps"; it's my understanding that this map includes faults in addition to those found in the CGS Alquist-Priolo Earthquake Fault Zone maps. I don't see any fault running through the Baylands".*
http://www.abag.ca.gov/bayarea/eqmaps/doc/BAFaults%202003.pdf"

According to C. Johnson (personal communication) "*the USGS has reported on two inactive (??!!) small earthquake faults that were found in the bay waters just east of the Baylands."*

In January 2002 GeoSyntec prepared a report for the SFRWQCB entitled, "Post-Earthquake Inspection and Corrective Action Plan – Brisbane Landfill, Brisbane, California." That report, reportedly for the "owners of the Brisbane Landfill" (Sunquest), made the following statements:

"*GeoSyntec Consultants, Inc. (GeoSyntec) has prepared this Post-Earthquake Inspection and Corrective Action Plan (Plan) for the Brisbane Landfill, as specified in Provision C.6 of the Waste Discharge Requirements (WDRs), Order No. 01-041 (the Order), issued by the California Regional Water Quality Control Board - San Francisco Bay Region (CRWQCB) on 18 April 2001 [CRWQCB, 2001a*]."

"*Provision C.6 of the WDRs issued by the CRWQCB [2001a] requires preparation of a Post-Earthquake Inspection and Corrective Action Plan. For clarity, specific language from this document is presented below.*

'The dischargers shall submit a detailed Post Earthquake Inspection and Corrective Action Plan acceptable to the Executive officer to be implemented in the event of any earthquake generating ground shaking of Richter Magnitude 7 or greater at or within 60 miles of the landfill. The report shall describe the containment features, and groundwater and leachate control facilities potentially impacted by the static and seismic deformations of the landfill. The plan shall provide for reporting results of the post earthquake inspection to the Board within 72 hours of the occurrence of the earthquake. Immediately after an earthquake event causing damage to the landfill structures, the corrective action plan shall be implemented and this Board shall be notified of any damage."

"2.1 Faulting and Seismicity
The Brisbane Landfill, along with the entire San Francisco Bay area, is dominated seismically by the active San Andreas fault system. The San Andreas Fault system forms the boundary between the northward moving Pacific Plate (west of the fault) and the southward moving North American Plate (east of the fault). In the San Francisco Bay area, this movement is distributed across a complex system of subparallel right-lateral strike-slip faults, which include the San Andreas, San Gregorio-¬Palo Colorado, Hayward, and Calaveras, among others (Figure 2)."

"2.3 Probable Impacts of a Magnitude 7.0 Earthquake on Brisbane Landfill
As presented in Table 1, the results of the seismic hazard evaluation performed by GeoSyntec

indicate that the Maximum Probable Earthquake (MPE) and the Maximum Credible Earthquake (MCE) at the Brisbane Landfill is a Moment Magnitude (MW) 7.9 event on the San Andreas fault. The site-to-source distance for both MPE and MCE is approximately 6 miles (9 km). GeoSyntec also estimated the Peak Horizontal Ground Acceleration (PHGA) for the active and potentially active faults located within the 60-mile (100-km) radius of the Brisbane Landfill. The estimate indicates that the expected PHGA for both the MPE and MCE is approximately 0.39 g (Table 1). The impact of this acceleration can be judged by comparing the site with other sites that have experienced shaking of similar intensity in past earthquakes.

GeoSyntec performed and documented post earthquake damage observations for 22 southern California landfills impacted by the 17 January 1994 Richter Magnitude 6.7 Northridge earthquake. This study was extended by incorporation of post-earthquake damage observations during the Richter Magnitude 6.9 Loma Prieta and several other strong earthquakes. The observations and conclusions are summarized in published articles describing the landfill inspections by Matasovic, et al., [1995] and Matasovic and Kavazanjian [1996]."

"Since the estimated PHGA for the Brisbane Landfill is less than PHGA estimated for several closed landfills in past earthquakes, and because there are no extreme features at the site, which may be associated with landfill failures (i.e. , unusually steep slopes, narrow decks, high slopes, etc.), it is GeoSyntec's opinion that it is reasonable to assume that the seismic performance of the Brisbane Landfill should be as good as the observed performance of other landfills in the past earthquakes, and major damage does not seem likely."

The Geosyntec report includes issues that should be inspected/evaluated following a major earthquake.

Biographical Information for G. Fred Lee and Anne Jones-Lee

Expertise and Experience in Hazardous Chemical Site and Municipal/Industrial Landfill Impact Assessment/Management

Dr. G. Fred Lee's work on hazardous chemical site and municipal/industrial landfill impact assessment began in the mid-1950s while he was an undergraduate student in environmental health sciences at San Jose State College in San Jose, California. His course and field work involved review of municipal and industrial solid waste landfill impacts on public health and the environment.

He obtained a Master of Science in Public Health degree from the University of North Carolina, Chapel Hill, in 1957. The focus of his masters degree work was on water quality evaluation and management with respect to public health and environmental protection from chemical constituents and pathogenic organisms.

Dr. Lee obtained a PhD degree specializing in environmental engineering from Harvard University in 1960. As part of this degree work he obtained further formal education in the fate, effects and significance and the development of control programs for chemical constituents in surface and ground water systems. An area of specialization during his PhD work was aquatic chemistry, which focused on the transport, fate and transformations of chemical constituents in aquatic (surface and ground water) and terrestrial systems as well as in waste management facilities.

For a 30-year period, he held university graduate-level teaching and research positions in departments of civil and environmental engineering at several major United States universities, including the University of Wisconsin-Madison, University of Texas at Dallas, and Colorado State University. During this period he taught graduate-level environmental engineering courses in water and wastewater analysis, water and wastewater treatment plant design, surface and ground water quality evaluation and management, and solid and hazardous waste management. He has published over 1,100 professional papers and reports on his research results and professional experience. His research included, beginning in the 1970s, the first work done on the impacts of organics on clay liners for landfills and waste piles/lagoons.

His work on the impacts of hazardous chemical site and municipal/industrial solid waste landfills began in the 1960s when, while directing the Water Chemistry Program in the Department of Civil and Environmental Engineering at the University of Wisconsin-Madison, he became involved in the review of the impacts of municipal solid waste landfills on groundwater quality.

In the 1970s, while he was Director of the Center for Environmental Studies at the University of Texas at Dallas, he was involved in the review of a number of municipal solid and industrial (hazardous) waste landfill situations, focusing on the impacts of releases from the landfill on public health and the environment.

In the early 1980s while holding a professorship in Civil and Environmental Engineering at Colorado State University, he served as an advisor to the town of Brush, Colorado, on the potential impacts of a proposed hazardous waste landfill on the groundwater resources of interest to the community. Based on this work, he published a paper in the Journal of the American Water Works Association discussing the ultimate failure of the liner systems proposed for that landfill in preventing groundwater pollution by landfill leachate. In 1984 this paper was judged by the Water Resources Division of the American Water Works Association as the best paper published in the journal for that year.

In the 1980s, he conducted a comprehensive review of the properties of HDPE liners of the type being used today for lining municipal solid waste and hazardous waste landfills with respect to their compatibility with landfill leachate and their expected performance in containing waste-derived constituents for as long as the waste will be a threat.

In the 1980s while he held the positions of Director of the Site Assessment and Remediation Division of a multi-university consortium hazardous waste research center and Distinguished Professor of Civil and Environmental Engineering at the New Jersey Institute of Technology, he was involved in numerous situations concerning the impact of landfilling of municipal solid waste on public health and the environment. He has served as an advisor to the states of California, Michigan, New Jersey and Texas on solid waste regulations and management. He was involved in evaluating the potential threat of uranium waste solids from radium watch dial painting on groundwater quality when disposed of by burial in a gravel pit. The public in the area of this state of New Jersey proposed disposal site objected to the State's proposed approach. Dr. Lee provided testimony in litigation, which caused the judge reviewing this matter to prohibit the State from proceeding with the disposal of uranium/radium waste at the proposed location.

Dr. Lee's expertise includes surface and ground water quality evaluation and management. This expertise is based on academic course work, research conducted by Dr. Lee and others and consulting activities. He has served as an advisor to numerous governmental agencies in the US and other countries on water quality issues. Further, he has served on several editorial boards for professional journals, including *Ground Water*, *Environmental Science and Technology*, *Environmental Toxicology and Chemistry*, *J. Stormwater, J. Remediation* etc. Throughout his over-50-year professional career, he has been a member of several professional organization committees, including chairing the American Water Works Association national Quality Control in Reservoirs Committee and the US Public Health Service PCBs in Drinking Water Committee.

Beginning in the 1960s, while a full-time university professor, Dr. Lee was a part-time private consultant to governmental agencies, industry and environmental groups on water quality and solid and hazardous waste and mining waste management issues. His work included evaluating the impacts of a number of municipal and industrial solid waste landfills. Much of this work was done on behalf of water utilities, governmental agencies and public interest groups who were concerned about the impacts of a proposed landfill on their groundwater resources, public health and the environment.

In 1989, he retired after 30 years of graduate-level university teaching and research and expanded the part-time consulting that he had been doing with governmental agencies, industry and community and environmental groups into a full-time activity. A principal area of his work since then has been assisting water utilities, municipalities, industry, community and environmental groups, agricultural interests and others in evaluating the potential public health and environmental impacts of proposed or existing hazardous, as well as municipal solid waste landfills. He has been involved in the review of approximately 85 different landfills and waste piles (tailings) in various parts of the United States and in other countries, including 12 hazardous waste landfills, eight Superfund site landfills and five construction and demolition waste landfills. He has also served as an advisor to a hazardous waste landfill developer and to IBM corporate headquarters and other companies on managing hazardous wastes.

Dr. Anne Jones-Lee (his wife) and he have published extensively on the issues that should be considered in developing new or expanded municipal solid waste and hazardous waste landfills in order to protect the health, groundwater resources, environment and interests of those within the sphere of influence of the landfill. Their over 150 professional papers and reports on landfilling issues provide guidance not only on the problems of today's minimum US EPA Subtitle D landfills, but also on how landfilling of non-recyclable wastes can and should take place to protect public health, groundwater resources, the environment, and the interests of those within the sphere of influence of a landfill/waste management unit. They make many of their publications available as downloadable files from their web site, www.gfredlee.com.

Their work on landfill issues has particular relevance to "Superfund" and hazardous waste site remediation, since regulatory agencies often propose to perform site remediation by developing an onsite landfill or capping waste materials that are present at the Superfund site. The proposed approach frequently falls short of providing true long-term health and environmental protection from the landfilled/ capped waste.

In the early 1990s, Dr. Lee was appointed to a California Environmental Protection Agency's Comparative Risk Project Human Health Subcommittee that reviewed the public health hazards of chemicals in California's air and water. In connection with this activity, Dr. Jones-Lee and he developed a report, "Impact of Municipal and Industrial Non-Hazardous Waste Landfills on Public Health and the Environment: An Overview," that served as a basis for the human health advisory committee to assess public health impacts of municipal landfills.

In 2004 Dr Lee was selected as one of two independent peer reviewers by the Pottstown (PA) Landfill Closure Committee to review the adequacy of the proposed closure of the Pottstown Landfill to protect public health, groundwater resources and the environment for as long as the wastes in the closed landfill will be a threat.

In addition to teaching and serving as a consultant in environmental engineering for over 50 years, Dr. Lee is a registered professional engineer in the state of Texas and an American Academy of Environmental Engineers (AAEE) board certified Environmental Engineer. The latter recognizes his leadership roles in the environmental engineering field. He served as the chief examiner for the AAEE in north-central California during 1990-2010 and in the 1980s in New Jersey, where he has been responsible for administering examinations for professional

engineers with extensive experience and expertise in various aspects of environmental engineering, including solid and hazardous waste management.

His work on landfill impacts has included developing and presenting several two-day short-courses devoted to landfills and groundwater quality protection issues. These courses have been presented through the American Society of Civil Engineers, the American Water Resources Association, and the National Ground Water Association in several United States cities, including New York, Atlanta, Seattle and Chicago, and the University of California Extension Programs at several of the UC campuses, as well as through other groups. He has also participated in a mine waste management short-course organized by the University of Wisconsin-Madison and the University of Nevada. He has been an American Chemical Society tour speaker, where he is invited to lecture on landfills and groundwater quality protection issues, as well as domestic water supply water quality issues throughout the United States.

Throughout Dr. Lee's 30-year university graduate-level teaching and research career and his subsequent 22-year private consulting career, he has been active in developing professional papers and reports that are designed to help regulatory agencies and the public gain technical information on environmental quality management issues. Drs. Lee and Jones-Lee have provided a number of reviews on issues pertinent to the appropriate landfilling of solid wastes. Their most comprehensive review of municipal solid waste landfilling issues is what they call the "Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste," which was originally developed in 1992, and redeveloped and updated in the fall of 2004. Between the two versions they have published numerous invited and contributed papers that provide information on various aspects of municipal solid waste landfilling, with emphasis on protecting public health and the environment from waste components for as long as they will be a threat. The "Flawed Technology" review has been periodically updated, including the most recent update in June 2010, which can be found on their website at
http://www.gfredlee.com/Landfills/SubtitleDFlawedTechnPap.pdf

This review provides a comprehensive, integrated discussion of the problems that can occur with minimum-design Subtitle D landfills and landfills developed in accord with state regulations that conform to minimum Subtitle D requirements. The "Flawed Technology" review contains a listing of the various reviews that Drs. Lee and Jones-Lee have developed, as well as peer-reviewed literature. Over 40 peer-reviewed papers are cited in "Flawed Technology" supporting issues discussed in this review.

Drs. Lee and Jones-Lee have developed guidance on the evaluation of the potential impacts of landfills. This guidance is available as,

Lee, G. F., and Jones-Lee, A., "Guidance on the Evaluation of the Potential Impacts of a Proposed Landfill," Report of G. Fred Lee & Associates, El Macero, CA January (2007). http://www.gfredlee.com/Landfills/EvaluationImpactLF.pdf.