Deadly Power

A case for eliminating the impacts of the South Bay Power Plant on San Diego Bay and ensuring better environmental options for the San Diego/Tijuana region.

Prepared by the

San Diego Bay Council

A coalition of San Diego environmental organizations dedicated to protection and restoration of San Diego's coastal water resources

Member Organizations

Environmental Health Coalition
San Diego Audubon Society
San Diego BayKeeper
San Diego Chapter of the Sierra Club
San Diego Chapter of the Surfrider Foundation
Southwest Wetlands Interpretive Association
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Executive Summary

The South Bay Power Plant has been responsible for severely degrading the San Diego Bay ecosystem with thermal and chemical pollution and by killing a wide range of juvenile, larval, and adult organisms in its cooling system for more than 40 years. These impacts are severe and continual. This degraded condition is now so long-standing that it is considered the "base-line" for South Bay. This grossly inefficient plant is also a source of air pollution and a visual blight on the community.

Soon, plans will be developed for a replacement for the South Bay Power Plant. We cannot let the degradation and destruction of San Diego Bay continue through the use of bay water for cooling. Now is the time to stop the *"cooling that kills."* The evidence in this report makes it clear that:

- the negative environmental impacts from the South Bay Power Plant to San Diego Bay are significant;
- there are feasible, viable, and protective alternatives for replacement of the South Bay Power Plant;
- the current permitting structure is inadequate; and
- government must act now to eliminate the damage to San Diego Bay.

The member organizations of the San Diego Bay Council, representing 22,000 San Diegans, are committed to act through community involvement, regulatory participation, and legal action, to ensure that the South Bay Power Plant is torn down and its damaging impacts to sensitive South San Diego Bay are ended. The Bay Council urges agencies with authority over the South Bay Power Plant to aggressively pursue the following actions:

I. Build a State of the Art, Dry-Cooled Power Plant to Replace the South Bay Power Plant

The South Bay Power Plant must be torn down and replaced as soon as possible with a more efficient, dry-cooled plant and there must be aggressive commitments to conservation and clean, renewable energy sources. This will result in less air and water pollution and use of less hazardous materials in the region. Officials should establish an enforceable time line to phase out the South Bay Power Plant.

2. Provide Comprehensive and Meaningful Regulation of the Existing Power Plant

The South Bay Power Plant's National Pollution Discharge Elimination System (NPDES) permit is up for a five year renewal. In the near-term, the Regional Water Quality Control Board must require new, more protective requirements for the discharges into San Diego Bay. The Regional Board should include a permit condition or resolution that clearly states that any replacement plant should not use Bay water for cooling and that impacts from current practices should be fully mitigated and the Bay should be restored. The monitoring regime for the new permit should include discharge and receiving water limits and monitoring for all constituents known to be present in the discharge. It should also be designed to fully assess impacts on beneficial uses.

3. Recognize the Impacts of the South Bay Power Plant on South San Diego Bay

Impacts to marine life of South Bay will not be addressed until we recognize the extent of the problem. South Bay is heavily impacted by the power plant discharges and cooling process itself. South San Diego Bay should be added to the 303(d) list of "impaired" waterbodies so that it receives priority action for protection.

Biological and Ecological Impacts

The South Bay Power Plant is a steam electric power generating facility located at the far southeast shore of San Diego Bay, surrounded by sensitive mudflat habitat. The plant uses what is called a once-through wet-cooling system that draws cooling water from San Diego Bay. This heated cooling water is then discharged back into the Bay. At full capacity, 601 million gallons of water are discharged back into the Bay each day. Other California power plants use this cooling method, but draw from and release water to the open ocean, where the volume of the water body greatly exceeds the amount being used and where the heated water is more quickly dissipated.

South San Diego Bay is a sensitive marine environment, highly vulnerable to thermal, chemical and other pollution sources. The south bay environment is most vulnerable in summer, the time of year that the SBPP releases the most thermal pollution because of increased summer energy demands. Water discharged from the plant can reach temperatures over 100°F, a lethal temperature for fishes and other marine life. The plant also releases toxic chemicals in discharged water, including copper, nickel, zinc, chromium and chlorine. The high temperatures exacerbate the effects of chemical pollution on marine life.

There is no maximum temperature limit for SBPP discharges. Between 1974 and 2000, average discharge temperatures have risen over 10°F in both summer and winter. Permitted increases in temperature between intake water and water discharged from the SBPP have risen from 12.5°F to 15°F. The higher water temperature decreases the amount of dissolved oxygen in the water and, at the same time, increases the metabolic rate of animals which increases their

oxygen demand. The plant discharges dead plants, fishes, shellfish and other organisms back into the Bay and the decay of these plants and animals further reduces oxygen levels.

The South Bay Power Plant has been disrupting the ecosystem of South San Diego Bay for more than 40 years. Roughly 20 percent of the water in the South Bay is drawn into the plant every day. Early life stages of marine plants and animals also are drawn into the cooling water system, where they are subjected to mechanical damage, as well as chemical, temperature and pressure shock. The loss of early life stages of fish, shellfish and other invertebrates, and other microscopic plants and animals that form the base of the food chain may affect the overall ecological balance of the Bay. Millions of these organisms are lost in the Power Plant each year.

Adult fish and invertebrates in the vicinity of the SBPP intake are drawn into the intake structure and impinged, or trapped, by either a "trash rack" or a series of screens. A 1979-1980 study considered impingement and estimated that 28,174 individual fish were killed in the plant in 1979.

A major concern is the use of up to 4,100 pounds of chlorine per month for the purposes of killing marine life in the intake water. The highly chlorinated water is then discharged back into the Bay. Almost all species of animals are hit hard by chlorine, and this effect is exacerbated in a shallow, poorly circulated environment like the South Bay. In addition to its immediate effects, chlorine is now known to break down, complex with other substances, and form new compounds such as chlorinated organics. These chlorinated organic compounds can remain toxic for aquatic life for long periods. The SBPP uses more chlorine in summer, compounding the effects of higher summer water temperature, less dissolved oxygen, and the greater toxicity of other chemicals.

The SBPP also releases an estimated 400-1020 pounds of copper, a heavy metal that is highly toxic to marine life and which is known to accumulate in fish and shellfish, into the Bay each year. Nickel concentrations in the cooling water have also been significant. Zinc waste plates, used for corrosion control, release zinc into the cooling water. For fishes, a decrease in oxygen levels of the water increases the apparent toxicity of zinc and copper. Water temperature is possibly the most important factor affecting zinc toxicity: the higher the temperature, the shorter the survival time. The juvenile inhabitants of South Bay are more sensitive to these metals than adult animals.

Eelgrass (Zostera marina) forms a distinct marine habitat providing vital shelter and food for many bay inhabitants. For some reason, eelgrass is absent in the vicinity of the plant, yet plentiful west of the plant and in other areas of the South Bay. Eelgrass is highly dependent on sufficient light to thrive, and declines in seagrass abundance have been linked to decreasing water transparency. Without the power plant discharge, we would expect a resurgence of eelgrass beds.

One problem associated with securing reliable information about the impacts of the plant is that the data we have is not independent of the discharger. Many of the existing studies are suspect because they were funded by the discharger with a significant interest in the

conclusions of the studies. Independent assessment of the impacts of the power plant is needed.

Efficiency and Economics

The South Bay Power Plant energy conversion efficiency is about 38 percent compared to modern day power plants which have design efficiencies upward of 56 percent. A new plant that generates the same amount of electricity would use significantly less natural gas and emit less air pollution. Efficient use of natural gas is critical given the negative air quality impacts of burning oil and the limited supply of natural gas. Further, two-thirds of the cost of operating a fossil fuel plant is the cost of fuel.

There are feasible, viable, and protective alternatives to once-through wet-cooling. Dry-cooling has been available for more than 40 years and has been used in all climates with several in arid regions of Mexico and the United States. Dry-cooling uses air instead of water to cool the low-pressure steam leaving the steam turbines. Large radiator-type tube banks are used to transfer heat from the condensing steam to air passing over the tubes. Dry-cooling has no air or water polluting emissions. There is no water evaporation, no visible plume, no thermal discharges, and no particulate air emissions associated with the cooling. Water is only needed for periodic system maintenance and cleaning. Dry cooling could result in reductions in water use by more than 99 percent over once-through wet-cooling. Through such reductions in water use, the need to use water from any sensitive or biologically productive water body is removed. Further, dry cooling does not need to sterilize the water it uses for cooling so the use of chlorine is eliminated.

There are over 600 electric power plants throughout the world that use dry-cooling, including 50 in the United States. These plants are of a variety of sizes, types, and located in a variety of climates including one planned in Otay Mesa.

Recommendations

, The **State Water Resources Control Board** should

< ensure that the updated Thermal Plan provides more protective requirements regarding thermal discharges into state waters. The update should strengthen protections for estuaries and enclosed bays. The new Thermal Plan should prohibit the use of natural surface waters for cooling of power plants since feasible alternatives exist.

< add the waters of South San Diego Bay to the 303 (d) list as impaired for heat, chlorine, and copper.

, The **Regional Water Quality Control Board** should

- specifically address requirements on any replacement plant for the SBPP and make clear the intent of the Board for any future proposal. This could be accomplished through a condition in the new NPDES permit or a resolution requiring any reconstruction/repower during this permit duration to carry a "new discharge" designation and, thus, subject to much more stringent requirements.
- strengthen the NPDES permit, increase monitoring, and require mitigation for damage caused by the operation of the SBPP in order to ensure protection of beneficial uses in San Diego Bay. The new permit should move closer to the elimination of water quality impacts from the power plant discharges as soon as possible. Essential changes include: establish limits and monitoring requirements for dissolved oxygen and all constituents present in the discharge such as metals and chlorine by-products; relocation of the compliance point to the real point of discharge (i.e. end of the pipe); set maximum temperature limits for the discharge; establish impingement and entrainment limits; establish sediment monitoring; and increase frequency of chlorine monitoring.
- ensure that storm water requirements are incorporated into the renewed NPDES permit and strengthened to include, at a minimum, acute toxicity and diversion of storm water from high risk areas.

, The **San Diego Unified Port District** should renegotiate the lease for the power plant and the Port should ensure that any operator is held to hard and fast deadlines for removal of the SBPP. A requirement should be added that any new plant on Port District tidelands must utilize dry cooling.

, The **California Energy Commission** should require all new and repowered plants to use dry cooling.

, The **San Diego Regional Energy Office** should recommend an aggressive Regional Energy Strategy that pursues conservation, efficiency, and clean renewable energy to the maximum extent possible for the San Diego/Tijuana region.

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Introduction

San Diego Bay is the crown jewel of San Diego. It is a magnificent natural and recreational resource and supports considerable economic activity in the region. It provides us with a beautiful backdrop for our city and is home to hundreds of resident and migrating wildlife species. It is invaluable for its commercial, industrial, and military uses and as a natural ecosystem. Balancing these uses has always been difficult and the health of the Bay ecosystem has, over time, suffered as a result.

San Diego Bay has, for too long, been negatively impacted by the uses around it. It is the recipient of polluted discharges from industrial and military operations as well as polluted runoff from the urbanized watershed. The result is that Bay fish and sediments have become contaminated and constant pollutant loading has taken a toll on the health of the Bay. One of the most devastating current impacts on the ecological health of San Diego Bay is the use of bay water for cooling by the South Bay Power Plant. In the past few years, there have been significant actions initiated to restore the Bay to health. This report focuses on the next action that must be initiated–**we must set a course to stop the use of bay water to cool the South Bay Power Plant.**

Power generation in San Diego/Mexico has commanded our attention in recent months due to apparent energy shortages that have now become surpluses. Out of all the confusion about where we get our power and how it is generated, one thing about our energy future is clear–we need to set a long-term goal to develop a binational strategy that promotes energy conservation and use of renewables and energy development that protects binational air basins and water resources from further degradation or depletion. This is a large task. How protective and environmentally sustainable this future will be relies, in strong measure, on how the repower or replacement of the South Bay Power Plant is achieved.

This report does not seek to answer all questions or issues related to the power generation future of the region. This report does seek to do the following:

- provide clear evidence that the negative environmental impacts to San Diego Bay are significant.
- ensure that these significant impacts are properly reflected in how we regulate these discharges.

- make recommendations to ensure that damaging impacts from the SBPP are reduced and eliminated as soon as possible.
- ensure that permits, policies, and governmental actions are initiated to ensure the ultimate replacement of the South Bay Power Plant for the good of economic development in the South County and that will greatly reduce the environmental impacts to the region.

Section 1

Permitting History and Regulation of the South Bay Power Plant

A. South Bay Power Plant (SBPP) Timeline

1960 SBPP begins operation

The first of four generating units of the SBPP began operations in 1960 prior to the promulgation of the Federal Pollution Control Act of 1972 and its amendments that formed the Clean Water Act in 1977. The other three units followed in 1962, 1964, and 1971.

1969 First Permit: Resolution 69-R3

The first Regional Water Quality Control Board permit allowed condenser cooling water (three units) discharges of 425 million gallons a day (MGD), boiler blowdown wastes, and 100 pounds a day of copper sulfate for corrosion control. Dissolved oxygen (DO) was monitored **weekly.** This permit specified the average and maximum differential temperatures between the discharge and the inlet cooling water (discharge minus inlet). The average differential was 12.5°F and the instantaneous maximum was 18.5°F. However, the permit lacked a maximum discharge temperature specification which leaves the waste heat discharges open-ended.

1974 Permit renewal: Order 74-91

Renewal permitted a discharge of 434 MGD cooling water and noted an average summer water discharge temperature of 78° and winter discharge temperature of 61°F.[1]

1975 The California Thermal Plan last revised.

The Thermal Plan (originally adopted in 1971) "grand-fathered" several power plant discharges as long as they met certain standards. Standards for existing discharges to designated estuaries were much higher than for enclosed bays. San Diego was determined to be an *"enclosed bay"* for purposes of the Thermal Plan.[2] The cost of upgrading old plants and the expectation that

[1] Order 74-91, Finding 3.

[2] *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California*, State Water Resources Control Board, adopted 1975.

old plants would be replaced with newer, cleaner technology factored into the State Board's decision to allow existing discharges, like the SBPP, to continue.[3] It is meaningful that the Thermal Plan prohibited **new** thermal waste discharges having a temperature greater than 4ºF above natural temperature of the receiving water.[4]

1976 Permit Renewal and addenda: Order 76-10

The NDPES permit renewal and addenda raised flows to 600.5 MGD and listed the temperatures in the water as much higher, with an average temperature in summer of 91ºF and an average winter temperature of 74º F.[5] Chlorine was monitored **monthly.** The permissable temperature difference between the discharge and intake water was increased to 15ºF average with a 25ºF instantaneous maximum. Dissolved oxygen was (DO) not monitored.

1985 Permit Renewal: Order 85-09

This Order permitted industrial waste discharges to the Bay. It maintained a compliance monitoring point far from the actual discharge from the plant. Chlorine was monitored **monthly.** DO was not monitored.

1996 Permit Renewal: Order 96-05

This permit was adopted after a bitter fight between SDG&E and the environmental community. It was appealed by both SDG&E and Environmental Health Coalition and resolved, in part, through settlement discussions. It succeeded in achieving a phase-out of some of the industrial process water discharges like the metal cleaning wastes and relocated the "discharge compliance point" at the edge of the power plant property line, about 100 feet from the actual discharges. This change was made for all constituents **except for the temperature limit[6] which is located 300 yards downstream** from the actual discharge point. The official "point of discharge" is located one mile from the actual point of discharge at the end of the rock jetty in the middle of the South Bay. There are no receiving water limitations for DO in the current permit and the discharge water is not monitored at all for DO.

1999 SBPP Sold to Port of San Diego, Leased to Duke

SBPP purchased by the San Diego Unified Port District for $110 million and leased to Duke Energy Power Services for 10 years. The agreement reached between Duke and the Port

[3]Legal Memorandum, from Craig Wilson, State Water Resources Control Board, March 24, 1999
[4]Thermal Plan, p. 5.
[5]Order 76-10
[6]Order 96-05, p. 17.

required that "*commercially reasonable efforts*" be made to develop a replacement plant and to decommission and remediate the existing facility.[7]

1999

South San Diego Bay National Wildlife Refuge established by the Port District, State Lands Commission and the US Fish and Wildlife Service. Management planning begins to restore some of salt ponds and degraded areas to estuarine habitats.[8]

2000

Duke Power reported that the average winter temperature for the discharge water was 73.8ºF and the average for the summer discharge water was 89.3ºF.[9] The maximum discharge temperatures were 76.3ºF in the winter and 94.3ºF in the summer.

2000

Duke begins discussions about a replacement of SBPP[10] with a water-cooled plant.[11] All options under consideration rely on varying levels of bay water for cooling and contemplate reliance on the existing 15ºF limit between the intake and the discharge water.

2001

Governor Gray Davis issues Executive Order D-22-01. The EO ordered the State Water Resources Control Board to ensure that power plants *"... are not precluded from operating as a result of thermal limits in waste discharge requirements."*

June 2001 Duke requests increases in heat discharges

In midst of an energy crisis, Duke Power requests that the Regional Board allow even further elevation of the waste heat discharge to the Bay by raising the average daily differential

[7]Staff report to the State Lands Commission, January 29, 1999, p. 2.

[8]http://sandiegorefuges.fws.gov/new/ccp/CCP%201%20Index.htm

[9]Summary of Year 2000 Discharge Monitoring Report Data, Application for Renewal of the NPDES Permit for Duke Energy South Bay LLC's South Bay Power Plant, EPA Form 2C, Appendix A, May 4, 2001

[10]The SBPP is designated by the state as a "must-run" plant, meaning that a new plant must be built before this existing plant is decommissioned.

[11]Letter from Margaret Rosegay, Pillsbury, Madison and Sutro, LLP to Craig M. Wilson, State Water Resources Control Board, November 3, 2000.

temperature from 15ºF to 23ºF.[12] Concerns of resource agencies caused Duke to withdraw request.[13] Concern of environmental community is significantly raised that the plant could continue to do even more damage to the Bay.

The Engineering Evaluation for the South Bay Plant submitted into the record by Duke showed that the plant could generate 725 MW gross output with the inlet water at 81ºF and the outlet water between 97ºF and 106ºF. Proposed scenarios for increases in operations showed predicted outlet temperatures as high as 107.5ºF from some units.[14]

Spring-Summer 2001 Duke and Other Energy Suppliers Come under Fire

Duke Power and other energy suppliers charged with profiteering by utilizing deregulation to manipulate California's energy supply. Stories of manipulation of the energy crises appear prominently in the Los Angeles Times, San Diego Union Tribune, national newspapers and electronic media. Intense public scrutiny follows.

2001 Permit renewal

Permit is up for its five year renewal in December. Hearing is expected to be held on December 12, 2001. The Tentative Draft NPDES Order 2001-283 proposes very few changes to existing monitoring and regulatory requirements outlined in the 1996 permit.

B. Regulation of Power Plant Water Discharges–Legal Framework

Clean Water Act

Under the Clean Water Act (CWA), states are required to issue National Pollutant Discharge Elimination System (NPDES) permits for thermal discharges, as well as other discharges that impact water quality and beneficial uses, subject to United States Environmental Protection Agency's (EPA) approval. These permits are issued by the State Water Resources Control Board (State Board) and Regional Water Quality Control Boards (Regional Boards), in accordance with the CWA, EPA, and any more stringent state requirements. The Porter-Cologne Water Quality Act (Porter-Cologne Act) allows California to both implement the CWA and assume responsibility for its NPDES permit program. Under the Porter-Cologne Act, State

[12]May 7, 2001 letter from Mr. Mark Hays, Duke/Fluor Daniel to Mr. John Robertus, Regional Water Quality Control Board, p. 5.

[13]*Duke Energy drops warm-water request*, San Diego Union Tribune, June 14, 2001; Letter from Mark Hayes, Duke Energy to John Robertus, Regional Water Quality Control Board June 13, 2001.

[14]Engineering Evaluation for South Bay, Attachment 3 to May 7, 2001 letter from Mr. Mark Hays, Duke/Fluor Daniel to Mr. John Robertus, Regional Water Quality Control Board.

and Regional Boards have additional authority to review and modify waste discharge requirements for point sources. However, the modifications must be consistent with the NPDES program requirements.

California Toxics Rule

The California Toxics Rule is a comprehensive list of criteria for priority toxic pollutants that was created to satisfy section 303(c)(2)(B) of the CWA.[15] It governs pollutant discharges into inland waters, bays, and estuaries of California. It was created to assist those issuing permits to apply appropriate waste discharge requirements for individual pollution sources discharging priority toxic pollutants.

303(d) Listing

Section 303(d) of the Clean Water Act requires States to identify "impaired" water bodies based on their inability to meet water quality objectives. This list is updated every two years, though the last scheduled update (2000) was postponed as new regulations were being promulgated. The most recent (1998) 303(d) listing included 36 separate impaired water areas in San Diego, including portions of San Diego Bay. The draft 2002 list proposes to increase that number to 60 separate water areas.[16]

The ad hoc workgroup of Regional Boards, State Board and EPA staff has developed guidelines for use by the Regional Boards in recommending additions or changes to the 303(d) list. Some of the factors considered include:

- Effluent limitations or other pollution control requirements are not stringent enough to *assure protection of beneficial uses* and *attainment of SWRCB and RWQCB objectives.*
- *Beneficial uses are impaired* or are expected to be impaired within the listing cycle (i.e., in next two years). Impairment is based upon evaluation of chemical, physical, or biological integrity. Qualitative and quantitative assessment of physical/chemical monitoring data, bioassay tests, and/or other biological monitoring will determine impairment. Federal and State criteria and statewide and Regional Water Quality Control Plans determine the basis for impairment.

Beneficial uses are defined in the San Diego Basin Plan as *"the uses of water necessary for the survival or well being of man, plants and wildlife."* [17]

[15]SWRCB, California EPA, Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, 2000.

[16]Draft Clean Water Act Section 303(d) List of Impaired Waters, 2002 Update, Regional Water Quality Control Board, October, 2001.

[17]San Diego Basin Plan, p. 2-1 (1994).

Total Maximum Daily Loads (TMDLs) must then be developed for these sites, allowing water quality-based controls to be established. TMDLs are created to ensure the restoration of beneficial uses and the achievement of water quality objectives. Once developed, TMDLs are adopted as amendments to Basin Plans.

SBPP's Designated Discharge Channel

A large section of the southeastern area of South San Diego Bay is designated as "the discharge channel." Historically, this area was treated as part of the power plant and not part of the Bay.[18] Because of this, the beneficial uses were not fully protected for waters in the discharge channel. When studies were conducted in the 1970s and 1980s they repeatedly found the plant was not significantly impacting South Bay because *"thermal effluent from the South Bay Power Plant had no major adverse effects on the benthic communities beyond the end of the cooling channel..."*[19] and *"..no significant ecological effects caused by the operation of the South Bay Power Plant at any location outside of the cooling channel."*[20]

It is also stated that at least one of these findings were true for the 1968-1973 cooling period.[21] During this period, the cooling water use was permitted for 434 MGD, far less that the 601 MGD permitted today. Even then, the studies showed that stations near the thermal effluent had *"considerably different chemical, physical, and biological characteristics than did those of all other stations."*[22]

Storm Water Permit Requirements

SBPP is regulated under the General Industrial Storm water Permit issued in 1997.[23] The new tentative permit does not include storm water requirements.

[18]Hearing transcript, RWQCB, SDG&E Permit Reissuance. June 13, 1996, p. 11.
[19]Ford and Chambers (1974) cited in Duke Application, Appendix G, p. 24.
[20]Lockheed Center for Marine Research cited in Duke Application, Appendix G, p. 24.
[21]Ford and Chambers (1974) cited in Duke Application, Appendix G, p. 24.
[22]Lockheed cited in Duke Application, Appendix G, p. 24.
[23]SWRCB Order No. 97-03.

Section 2

Environmental and Human Health Impacts from the South Bay Power Plant

A. Overview of Plant Operations

The South Bay Power Plant is an electric power generating facility. It is located at 990 Bay Blvd., Chula Vista, California, at the far southeast shore of South San Diego Bay and is surrounded by sensitive mudflat habitat. The facility has four steam turbine electrical generating units and one gas turbine generator. Each of the four steam units burns natural gas with the option of burning fuel oil during natural gas curtailment. Each of the units can generate electricity independently or in conjunction with one another, with a total rating of 737 MW.

SBPP generates electricity through a closed-cycle in which steam is produced in boilers, passed through turbines to generate electricity and then condensed to a liquid by the cooling water system before being returned to the boilers. The plant uses what is called a once-through cooling system which means that cooling water is drawn from San Diego Bay. Waste heat from the condensation of steam leaving the turbines is transferred to the cooling water in condenser tubes. This heated cooling water is then discharged to the Bay. At full capacity the amount of water used and discharged back to the Bay is 601 million gallons a day (MGD).[24] (601 MGD is the permit limit and design rate of the units. Actual usage varies according to plant operation. From 1996 to 1999 monthly average use was 513 MGD and the median was 519 MGD, with a maximum monthly average of 596 MGD.)[25] Power plants including San Onofre and the Encina Plant in Carlsbad use this cooling method, but draw from and release to the open ocean, where the volume of the water body greatly exceeds the amount of water being used, and where the heated water is much more quickly dissipated.

The SBPP energy conversion efficiency is about 38%, inefficient compared to modern day power plants which can be upwards of 56% efficient.[26] A new plant that generates the same electricity would use significantly less natural gas and emit less air pollution.

The SBPP is also the worst urban blight in the South County. Its antiquated industrial revolution appearance frustrates economic and tourism development for Chula Vista and

[24]SWRCB Order No. 96-05.

[25]Application for renewal of the NPDES permit for Duke Energy's South Bay Power Plant, EPA Form 2C, Appendix A, May 4, 2001.

[26]CEC staff report, May 2000, 99-AFC-5, p. 365.

Imperial Beach.

SBPP also uses, stores, and transports large amounts of dangerous toxic chemicals. The San Diego County Hazardous Materials Database indicates that the SBPP uses 89,000 gallons a year of sodium hypochlorite (chlorine bleach) storing 6,500 gallons at a time in above ground storage tanks.[27] Sodium hypochlorite is listed as an Immediate Health Hazard. This chemical is dangerous in storage, use, and during its transportation through communities. Even the material provided by Duke in the application for renewal warns that sodium hypochlorite exhibits aquatic toxicity and *"May seriously affect aquatic life. Do not allow spilled material to enter sewers or streams."*[28] In conjunction with chlorine, the use of sodium bromide is allowed as well but not monitored for separately.[29]

B. Biological and Ecological Impacts of the South Bay Power Plant

–By Elaine M. Carlin

Introduction

Today a generating station like the SBPP, which uses large volumes of sea water for cooling, would never be permitted to operate in the shallow, enclosed, marine environment of South San Diego Bay. Its shallow waters, dark sediments that are solar-heated, and sluggish tidal circulation make the South Bay a sensitive marine environment, highly vulnerable to heat (thermal), chemical and other pollution sources. Already in 1967, two years after it began operation, the plant was considered by the US Department of the Interior to be one of two sources of pollution in the South Bay.[30]

> *"South San Diego Bay contains a substantial proportion of the remaining examples of several critical and sensitive Southern California coastal resources–saltmarsh, intertidal and shallow-subtidal protected embayment habitats, eelgrass beds, fishery and shorebird habitats. Each of these resources has suffered very substantial historical declines, and what remains must be protected from further degradation."*[31]
>
> –Michael Branden Associates, *et al.*

[27]County of San Diego Hazardous Waste Inventory, search conducted November 5, 2001. Establishment #H 13939. A check of this number against usage reported to the Regional Board revealed lower use estimates of 57,000 gallons.

[28]GPA Industries Material Safety Data Sheet, Sodium Hypochlorite, taken from the Duke Application.

[29]Order 96-05, p. 5.

[30]Parrish and Mackenthum, 1968, *San Diego Bay. An Evaluation of the Benthic Environment. October 1967.* Biology and Chemistry Section, Technical Advisory & Investigations Branch, Federal Water Pollution Control Administration, U. S. Department of Interior, pp. 21, iv.

[31]Michael Brandman Associates, Philip Williams & Associates, Ltd., and TRC Environmental Consultants, 1990, *Preliminary Report of City of Chula Vista: (SDG&E) 89-NOI-1, p. III-4.*

The south bay environment is the most vulnerable in summer because of naturally high water temperatures. Yet in summer the plant releases the most thermal pollution (the warmest water) because of higher summer energy demands. Water temperatures discharged from the plant can reach over 100°F degrees, a lethal temperature for fishes, shellfish, and other marine life. In addition to heat, the plant releases toxic chemicals in its discharge water, including copper, nickel, zinc, and chromium (primarily from corrosion in the condenser and condenser tubing), and chlorine. Studies have shown that the high temperatures make the effects of these chemicals even more toxic to marine life, for metabolic reasons.[32]

Higher water temperatures also reduce the amount of oxygen in the water, and at the same time increase the metabolic rates of animals, which in turn increases their oxygen demand. In fact, the metabolic rate has been shown to double every 10°C (18°F).[33] Thus, animals have a higher need for oxygen but there is less available in the water. The plant further decreases the amount of oxygen in the water by discharging the dead plants, fishes, shellfish and other invertebrates, and microscopic organisms that die in the cooling water system, back into the shallow waters of the bay. These excess nutrients cause the growth of bacteria and other microscopic organisms. Their metabolic activity further decreases the oxygen supply. These organisms then die-off and the decay of the dead animals, plants and microscopic organisms take yet more oxygen out of the water.

When the power plant is running at full capacity, the plant is licensed to draw 601 million gallons of bay water into the plant each day for cooling purposes. The water is used as a heat exchange medium in the steam condensation process. This is roughly 20 percent of the water in the entire South Bay at mean sea level (601 million gallons out of 2,972 million gallons).[34] The percentage is higher at low tide and less at high tide. Fishes, shellfish and other invertebrates are drawn into the plant, trapped and killed on racks and screens. Early life stages of marine plants and animals are also drawn into the cooling water system, where they are subjected to mechanical damage, as well as chemical, temperature and pressure shock.

Biodiversity and Ecosystem Health

Ecosystems are by nature extremely complex systems in which many, many relationships exist. In addition to relationships between organisms (the food chain or web for example), there are many more chemical and physical phenomena that are involved in these relationships. Much about how ecosystems work is not yet known; however scientists have determined with some certainty that the more complex an ecosystem, the more stable it will be. As humans

[32]Richard F. Ford, personal communication, 2001; See for example, Capuzzo, Judith M., 1979, "The Effects of Temperature on the Toxicity of Chlorinated Cooling Waters to Marine Animals – A Preliminary Review," *Marine Pollution Bulletin*, Vol 10, pp. 45-47.

[33]Van't Hoff's Law.

[34]The area of South Bay is defined as extending to a line running from the Sweetwater Flood Control Channel to the Silver Strand. Merkel, Keith and Scott Jenkins, 1996, *San Diego Gas & Electric South Bay Power Plant NPDES Permit Renewal. South Bay Residence and Recirculation,* p. 2.

disturb and change ecosystems, the systems become less stable. In addition, we upset the balance of these systems, creating a myriad of changes that are impossible to predict or understand given the young stage of the ecological sciences. An important example is how we have upset the balance of atmospheric gases by the burning of fossil fuels, which is now causing global scale changes to the atmosphere and oceans.

On the much smaller scale of South San Diego Bay, there is an intricate ecosystem at work, providing essential services of many kinds. The SBPP has been disrupting the natural ecosystem for almost 40 years, since it began operating in the 1960s. Certain of these disruptions are easy to identify, but most are unknown. Almost certainly the ecosystem is less diverse, with dominant species present because of their ability to withstand the warmer water. Annual studies from 1977 to 1994 have confirmed that diversity of benthic (bottom dwelling) marine life is significantly reduced in the South Bay in areas directly affected by the plant's discharge.[35]

The dominant fish species near the plant is now the round stingray (Urolophus halleri), which is a voracious feeder on a wide spectrum of benthic animals.[36] Species that cannot withstand the high temperatures have become reduced in abundance or eliminated in the areas of the discharge. Others die off each summer. Invader species that are not native to this part of the world and that have a high temperature tolerance, such as the Japanese mussel *(*Musculiata senhousei*)* can then become established. This species has forced out natural mollusk populations in the South Bay, in other parts of San Diego Bay, and in Mission Bay, and is responsible for major damage to native ecosystems. The Japanese mussel is especially likely to take hold in disturbed habitats, such as the dredged bottoms of the power plant's intake and discharge channels.

Microbial (microscopic-level) organisms are an essential component of biodiversity. All animals and plants (and humans) are dependent on their activities. Almost certainly there is less microbial diversity in the South Bay, because bacteria and microorganisms essential for healthy and sustainable ecosystems are repeatedly exposed to chlorination and other damage (discussed below). Given the large percentage of South Bay water drawn through the plant, a significant percentage of these populations are apparently affected.

[35]EA Engineering, Science, and Technology, 1995, *South Bay Power Plant Receiving Water Monitoring Program with Emphasis on the Benthic Invertebrate Community (1977-1994),* Prepared for San Diego Gas and Electric Company, San Diego, California.

[36]*Application for Renewal of the NPDES Permit for Duke Energy South Bay LLC's South Bay Power Plant*, 2001, Submitted to the Regional Water Quality Control Board, Appendix G, p. 13; Richard F. Ford, personal communication, 2001.

Power Plant Effects on the Water Itself

> *"Temperature changes are known to affect every physical property of concern in water quality management, including water density, state, viscosity, vapor pressure, surface tension, gas solubility and diffusion."* [37]
>
> –Majewski and Miller, p. 22

Temperature affects many of the physical and chemical properties of water, and these changes in turn have biological consequences. For example, decreased viscosity may result in increased sedimentation, which can prevent eelgrass growth.[38] Increased temperature changes chemical reaction rates, altering a multitude of biological processes, the assimilation of waste, the efficiency of waste treatment systems, and the corrosion of materials.[39] The plant also adds chemicals directly into the Bay in the cooling water, producing additional changes in water chemistry. By increasing temperature and adding excess nutrients, the plant reduces the amount of oxygen in the water. The nutrients also change biological processes and decrease the transparency of the water which can limit plant growth.

Killing of Early Life Stages of Organisms

The South Bay is widely recognized as a critically-important spawning and nursery ground for many early life stages of fishes and invertebrates, including the California halibut. It is one of the increasingly rare habitats of its type (in California, in the United States, and around the globe). Baywide, 88 percent of salt marsh habitat has been lost, and now only remains in South San Diego Bay.[40] The South Bay is also an important resting, feeding, and breeding area for a diverse community of resident and migratory shore and other water birds.[41]

The loss of early life stages of fish, shellfish and other invertebrates, and other microscopic plants and animals that form the base of the food chain/web, may affect the overall ecological balance of aquatic ecosystems.[42] These small organisms include phytoplankton,

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[37]Majewski, W. and D. C. Miller, Eds., 1979, *Predicting effects of power plant once-through cooling on aquatic systems,* A Contribution to the International Hydrological Programme, UNESCO. p. 22.

[38]*Ibid.*, p. 22; Richard F. Ford, personal communication, 2001.

[39]*Ibid.*, p. 22.

[40]U.S. Department of the Navy, Southwest Division, 1999, *San Diego Bay Integrated Natural Resources Management Plan,* Prepared by Tierra Data Systems, pp. 2-40.

[41]Ford, Richard F., *1968, Marine Organisms of South San Diego Bay and the ecological effects of Power station cooling water, A pilot study conducted for the San Diego Gas & Electric Co.,* Environmental Engineering Laboratory Tech. Rept.

[42]Clarke, J. and W. Brownell, 1973, "Electric Power Plants in the Coastal Zone: Environmental Issues." *American Littoral Society Special Publication,* Volume 7, as cited in Lawler, Matusky & Skelly Engineers, 1979, *Ecosystem Effects of Phytoplankton and Zooplankton Entrainment,* Prepared for Electric Power Research Institute (EPRI); Effer, W. R. and J. B. Bryce, 1975, "Thermal Discharge Studies on the Great Lakes – The Canadian Experience," In *Environmental Effects of Cooling Systems at Nuclear Power Plants, Proceedings of a Symposium, Oslo, 26-30 August 1974,* IAEA (Vienna), as cited in Lawler, Matusky & Skelly Engineers, *op. cit.*; Henderson,

zooplankton, fish and invertebrate eggs and larvae, and very small (juvenile) fish and invertebrates. The plant draws these organisms in (entrains them) as it draws in cooling water.

> *"One of the most important potential aquatic impacts of steam electric power plants is the mortality of organisms that are contained in the water that is drawn through the plant for condenser cooling purposes. Organisms that are small enough to pass through the plant's intake screening system are said to be entrained, and many of these organisms may be killed by exposure to mechanical, chemical, or thermal stresses during plant passage. Of particular concern are the early life stages of populations of fish and shellfish that inhabit the adjacent water body or use the area as a spawning or nursery habitat."* [43]
>
> –Boreman and Goodyear, p. iii

Due to concerns over the potential damage to the populations of these organisms, and the ecosystem balance as a whole, the electric power industry itself recommends that an entrainment impact assessment be carried out when a plant uses a large percentage of the water body.[44] Not only does the SBPP withdraw cooling water from the entire water column,[45] the plant's daily intake of water is an extraordinarily high percentage of the water body. Yet, no entrainment impact assessment has been performed for the South Bay Power Plant for over 20 years.[46]

Entrained organisms are either killed outright by the plant due to temperature, pressure and chemical shock, or come through the plant alive, but in a significantly compromised state. Many of these organisms will go through the plant multiple times because what is supposed to be "once-through" cooling is actually "many times-through" cooling. In 1980 it was estimated that approximately 31 percent of the intake water was recirculated at least once in two and a half days.[47] In 1996 it was estimated that approximately 45 percent of the discharged water was being recirculated at least once. In fact, "significant multiple recirculation appears to occur over a period of 5 days following initial entrainment of new water."[48]

This recirculation exacerbates the impacts of temperature, chemical pollution,

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P.A. and R.M.H. Sealby, 2000, *Technical Evaluation of US Environmental Protection Agency Proposed Cooling Water Intake Regulation for New Facilities,* Pisces Conservation Ltd.

[43]Boreman, John and C. Phillip Goodyear, 1978, *An Empirical Transport Model for Evaluating Entrainment of Aquatic Organisms By Power Plants,* Power Plant Project, Office of Biological Services, Fish and Wildlife Service, U. S. Department of Interior, p. iii.

[44]Lawler, Matusky & Skelley Engineers, *op. cit.*, p. S-9.

[45] San Diego Gas & Electric Co., 1980, *South Bay Power Plant Cooling Water Intake System Demonstration,* Prepared for: California Regional Water Quality Control Board, San Diego, CA, p. 4-19.

[46]The last such study was conducted in 1979-1980. *Ibid.*

[47]*Ibid.*, p. 5-4.

[48]EA Engineering, Science, and Technology, 1996, *Technical Report on Net/Gross Discharge Limits.* Final Report prepared for San Diego Gas and Electric Co., p. 6.

entrainment, excess nutrients, suspended solids, and other harmful impacts discussed throughout this paper. The problems associated with recirculation are further amplified by the sluggish circulation in South Bay. The tidal current exchange process is quite slow, tending to isolate this region from the rest of the bay.[49] In the "*near field*" area (the body of water under direct influence of the plant) ebb directed flow is never strong enough to counteract intake water withdrawal.

A study was conducted in 1979-1980 to evaluate the impacts of the SBPP intake system, in order to *affirm or disprove its designation by the State as a "high impact" plant.* Study results were also used to determine *whether the intake design reflects the best available technology to minimize adverse environmental impacts.*[50] The SBPP had been designated by the state as a "high impact" plant based on the location of its intake in an

> *"...area of very high value aquatic habitat."* [51]
>
> –San Diego Gas & Electric Co., 1980, p. 4-3

The entrainment of organisms in the SBPP was found to exert a negative influence on the marine animal communities during most of the year. The near field area was found to have a different zoological plankton community, as compared to the rest of the bay, in terms of species composition and abundance.[52] Most critical zooplankton taxa were significantly lower in number than those found at stations located away from the plant's influence. Only one species was higher in abundance in the near field.

The study also found that, in general, the near field environment was biologically different than the remainder of the bay with certain species preferring to spawn in this area, while others were absent (apparently either avoiding the region or killed off in this area). The study suggested high power plant recirculation rates may be partly responsible for the lower abundance, as may the harsh physical conditions of high turbidity, slow flushing, and temperature and salinity extremes.[53]

Effects on phytoplankton were documented by measuring differences in the chlorophyll a of the microscopic plants. Chlorophyll a concentration decreased by as much as 88 percent after the plankton passed through the plant in summer, and by 28 percent in winter.[54] Plankton killed by the plant was estimated to be less than one percent of the total bay's plankton community.[55]

To determine the impact of entrainment losses, estimates of the number of organisms

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[49]San Diego Gas & Electric Co., *op. cit.*, p. 5-4
[50]*Ibid.*, pp. 4-1, 4-2
[51]*Ibid.*, p. 4-3
[52]*Ibid.*, p. 10-28
[53]*Ibid.*, p. 10-37
[54]*Ibid.*, p. 9-3
[55]*Ibid.*, 1980, p. 9-3

killed by the plant were compared to the total population of these organisms in the bay. In order to determine total bay population size, the average densities of organisms found at the sampling stations were multiplied by the volume of the bay. This method resulted in very large population numbers. Even so, the percentage of the populations of various species killed by the plant in 1979 ranged from less than 1 percent of the population to 28 percent of the population for goby-types fishes during peak entrainment.[56] As one example of the potential ecological impacts of these losses, gobies are believed to be an important food source for young tern chicks.[57]

One method used to analyze the importance of entrainment of fish eggs and larvae is to estimate the number of adults which would have resulted from the entrained larvae.[58] Although the method provides little insight into the long term viability of the affected populations, it can be used to obtain a first approximation of the severity of potential losses. The 1979-1980 study estimated loss using such a method and found that the plant killed 8 million gobiids (goby-type fishes) in 1979, 240,000 anchovies, and 42,000 topsmelt.[59] At the time, these numbers were considered to represent an acceptably low impact. Based on this finding, and a low impact finding for impingement (discussed below), the SBPP's designation as a high impact plant was changed to "low impact."[60] Because the plant's impact was determined to be low, it was assumed that the technology used at the time was the best technology available.

Because the natural community of plankton and early life stage organisms was not documented before the plant began operating, we do not know the cumulative, long-term effects of the damage to these populations. Obviously there is a huge impact to south bay plankton and early life stages of organisms, with up to 20 percent (at mean sea level) of the South Bay's water moving through the plant at least once per day. Most of the organisms present today apparently come in with the tide from other parts of the bay. Enhancements to the south bay environment to protect this rare habitat, and increase its productiveness, would appear to be quickly counteracted by the plant's huge influence on what should be a critical nursery ground.

Trapping and Killing of Fishes and Large Invertebrates

Adult fishes and invertebrates in the vicinity of the intake are drawn into the plant intake structure and are trapped (impinged) by either a "trash rack" or by a series of screens. Fishes that are attracted by the heated discharge water or take refuge in the area during storms may also become impinged due to the proximity of the intake to the discharge channel. The

[56] *Ibid.*, p. 10-38.

[57] Gilbert, N., US Fish and Wildlife Service, June 6, 2001, Letter to J. Robertus, Regional Water Qualtiy Control Board.

[58] Goodyear, C. Phillip, 1978, *Entrainment Impact Estimates Using the Equivalent Adult Approach,* Power Plant Project, Office of Biological Services, Fish and Wildlife Service, U.S. Department of the Interior, p. 1.

[59] San Diego Gas & Electric Co., *op. cit.*, p. 10-49.

[60] *Ibid.*, p. 10-1.

dominant species observed at the San Onofre Power Plant outfall, for example, were also those found to suffer the highest rates of entrapment in the intake system.[61]

Despite wide acknowledgment that impingement is a major source of power plant impacts, no study has been conducted to address this impact for the last 20 years. The only recent fish-related study of the south bay plant is a report on fishes that are found in the discharge channel.[62] This study does not address the millions of larval fishes and tens of thousands of adult fishes that are drawn into and die in the plant each year.

The 1979-1980 study (discussed above) considered impingement and estimated that 28,174 individual fish were killed in the plant in 1979. The most commonly impinged species were the round stingray, topsmelt, two species of anchovies, the specklefin midshipman, and the Pacific butterfish.[63] The numbers of fish impacted were considered to be insignificant when compared to the total population of these fish species in San Diego Bay. If the "source water resource" was considered to be the South Bay rather than the entire bay, then the percentage of the population killed would be much higher. Impingement losses were also compared to commercial fishing takes and natural losses.

The effect of these types of environmental impacts do not necessarily diminish with distance from their source[64] and there may be time lags before the impact occurs.

> *"Entrainment and impingement losses may affect ecosystems many miles from the power plant, particularly when species are migratory. Similarly, time lags in response may mask severe impacts."* [65]
>
> –Fritz *et al.*, p. 20

Killing of Clams, Mussels, and Other Organisms That Inhabit the Bottom (Benthic) Environment

Operation of the power plant kills benthic life in the discharge channel. This has been an established fact since the first studies of the plant's effects were conducted in the late 1960s and early 1970s.[66] At that time and until very recently (1997) the discharge channel was not

[61]Tetra Tech, Inc., 1977, Unpublished, as cited in Thomas, *et al., The Effects of Thermal Discharges on Fish Distribution and Abundance in the Vicinity of the San Onofre Nuclear Generating Station,* Final Report to the Marine Review Committee, p. 12.

[62]Merkel and Associates, Inc., 2000, *South Bay Power Plant Cooling Water Discharge Channel Fish Community Characterization Study,* Final Report, Prepared for Duke Energy South Bay LLC.

[63]San Diego Gas & Electric Co., *op. cit.*, p. 7-2.

[64]Holling, 1978, as cited in Fritz et al, 1980, *Strategy for Assessing Impacts of Power Plants on Fish and Shellfish Populations,* Power Plant Project, Office of Biological Services, Fish and Wildlife Service, U.S. Department of the Interior, p. 20.

[65]Fritz *et al.*, *op. cit.*, p. 20.

[66]Ford, 1968, *op. cit.*, Ford *et al.*, 1970, *Ecological effects of power station cooling water in South San Diego Bay during August 1970,* Prepared for the San Diego Gas & Electric Co., Environmental Engineering

considered by the power plant or the regulatory authority as part of the Bay, even though this channel "incorporates many acres of prime biological shallow water and intertidal habitat."[67] Instead this part of the Bay was defined as part of the plant. For this reason, studies up until 1997 could conclude that there were "no significant impacts" from the plant on benthic life.

Dissertation research on two types of clams illustrates the toxicity of temperatures in the discharge channel. In 1981, Merino found that the heated discharge from the plant affected the distribution, growth, and reproductive characteristics of the California jackknife clam (Tagelus californianus) and the pencil clam (Solen rosaceus).[68] The pencil clam could only survive at a distance of more than 2100 meters from the point of discharge; the jackknife clam could survive beyond 750 meters, and only by buffering itself in the sediments.[69] Clams surviving in the discharge channel beyond these distances were found to grow faster, but to have more variable reproductive effort, fewer young, and shorter life spans, while clams inhabiting areas away from the increased temperatures of the discharge channel had a more predictable breeding cycle resulting in numerous young, longer life spans, and larger ultimate size.[70]

Sea Turtles

It is believed that sea turtles were residing in San Diego Bay long before human settlement. Today the Bay supports a population of turtles, roughly estimated at 30 to 60 individuals. Over 30 have been tagged over a ten year period.[71] Turtles also occur in Mission Bay, and are known to associate with power plants north of San Diego.[72] With the use of genetic information, these turtles have now been identified as green turtles (Chelonia mydas) belonging to a Mexican subpopulation.[73] The green turtle population has crashed due to

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Laboratory Tech. Rept.; Ford *et al.*, 1971, *Ecological effects of power station cooling water in South San Diego Bay during February-March 1971,* Prepared for the San Diego Gas & Electric Co., Environmental Engineering Laboratory Tech. Rept.; Ford *et al.*, 1972, *Ecological effects of power station cooling water in South San Diego Bay during August 1972,* Prepared for the San Diego Gas & Electric Co., Environmental Engineering Laboratory Tech. Rept.; Ford, R.F., and R.L. Chambers, 1973, *Thermal Distribution and biological studies of the South Bay Power Plant,* Prepared for the San Diego Gas & Electric Co., Environmental Engineering Laboratory Tech. Rept.; Ford, R.F., and R.L. Chambers, 1974, *Thermal distribution and biological studies for the South Bay Power Plant,* Prepared for the San Diego Gas & Electric Co., Environmental Engineering Laboratory Tech. Rept.

[67]Michael Brandman Associates, *et al., op. cit., p. III-15.*

[68]Merino, Jose-Maria, 1981, *A Study of the Temperature Tolerances of Adult Solen rosaceus and Tagelus californianus in South San Diego Bay: The Effects of Power Plant Cooling Waste Discharge,* A Dissertation, San Diego State University/University of California Riverside, p. 3.

[69]*Ibid.*, p. 110-111.

[70]*Ibid.*, p. 121.

[71]Peter Dutton, personal communication, 2001.

[72]McDonald *et al.*, 1994, *A Review of the Green Turtles of South San Diego Bay in Relation to the Operations of the SDG&E South Bay Power Plant, Doc 94-045-01,* Prepared for San Diego Gas & Electric Co., San Diego, CA, p. 10.

[73]Peter Dutton, personal communication, 2001.

enormous taking (killing) of these turtles in the lagoons of Mexico where they feed (foraging grounds), and is now considered endangered throughout most of its range.[74] Because the waters of South Bay are naturally warm due to shallow depths, it is expected that turtles would continue to come to San Diego bay to feed in the absence of the power plant.[75]

Halibut

The California halibut (Paralichthys californicus) is important to the ecology and fisheries of southern California. Its population may be threatened by the development of embayments used as nursery habitats. It appears that temperature, turbulence, and sediment characteristics (related to turbulence) are important factors determining whether juvenile halibut will settle in an area. Juveniles tend to be found in areas with higher oxygen concentrations[76] and settlement of halibut has been found to decrease rapidly above 22°C (72°F).[77]

A study of the distribution of juvenile halibut revealed that there are many fewer juveniles in San Diego Bay (13,759) as compared to Mission Bay (22,082), yet San Diego Bay is approximately five times the area of Mission Bay.[78] The density in shallow water habitats (less than 1 meter in depth) was found to be 21 per hectare in Agua Hediona, 66 per hectare in Mission Bay, and less than 1 per hectare in San Diego Bay.[79]

Impacts of Chlorine on Marine Life

The South Bay Power Plant uses chlorine in the form of sodium hypochlorite daily to kill plants and animals that would otherwise grow on the cooling water system piping or other surfaces. The use of chlorination in once-through cooling systems has been questioned since at least 1979.[80] Almost all species of animals are hit hard by chlorine. This effect is exacerbated in a shallow, poorly circulated environment like the South Bay. Valves in the plant are designed to automatically release chlorine for a total of 80 minutes every four hours, but may periodically become stuck open. A stuck valve means that chlorine is being continuously released; this may be one explanation for fish kills reported in the area of the SBPP.

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[74]McDonald *et al., op. cit.*, p. 9.

[75]Peter Dutton, personal communication, 2001.

[76]MBC Applied Environmental Sciences, 1992, *Distribution of Juvenile California Halibut (Paralichthys Californicus) in Bay and Coastal Habitats of Los Angeles, Orange, and San Diego Counties in 1992.* Final Report, p. 1, viii.

[77]MBC 1991b, as cited in *ibid.*, p. 1.

[78]Kramer, Sharon Hendrix, 1990, *Habitat Specificity and Ontogenetic Movements of Juvenile California Halibut, Paralichthys californicus, and Other Flatfishes in Shallow Waters of Southern California,* A Dissertation, University of California, San Diego, p. 61; Kramer, S. H., "Distribution and Abundance of Juvenile California Halibut, Paralichthys californicus, in Shallow Waters of San Diego County," p. 119, listed in *The California Halibut, Paralichthys californicus, Resource and Fisheries* edited by Charles W. Haugen, 1990.

[79]Kramer, S. H., 1997, Memorandum to Laura Hunter, Environmental Health Coalition.

[80]Majewski and Miller, *op. cit.*, p. 22.

In addition to its immediate effects, chlorine is now known to break down, complex with other substances, and form new compounds such as chlorinated organics.[81] These chlorinated organic compounds can remain toxic for aquatic life for long periods.[82] Sublethal effects of free and combined chlorine on fish, invertebrates, and other marine organisms need to be assessed for the SBPP discharge, and factored into regulatory limits.[83] Chlorinated cooling waters have been found to cause significant sublethal stress to some organisms, so that measurements of surviving organisms underestimate chlorine toxicity.[84] Low-levels of chlorination, dechlorination of water, and rapid dilution of cooling water discharge are recommended to protect marine life.[85] Yet the SBPP uses significant amounts of chlorine (see below), does not dechlorinate, and rapid dilution is impossible in the shallow waters of South Bay (unlike power plants on the coastal ocean where dilution is rapid, and the intake and discharge water volumes represent a small percentage of the overall water body).

The plant uses more chlorine in summer, compounding the effects of higher summer water temperature, less dissolved oxygen, and the greater toxicity of other chemicals. In 1980 it was reported that to produce the (then) seven minute injections of chlorine, a maximum of 233 pounds of chlorine was injected per 24 hours in the winter, and 653 pounds in the summer.[86] More recently, the SBPP reported use of 4119 pounds of chlorine during the month of August, 2001.[87] We know little of the concentration of chlorine in the cooling water released by the plant, and how these concentrations fluctuate, because the plant only tests the discharge water for chlorine twice monthly, and uses a "grab" water sample to test, rather than using a continuously-plotting analyzer. These major problems with the plant's monitoring for chlorine have been raised by the regulatory authority:

> *"Here is a pollutant that SDG&E intentionally puts into cooling water several times daily for purposes [of] killing marine organisms yet monitoring is required only twice a month, during one chlorination cycle, when the SDG&E thinks the concentrations are likely to be highest, by means of grab samples."* [88]

> *"The more I think about the current requirement for monitoring chlorine by means of twice monthly grab samples, the more inadequate and ridiculous that seems to me, given (a) the intermittent nature of chlorine discharges, (b) the likely fluctuations in effluent chlorine concentrations and (c) the relationship between the chlorine limit and the duration of uninterrupted chlorine discharge. That thought is reinforced when I learn*

[81]Jolley, R. L. 1975, "Chlorine-containing organic constituents in sewage effluents," *J. Water Poll. Control Fed.*, Vol. 47, p. 601-618, as cited in Majewski and Miller, *op. cit.*, p. 22.

[82]Gehrs *et al.*, 1974, "Effects of stable chlorine-containing organics on aquatic environments." *Nature,* Vol. 249, p. 675-676, as cited in Majewsi and Miller, *op. cit.*, p. 22.

[83]Capuzzo, Judith M. *et al.* 1977, "Chlorinated Cooling Waters in the Marine Environment: Development of Effluent Guidelines," *Marine Pollution Biology,* Vol. 8, No. 7, p. 161-163.

[84]*Ibid.*, p. 162.

[85]*Ibid.*, p. 163.

[86]San Diego Gas & Electric Co., *op. cit.*, p. 3-9.

[87]San Diego Regional Water Quality Control Board staff, personal communication, 2001.

[88]Email from B. Posthumus, RWQCB, to J. Richards, SWRCB, Sept. 7, 1998.

that SDG&E's self monitoring reports apparently typically specify the duration of uninterrupted chlorine discharge to be 20 minutes, although in our discussions with SDG&E and in their consultant's proposed chlorine limit report, a figure of 80 minutes (4 units at twenty minutes each, one right after the other) was used. Chlorine really should be measured by means of a continuously recording/plotting analyzer." [89]

"I should have realized that there is no incentive for SDG&E to use a more sensitive analytical method which would actually produce reliable measurement at level at or nearer the concentrator limits. Such a method might actually reveal noncompliance! If you use a yard stick you conveniently can't measure those small fractions of an inch...insensitive analytical methods can nullify numerical limits intended to protect sensitive critters..." [90]

–Regional Water Quality Control Board, staff correspondence

A consultant to the power company has suggested that the ability of species to avoid chlorine exposure by temporarily retreating into their shells means they can actively avoid exposure under intermittent chlorine programs.[91] This suggestion points up the toxicity of chlorine to marine organisms. Moreover, according to the consultant, more mobile forms will actively avoid chlorine concentrations in the discharge vicinity but can still utilize all habitat during the unchlorinated periods.[92] It is unclear how these mobile forms would time their use of this habitat according to the plant's chlorination cycle. Furthermore, according to the consultant, the flushing of plankton forms by tidal action and the unchlorinated plant flow in the intervals also reduces exposure of free floating organisms.[93] Again, this suggestion speaks to the risk of exposure to chlorine. Tidal flushing in South Bay is sluggish at best.

Impacts of the Release of Copper and Zinc into the Bay

The SBPP releases an estimated 400-1020 pounds of copper (a heavy metal which is highly toxic to marine life and known to accumulate in fish and shellfish) into the Bay each year.[94] Nickel concentrations in the cooling water have also been significant.[95] In addition, zinc waste plates, used for corrosion control, release zinc into the cooling water.[96]

[89]Email from B. Posthumus, RWQCB, to P. Husby, EPA, Aug. 28, 1998.

[90]Posthumus, *op. cit.* Sept. 7, 1998.

[91]Applied Science Associates, 1988, *Proposed Effluent Limit for Residual Chlorine for the South Bay Power Plant* (This document is labeled : "For settlement purposes only."), p. 6.

[92]*Ibid.*

[93]*Ibid.*

[94]SPAWARSYSCEN San Diego, 1999, *Cooling Water System Copper Study,* Final Report, p. 10.

[95]San Diego Regional Water Quality Control Board staff, personnel communication, 2001.

[96]California Regional Water Quality Control Board, San Diego Region, *Fact Sheet, Tentative Order No. 2001-283, Waste Discharge Requirements, South Bay Power Plant,* p. 7.

Copper concentration in the cooling water measured at a power plant in California was 1,800 micrograms per liter after a plant shutdown, when water sat in contact with copper-nickel tubing of the cooling water heat exchange system. This initial concentration was rapidly diluted, however even after 30 days, copper concentration in the cooling water discharge was 20 micrograms per liter.[97] Researchers reported that 1500 abalone were killed in this instance. Laboratory studies show 30 to 65 micrograms per liter of copper to be lethal to adult organisms after 96 hours of exposure for the two species tested.[98]

Copper concentrations reported in the cooling water of the SBPP were 25.7 micrograms per liter in routine monitoring required by EPA. The plant sampled over a 24 hour period in December 2000. The power plant's report states that this level is abnormally high because of "weather conditions" described as rain and choppy water conditions (which according to the report, likely stirred up the bottom of the channel and produced runoff from storm drain channels).[99] In contrast, the report indicates that measurements taken in January showed no detectable concentration of copper. As yet another example of the complexity of ecosystems, and the biological, chemical and physical processes involved, copper joins with organic material in the bay water to form additional forms of copper with different behaviors and effects.

For fishes, a decrease in oxygen levels of the water increases the apparent toxicity of zinc and copper.[100] Water temperature is possibly the most important factor affecting zinc toxicity, the higher the temperature, the shorter the survival time.[101] The juvenile inhabitants of South Bay are more sensitive to these metals than adult animals. Effects of zinc on fish populations and communities may be subtle and difficult to evaluate. Sublethal effects influence behavior, and concentrations far below the lethal level have been shown to decrease fish growth rates, and to reduce reproductive potential. The tendency of fishes to bioaccumulate zinc is variable–when bioaccumulation occurs, the metal is concentrated mainly in the liver, kidney, and digestive tract.[102] Accumulation of copper by the American oyster in the vicinity of a power plant has been documented where body burdens were measured as high as 1.28 mg/g dry weight within the cooling water discharge channel.[103] Another researcher found summer high values of 482 ppm of zinc and 80 ppm copper in oysters from the

[97]Martin, M. *et al.*, 1977, "Copper toxicity experiments in relation to abalone deaths observed in a power plant's cooling waters," California *Fish and Game,* Vol. 63, p. 95-100, as cited in Majewski and Miller, *op. cit.*, p. 39.

[98]*Ibid.*

[99]*Application for Renewal*, op. cit., EPA Form 2C Section, p. 1.

[100]Lloyd, 1960, and Lloyd and Herbert, 1962, as cited in Weatherley, Alan H., *et al.*, "Zinc Pollution and the Ecology of the Freshwater Environment," In Nriagu, Jerome O., Ed., *Zinc in the Marine Environment; Part I: Ecological Cycling.* John Wiley and Sons, New York, p. 377.

[101]*Ibid.*

[102]Weatherley, Alan H. *et al., op. cit.*

[103]Roosenburg, W.H., 1969, "Greening and copper accumulation in the American oyster, Crassostrea virginica, in the vicinity of a steam electric generating station," *Chesapeake Sci.,* Vol 10, pp. 241-252, as cited in Majewski and Miller, *op. cit.*, p. 39-40.

discharge. Intake canal oyster concentration in comparison were 138 ppm for zinc and 9 ppm copper.[104]

The SBPP reports the amount of copper released as the difference between the amount of copper in the intake water, and the amount of copper in the discharge water. But as discussed above, approximately 45 percent of the water entering the plant is recirculated at least once from the discharge channel. By allowing the plant to assume the copper in the intake water did not originate from the plant, the impact of copper from the plant on the Bay is greatly underestimated.

Eelgrass

Eelgrass (Zostera marina) forms a distinct marine habitat providing vital shelter and food for many bay inhabitants. The South Bay contains the vast majority of eelgrass living in San Diego Bay. For some reason, eelgrass is absent in the vicinity of the plant, yet plentiful west of the plant and in other areas of the South Bay. Eelgrass is highly dependent on sufficient light to thrive,[105] and declines in seagrass abundance have been linked to decreasing water transparency.[106]

The SBPP influences the amount of available light in a number of ways. First, by dredging the intake and discharge channels, the plant has created depths without sufficient light for eelgrass. Second, the discharge increases turbidity of the water which decreases light. Third, the discharge contains 20 percent more suspended solids than the intake water;[107] these solids block light and can deposit on eelgrass leaves where light is required at the plant-leaf surface. Fourth, the plant is increasing the amount of nutrients in the water (as discussed in other sections of this paper), which reduces water transparency.

Without the power plant discharge, we would expect a resurgence of eelgrass beds.

> *"Any enhancement of seagrass productivity through improved water quality will lead to improved growth, successful reproduction and an increase in the overall coverage and distribution of seagrasses. In turn this will enhance the fish, shellfish and wildlife resources dependent on seagrass habitat for food and shelter and improve shoreline and benthic stability..."* [108]

[104]Grimes, C.B., 1971, "Thermal addition studies at the Crystal River steam electric station," *Professional Paper Series*, No. 11, Florida Dept. Nat'l. Resour. Res. Lab., St. Petersburg, FL., p. 53, as cited in Majewski and Miller, *op. cit.*, p. 40.

[105]NOAA, 1991, *The Light Requirements of Seagrasses,* Results and Recommendations of a Workshop, Technical Memorandum NMFS-SEFC-287.

[106]*Ibid.*, p. 5; See also Backman, T.W, and D.C. Barilotti, 1976, "Irradiance reduction: effects on standing crops of the eelgrass *Zostera marina* in a coastal lagoon," *Marine Biology* 34:33-40.

[107]*Application for Renewal, op. cit.*, Appendix F, p. 5.

[108]NOAA, *op. cit.*, pp. 6-7.

Metals and chlorine released by the plant (discussed in other sections of this paper) may also be impacting eelgrass where present, and the absence of eelgrass near the plant. Changes in sediment composition produced by the plant may also render the sediments unsuitable for eelgrass, which requires a moderate amount of grain.[109]

A study to determine the effects of the cooling water discharge on eelgrass distributions was required as a condition of the plant's most recent permit renewal.[110] This study was required based on

> *"...the observed lack of eelgrass within the central portion of south bay in apparent synonymy with the measurable limits of the power plant thermal discharge plume."*[111]
>
> –Merkel and Associates, Inc., *Environmental Controls*, p. 1

The study determined that light environments appear to control the presence of eelgrass although "many of the specific factors dictating the light environment are not fully quantifiable and in many instances may interact with each other."[112] Findings suggest that light transmission is strongly related to suspended particulate material.[113] As discussed above, the power plant increases suspended solids, and thus water turbidity, by 20 percent.

C. Air Quality Impacts from Emissions from the South Bay Power Plant

Emissions from the South Bay Power Plant

The SBPP is primarily a natural gas burning plant, though it can run on oil when natural gas supplies are curtailed. Natural gas plants are often called "clean-burning", which is not an accurate description. While natural gas certainly burns clean**er** than oil and coal, natural gas plants still pollute the air with significant quantities of nitrogen oxides (NO_x), particulate matter (PM), other criteria pollutants, and toxic air contaminants (TACs).

[109]Richard F. Ford, personal communication, 2001.

[110]Merkel & Associates, Inc., 2000, *Environmental Controls on the Distribution of Eelgrass (Zostera marina L.) in South San Diego Bay: An assessment of the Relative Roles of Light, Temperature, and Turbidity in Dictating the Development and Persistence of Seagrass in a Shallow Back-Bay Environment.*

[111]*Ibid.*, p. 1.

[112]*Ibid.*, p. 2.

[113]*Ibid.*, p. 10.

Air pollutants are classified into two basic regulatory categories, criteria pollutants and Toxic Air Contaminants (TACs). Criteria pollutants were chosen for a special regulatory structure because there was well-documented evidence (criteria) of the health risks posed by these pollutants.

The criteria pollutants that are of primary concern from the South Bay Power Plant are nitrogen oxides and particulate matter, of a size 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$), though other criteria pollutants may be of concern under certain conditions. When burning natural gas, the SBPP emits 3.1 tons (6,200 pounds) a day of NO_X and 0.8 tons (1,600 lbs.) a day of PM_{10} at peak generation.[114]

NO_x are of concern primarily as precursors to ozone (smog). Ozone has been linked to asthma, reduced lung development in children, and other adverse health impacts. San Diego is classified as non-attainment-serious for ozone at the federal and state levels, meaning that San Diego violates both federal and state air quality standards.

Particulate matter (PM_{10} and $PM_{2.5}$) aggravates and may cause asthma and other respiratory illnesses and has been linked to premature death among the sick and elderly. San Diego is classified as non-attainment for PM_{10} at the state level, and has yet to be classified for $PM_{2.5}$ at the federal or state levels. Particulate matter can travel as a regional pollutant but can also have significant localized impacts.

Emissions under natural-gas curtailment

The SBPP is a dual-fuel plant, meaning that it can run on oil when natural gas supplies are cut off. During the year prior to April 2001, natural gas supply was curtailed to the South Bay Plant on 14 days. When burning oil, the SBPP can emit over two times more NO_x, three times more particulate matter, 400 times more SO_x (sulfur oxides), and far greater quantities of TACs.[115] Oil burning by power plants can also result in emissions of highly toxic dioxin.[116]

D. Environmental Justice Impacts of Power Plants in South Bay Area

In the wake of the energy crisis, there is a serious concern that the press to build power plants to offset the energy demand is resulting in low income and communities color bearing a disproportionate burden of impacts of these plants. In a study that examined the recent siting

[114]Steven Moore. San Diego County Air Pollution Control District. Testimony on behalf of APCD before the Public Utilities Commission per an "Order Instituting Investigation into the Adequacy of the SoCalGas' and San Diego Gas & Electric Company's (SDG&E) gas transmission systems to serve the present and future gas requirements of SDG&E's core and non-core customers" April 25, 2001. p. 8.

[115]*Ibid.*, p. 8.

[116]EPA Sector Notebook, Profile of the Fossil Fuel Electric Power Generation Industry, Sept., 1997, p. 67.

of power plants in California, 89% of plants studied were sited in areas that contained over 50% people of color within six miles of the plants.[117] Latinos were particularly over-represented in communities where power plants were sited.

According to the study, low-income communities were targeted for power plant siting. For 83% of the plants, the average household income was less than $25,000 per annum among the population living within six miles of the facility.[118] Locally, a peaker power plant proposed by Ramco Inc., in Chula Vista was sited near a community that is 77.3% Latino. In addition, new power plants have been proposed in Baja California, Mexico that will impact the San Diego/Tijuana air basin. Of power plants of which construction has begun or been completed over the past year in San Diego County, many are located in the South Bay Area, including Otay Mesa, which has raised concerns about this area bearing a disproportionate burden of new power plant development in San Diego.[119] In Otay Mesa, the 90 MW Wildflower Larkspur Peaker Plant was built last summer, and the 500 MW Otay Mesa Generating Project and the 49 MW Calpeak Border Peaker are under construction. In Chula Vista, a 49 MW facility owned by PG&E is under construction.[120] The community living in a six mile radius of the SBPP is 77% Latino and people of color, with 14.6% living below the poverty level.[121]

[117] Latino Issues Forum. *Power Against the People?: Moving Beyond Crisis Planning in California Energy Policy,* November 13, 2001, p. 5.

[118] *Ibid.*, p. 5.

[119] *Comments on RAMCO Chula Vista II Peaker Generation Station (01-EP-3);* City of Chula Vista comment letter to the California Energy Commission, June 11, 2001, p. 1.

[120] California Energy Commission web site. Status of all Projects. <http://www.energy.ca.gov/sitingcases/status_all_projects.html> Accessed Nov. 19, 2001.

[121] 2000 census data (ethnicity); 1990 Census Data (poverty level). This % compares with 11.3% poverty level for the county. The 2000 poverty levels are not available.

Section 3

Environmentally Preferable Alternatives to once-through cooling

There are essentially three methods of cooling a power plant: wet-cooling (once-through and closed-cycle) and dry-cooling. Fortunately, there are feasible, viable, and protective alternatives to the once-through cooling currently used by SBPP. These are discussed below.

A. Overview: Wet-cooling: once-through and closed-cycle

Wet-cooling systems can be **once-through** or **closed-cycle**[122] systems. Both wet-cooling systems are water intensive.[123] In once-through cooling, water is taken from a local body of water, passed through steam condensers, heated up, then discharged back to the waterbody. As previously discussed, this method is environmentally devastating in a sensitive marine environment like South San Diego Bay.

Another type of cooling system is "closed-cycle"or use of evaporative cooling towers. It involves significant reuse and recirculation of cooling water. In a cooling tower system, water is circulated through the towers to transfer heat to the air through evaporation. Closed-cycle results in a unsightly steam plume and particulate matter emissions to the air. In wet-cooling systems, the heat is removed from the cooling water by being evaporated off in cooling towers. Towers are used to transfer the heat to the air through evaporation. This kind of system also has significant impacts. There are air quality impacts in that the evaporated water results in emissions of PM_{10} particulates although most particulate emissions are the salts and minerals and not the combustion by-products that are of more concern for human health.[124] A 500 MW plant with a cooling tower emits 30 tons a year of PM_{10}.[125] They require significant use of water (2-3,000 acre feet of water a year for 500 MW plant) to replace water lost to evaporation in the cooling towers ("make-up" water) and still produces thermal discharges to the bay. Cooling towers are also large, unsightly, and the evaporation emits a large visible, unattractive plume.

[122]We recognize that "closed" system is a misnomer because in all cases, heat leaves the cooling system. However, this is a common usage term for this type of system.

[123]Tellus report, pp. 2-3.

[124]Personal Communication, M. Layton, CEC, November 11, 2001.

[125]Position Paper: Environmental Impacts and Sustainable Solutions for New Power Plants in the U.S.-Mexico Border Region; Border Power Plant Working Group, August 22, 2001, p. 7.

B. Dry-cooling: The Better Option

Dry-cooling of steam turbine condensate has been available for more than 40 years and has been used in all climates. For example, a large number of dry-cooled plants are located in the arid regions of Mexico and the United States.[126] Dry-cooling is recommended by the World Bank for all climatic conditions due to the inherently "sustainable" nature of the technology from the standpoint of water resource use.[127]

Dry-cooling **uses air instead of water to cool the low-pressure steam leaving the steam turbines.** Large radiator-type tube banks are used to transfer heat from the condensing steam to air passing over the tubes. Large diameter axial fans are located under the tubes and force large quantities of air through the tube banks via a boiler feedwater pump. Dry-cooling has no air or water polluting emissions. There is no water evaporation, no visible plume, no thermal discharges, and no particulate air emissions.[128] Dry-cooling results in a small loss in plant thermal efficiency at high ambient temperatures compared to wet-cooling. For example, the overall plant thermal efficiency of the air-cooled Otay Mesa Power Plant is about 2% less on an annual basis compared to a hypothetical wet-cooled alternative, primarily due to the high summertime temperatures at the inland plant site location. There would be virtually no difference in the performance of a wet- or dry-cooled plant located on San Diego Bay in a perpetually temperate, humid micro-climate. Some or all of any efficiency loss would be counterbalanced by the capital costs, parasitic energy loads, and maintenance costs of wet-cooling auxiliary systems. For once-through wet-cooling systems these loads and costs include the energy necessary to move massive quantities of water through the cooling circuit and the cost of biocides and corrosion inhibitors to protect cooling system hardware. For evaporative wet-cooling systems, these costs include:

- Capital cost of civil works infrastructure to transport raw water to plant site
- Capital cost of wet-cooling tower and condensing plant
- Pump energy to move water to plant site
- Raw water
- Capital cost of raw water treatment civil works and mechanical infrastructure (if necessary)
- Raw water treatment (if necessary)
- Water treatment solids generation and disposal
- PM_{10} emissions from cooling tower(s) – emission reduction credit cost

[126]Position Paper: Environmental Impacts and Sustainable Solutions for New Power Plants in the U.S.-Mexico Border Region, Border Power Plant Working Group, August 22, 2001, p. 7.

[127]*Ibid.*, Border Working Group Position paper, p. 7.

[128]*Urgent Need for Bilateral Agreement Between the United States and Mexico Regarding Sustainable Environmental Requirements for New Power Plants in the Border Region;* letter from Border Power Plant Working Group to The Honorable Colin Powell and Dr. Jorge Castaneda *et al.*; August 22, 2001; p. 3; Tellus Report, pp. 6-7.

- Capital cost of cooling tower blowdown treatment civil works and mechanical infrastructure
- Cooling tower blowdown (wastewater) treatment
- Capital cost of evaporation ponds for cooling tower blowdown (if used)
- Cooling tower blowdown treatment solids generation and disposal[129]

The air cooled Otay Mesa Power Plant sacrifices about 2% efficiency due to cooling.[130] Water is only needed for periodic system maintenance and cleaning. Dry-cooling could result in reductions in water use by over 99% over once-through wet-cooling and over 95% over closed-cycle wet-cooling.[131]

Two additional factors are present to further reduce and eliminate fish and marine life impacts. First, the relatively minuscule volumes of water required by dry-cooling allow for lower intake velocities, smaller intake structures, and other factors that reduce impacts. Second, the amounts of water are so low that other water supplies, such as reclaimed water, can be substituted for the biologically rich bay water.

Dry-cooling uses no chlorine or chlorine products

Another significant advantage of dry-cooling is that it does not need to sterilize the water it uses for cooling. The current, massive amount of sodium hypochlorite (chlorine) used to sterilize the once-though cooling water is completely avoided. This removes the need for up to 89,000 gallons of chlorine per year to be stored on site and transported through neighboring communities. Chlorine products are also very damaging to the environment during their manufacture and these impacts, too, are avoided through the use of dry-cooling.

Other advantages of Dry-cooling

Dry-cooling is desirable for other, non-ecological reasons. Because the system allows siting flexibility (i.e. does not need to be located on a body of water) a plant need not usurp valuable bayfront property. Such facilities can be located on difficult to develop sites.

Further, permitting issues are greatly reduced with dry-cooling and will allow a plant to be permitted, built, and processed more quickly. Several power developers have found that by using dry-cooling they can move more rapidly through federal and state permitting processes, getting energy to market more quickly.[132] Dry-cooling will enjoy a higher level of community

[129]Personal communication (email), Bill Powers, Powers Engineering, Inc., Nov. 20, 2001.

[130] California Energy Commission Staff Report Otay Mesa Generating Project May 2000, p. 367

[131]Comments on EPA's Proposed Regulation for Cooling Water Intake Structures, Riverkeeper *et.al.*, Nov. 9, 2000. p .21.

[132]*Comments on the EPA's Proposed Regulation on Cooling Water Intake Structures for New Facilities*, prepared by Bill Dougherty, Ph.D., *et al.*, Tellus Institute, November 8, p. 18 .

acceptance and less permitting obstacles. Smoother permitting means a plant can be on-line months earlier, earning back the money spent on dry-cooling. For example, the 480 MW dry-cooled El Dorado Energy Plant build in Nevada by Enron broke ground in 1998 and was online in 1999.

What are the drawbacks to dry-cooling?

There are very few drawbacks to dry-cooling. The cooling units require more land than cooling towers as they to not stick up like factory smokes stacks. There is an incremental efficiency reduction at high ambient temperatures and low ambient humidity conditions compared to wet-cooling. Depending on conditions, this is expected to be no more that 2% on an annual average. When permitting the Otay Mesa Generating Plant, California Energy Commission staff stated, "Given the vast reduction in plant water requirements, staff deems this an insignificant reduction."[133] At the Athens Generating plant in New York state estimates are between 1.4 and 1.9% efficiency loss.[134] Dry-cooling also requires larger up-front capital costs than wet-cooling although these costs are offset over time by the capital and the operating and maintenance costs of wet-cooling auxiliary systems, cost reductions resulting from quicker permitting, and the use of lower cost, non-waterfront property. The destruction of San Diego Bay natural resources also constitutes a "cost" to the region and the environment that has never been recognized and amounts to a subsidy of power generation by the natural environment. If there were true-cost accounting of impacts to water quality, wet-cooling would prove to be the most expensive cooling options by a wide margin.

C. Dry-cooling Case Studies

Dry-cooling is increasing in use

San Diego is not the only location where the conflict is growing over the use of native surface waters for cooling power plants. The use of dry-cooling in power plant applications is widespread and on the increase. There are over 600 dry-cooled electric power plants world-wide and there are 50 dry-cooled power plants in the United States. These plants are of a variety of sizes, types, and located in a variety of climates. Although dry-cooling (like all cooling) can be most effective in colder climates, dry-cooling is used effectively in very warm climates such as Mexico, Nevada, and Saudi Arabia, as well as Southern California. The Public Utilities Commission recently approved the construction of the Otay Mesa Generating project, a 510 MW combined cycle power plant that uses dry-cooling. The world's largest dry-cooled plant is the 4,000 MW Matimba plant in South Africa.[135] Twenty-seven percent of new capacity

[133]CEC staff report, p. 367.
[134]Judge's brief, Case 97-F-1563, pp. 228-229.
[135]Tellus Report, p. 10.

since 1985 has utilized dry-cooling and 4600 MW of dry-cooled power are currently under construction.[136] Locally, the Border Power Plant Working Group recommends that dry-cooling be mandated in all non-coastal areas.

Case Study in Dry-cooling: PG&E Athens Generating Plant, New York

In a recent and significant victory for ecological protection, a new power plant was sited in Athens, New York, near the Hudson River. It is a combined-cycle power plant that will generate 1080 megawatts of electric power–and is dry-cooled. The entire plant and cooling system occupy a 20 acre site and there are no emissions or plumes associated with the cooling system.[137] Combined-cycle technology plants have an efficiency nearly double that of older power plants and in this case the new plant uses only 0.18 MGD (180,000 gallons a day). This amount is only 2.4% of the water that would be used if the Athens Generating Plant used a state-of-the-art closed-cycle wet-cooling system.[138] This plant will kill on the order of one-thousandth of the number of fish of a comparably sized once-through plant. Instead of being resentful of the requirement to use dry-cooling, the PG&E Director of Public Relations told the Albany newspaper *"We're not challenging any of the conditions. We're going to accept it. Glad to have it."*[139]

Case Study in Dry-cooling: The Samalayuca Plant, Chihuaua, Mexico

This plant has been in operation and using dry-cooling since the mid-1990s. The Comisión Federal de Electricidad (CFE-Mexico's utility monopoly) stated that the CFE considers dry-cooling the state-of-the-art cooling system for new power plants, both for performance and environmental reasons.[140]

[136]Tellus Report, pp. 9-10.
[137]Personal communication, Kristine Schittini, Athens Generating Project, September 25, 2001
[138]Tellus report, p. 14.
[139]*Albany Times-Union*, July 15, 2000 as cited in Riverkeeper *et al.*
[140]Position Paper: Border Power Plant Working Group, p. 7.

Section 4

Recommendations and Rationale for Action

A. Overview of Problems and Solutions

The Problem: Cooling that Kills

The South Bay Power Plant has been severely degrading the San Diego Bay ecosystem with thermal and chemical discharges pollution and killing of plankton, juvenile, larvae, and adult organisms through entrainment and impingement for more than 40 years. These continual impacts have resulted is a degraded marine ecosystem. This degraded condition is now so long-standing that it is considered the "base-line" for South Bay. This grossly inefficient plant is also a source of air pollution and a blight on the community. With increasing evidence of the plant's negative impacts combined with the timing of an NPDES renewal and 303(d) update, **now** is the time to address the plant's chronic impacts.

The Solutions:

1. Build a State of the Art Power Plant to Replace the SBPP

The SBPP must be replaced as soon as possible with a more efficient, dry-cooled plant and there must be aggressive commitments to conservation and clean, renewable energy sources. A dry-cooled plant will not need to use Bay water for cooling. This will result in less air and water emissions and use of less hazardous materials in the region. Officials should establish an enforceable time line to phase out the South Bay plant.

2. Provide Comprehensive and Meaningful Regulation of the Existing Power Plant

The SBPP NPDES permit is up for renewal in December for another five years. In the near-term, the Regional Board must require new, more protective requirements for the discharge. The renewal should include a condition that any replacement plant should not use Bay water for cooling, that impacts from current practices should be fully mitigated, and that the Bay should be restored. The monitoring regime for the new permit should reflect current discharges to the Bay and be designed to fully assess impacts on beneficial uses.

3. Recognize the Impacts of the SBPP on South San Diego Bay

The marine life of South Bay is heavily impacted by the power plant discharge and cooling process. South San Diego Bay should be added to the 303(d) list of "impaired" waterbodies so that it receives priority action for protection.

B. Future Plans for the SBPP

Within the next five year permit period (December I4, 200I through December I4, 2006), options for the SBPP include:

- Continued operation of the existing power plant;
- Replacement of the existing plant with a new plant; or,
- Cease operations of the plant completely.

Increasing evidence suggests that the power plant will be replaced and this could happen soon. Documents from the City of Chula Vista, San Diego Unified Port District, Duke Energy, and advocates wishing to form a public utility district show it is the strong intention that the SBPP be torn down and replaced. Some of this evidence includes:

I. Closing Sales Documents (I998)

"Buyer proposes that the closure and decommissioning of the Plant would serve the public interest by mitigating air, water and other environmental, health and safety, and community impacts associated with the Plant." [141]

2. Cooperative Agreement Port and Duke (I998)

"*...Duke shall use commercially reasonable efforts to develop, finance, construct and place into commercial operation a new generation plant replacing the South Bay Power Plant..."* [142]

3. Resolution of the Directors of Duke Capital Corporation (I998)

"Duke South Bay will agree to use its commercially reasonable efforts to develop a new generating facility to replace the capacity of the South Bay Plant pursuant to the terms of the Cooperation Agreement.." and " Duke South Bay anticipates making ceratin capital expenditures at the South Bay Plant.....in order...to meet more stringent environmental criteria and anticipates expending certain of its own funds in order to decommission the South Bay Plant at the end of the Lease." [143]

[141]SDG&E South Bay Execution Closing Documents, December II, I998, p. 2.

[142]Cooperation Agreement between San Diego Unified Port District and Duke Energy South Bay, LLC, Dated as of December, II, I998, Article 7.

[143]Resolutions of the Directors of Duke Capital Corporation, Effective December 9, I998.

4. State Lands Commission

A January 9, 1999 staff report to the State Lands Commission outlined the Port's rationale for purchasing the power plant. *"The Port's purchase of the property would be with the intent of decommissioning and demolishing the plant for the betterment of the San Diego region and to make these bayfront lands available for Public Trust purposes..."* [144]

5. San Diego Unified Port District

The December 3, 1998 Port District staff report states "*The Port of San Diego recognized that it would be in the baywide region's best interest to purchase the plant as the means to accelerate the closure, decommissioning and/or relocation of the plant."* [145] If a relocation or closure of the plant is not possible, the Port made clear that, "*If reasonable commercial efforts fail to identify an acceptable site away from the SBPP site, the Port may permit Duke to construct the RGP at the South Bay site. A modern, more efficient and environmentally sensitive plant could be built on approximately 25 acres..".*[146]

6. San Diego Daily Transcript (1999)

"...Duke Energy Power services to lease and operate the plant for 10 ½ years during which time Duke is required to dismantle the plant and either build a smaller and more environmentally friendly plant on the same site or relocate and build elsewhere." [147]

7. San Diego Union Tribune (2001)

"Duke said efforts to find a new site for a power plant have failed....The company plans to file applications by October to build a new plant on 30 acres at the current site." [148]

The intent is crystal clear. There will be efforts to replace the SBPP and the planning will occur soon.

C. The Rationale for a "Dry-cooled" Replacement Plant

A repower alone, however, is insufficient. We must address the ongoing impacts of the SBPP with the cleanest repower possible and Duke's "Moss Landing" approach is not an option. Although Duke has expanded the power plant in Moss Landing, this was done without reducing or eliminating the heated water discharge. Such action will be vigorously opposed in San Diego. In the case of Moss Landing, Duke "mitigated" the biological impacts of pumping 1.2

[144]Staff report to the State Lands Commission, January 29, 1999, p. 2.
[145]Staff report to San Diego Unified Port District December 3, 1998, p. 4.
[146]Staff report to San Diego Unified Port District, December 3, 1998, p. 14.
[147]"Next Level in Win-Win Deal May Be Hard To Reach," *San Diego Daily Transcript*, August 19, 1999.
[148]"Port's South Bay deal with Duke draws fire," *San Diego Union Tribune*, May 2, 2001.

billion gallons a day of seawater by paying $12 million to five environmental groups.[149] Fortunately, Voices of the Wetlands and Earthjustice Legal Defense Fund, opposed the impacts and has filed a lawsuit in an attempt to overturn the State's permit renewal.[150]

A New Plant with Dry-cooling is the Only Acceptable Replacement Option to Protect Environment, Public Health, and Community Interests

A feasible and reasonable alternative to the use of once-through cooling in a old, inefficient power plant exists and is readily available. Dry-cooling of a new, more efficient power plant would result in reduction in water use by over 99% over once-through wet-cooling and over 95% over closed-cycle cooling. This would provide tremendous environmental benefits because water use could be met with a non-Bay water source. Dry-cooling also uses no chlorine or chlorine products, thus reducing the impacts on the bay and eliminating the use of hazardous materials and the impacts related to the production, transportation, and storage of this highly toxic material.

Air emissions could also be significantly reduced. Currently, the SBPP emits an unacceptable 3.1 tons (6,200 pounds) a day of NO_x. and 0.8 tons (1,600 lbs.) of PM_{10} at peak generation burning natural gas.[151] Emissions from a new, more efficient power plant with dry-cooling would dramatically lower this total. The Otay Mesa Generating Project provides an example of how a repowered SBPP could result in reduced air emissions. In contrast to the gross emissions from the SBPP, the new Otay Mesa Generating Station is anticipated to produce 716 pounds of NO_x and 916.8 pounds of PM_{10} a day as a worst-case emissions for its 510 MW generating capacity.[152] It is important to note that many factors complicate a comparison of one plant's emissions to another, such as the size of a plant, the effectiveness of control technologies, and other factors. However, a comparison between the peak emissions in 2001 at the SBPP power plant and the predicted worst-case emissions from the OMGP can provide an estimate of how much less pollution a repowered SBPP might emit. The predicted worst-case emissions of NO_x and PM_{10} from OMGP would be 83 percent and 17 percent lower per megawatt of energy produced than peak day emissions at the SBPP.

Moreover, the illusive power crisis has precipitated an unprecedented rush to construct large-scale power and peaker power plants in the region. These are targeted for areas on both sides of the U.S./Mexico border and will add tons of dangerous air pollutants to an overburdened air basin where residents are already exposed to levels of air pollution considered hazardous to human health. Plants in Mexico are under construction without the mitigation off-sets required in the U.S. This allows a U.S. corporation to avoid $50-55 million of mitigation costs and relies on residents of the region to subsidize corporate profits with their

[149]"Cutting a deal on the environment. Activists accused of favoring cash over mission at Moss Landing," San Francisco Chronicle, June 3, 2001.

[150]*Environmental group sues to stop Monterey power plant's expansion,* Sacramento Bee, July 28, 2001.

[151]*Op. cit.*, Steven Moore, Testimony, April 25, 2001, p. 8.

[152]Final Staff Assessment, Otay Mesa Generating Project, Application for Certification (99-AFC-5), p. 25.

lungs.[153] As cited above, a recent examination of the siting of 18 new power plants in California revealed that the majority of these (over 80%) are being built in poor communities of color, thus ensuring they would bear the worst of the impacts.[154] The South County/Tijuana air basin is already heavily impacted and new power plants will make the situation worse. Any plants operating in this region must be as clean as possible and impacts to air quality fully mitigated.

The SBPP is also the worst urban blight in the South County. Its antiquated industrial revolution appearance frustrates economic and tourism development for Chula Vista and Imperial Beach as well as South San Diego. A new plant could be moved off the bayfront and have a lower, less industrial profile.

We are in a new century and a new era in many ways. That we would greatly benefit, and profit, by developing a sustainable, local energy source is clear. It is also clear that there are a number of options. Replacement of the power generation of the SBPP could involve a new, more efficient plant at this location or another site. It could involve aggressive development of conservation, solar and renewal sources in the region to off-set a portion of the power needs. The replacement could be owned and operated for a public utility district so that the public would have a meaningful voice in how power is generated. **All of the options that reduce the air, water, and negative economic development impacts of the current plant and should be evaluated and pursued soon.**

Efficiency and Economics

Simply put, the current SBPP is obsolete and extremely inefficient which necessarily makes the plant uneconomical. The natural gas supply constraints in San Diego strengthen the case for rapid repowering of the SBPP given that a more efficient plant would yield the same electricity and use less fuel. While we do not at present have information about how much gas a repowered SBPP would require, an indication of those requirements is given by the gas needs of the Otay Mesa Generating Project (OMGP). The OMGP represents a state-of-the-art efficient combined-cycle power plant using dry-cooling. A comparison of the two plants is provided on the chart below. Given the scarcity of natural gas supplies in San Diego, and the limited natural gas supplies worldwide it is important to use natural gas in the most efficient way possible. Further, fuel accounts for over two-thirds of the cost of operating a fossil-fuel power plant.[155] A replaced SBPP is likely to use 25-35 percent less natural gas per megawatt of energy produced than the current plant.

The construction of a new power plant is good for the economy and job creation too. The Athens Plant highlighted in the case studies above will provide construction jobs for three years and use 600 workers for the $300 million project.[156]

[153]Position Paper: Border Power Plant Working Group, page 8.
[154]Power Against the People? Estrada ECOonsulting
[155]California Energy Commission staff report, May 2000, Application 99-AFC-5, p. 366.
[156]Email from Kristine Schittini, Athens Generating Project, November 6, 2001.

Comparison of Existing Plant with a New, Dry-cooled Power Plant

Impacts	Current SBPP with once-through cooling using San Diego Bay water (737 MW)	New, combined- cycle dry-cooled plant
Killing of Early Life Stages of Organisms	Larvae and eggs of an estimated 8 million goby-type fishes, 240,000 anchovies, and 42,000 topsmelt in one year. Impacts to microscopic life forms are not quantified but expected to be significant.	None
Trapping and Killing of Fishes and Large Invertebrates	Gobies, anchovies, topsmelt killed in the power plant cooling process. One year estimates found that 28,174 individual fish were killed by the plant.	None
Impacts on Clams, Mussels and Other Marine Life	Toxic levels of heat in discharge water for bottom dwelling species. Artificially accelerates growth rate and reduces life span and reproductive abundance in clams.	None
Impacts on Bay Plants	Reduces Chlorophyll a by 88 % in plankton which is the basis of photosynthesis. Power plant discharge increase solids in the water and reduces amount of light necessary for eelgrass habitat in South Bay.	None
Fisheries Nursery Area	SSDB is a critical remaining nursery area of the Bay. The Plant kills many of the early life stages of fishes and other marine life.	None
Halibut	Water is too hot for juvenile halibut and other species. Juvenile halibut tend to be found where oxygen concentration is higher and the chlorinated, heated discharge reduces the amount of oxygen in South Bay water.	None
Species Diversity	South Bay areas dominated by heat-tolerant species like round stingray which are voracious predators of benthic species.	None
Chlorine Use	Up to 89,000 gallons used a year. Toxic to marine life. 6,000 gallons stored on site at a time.	None
Water Discharge to Bay	601 million gallons a day	None
Fuel Use	Oil or Natural Gas	60% less natural gas per MW
Air emissions	6,200 lbs/day NO_x 1,600 lbs/day PM_{10}	**716 lbs/day NO_x** (83% less per MW) **916.8 lbs/day PM_{10}** (17% less per MW)

Legal Implications of Replacing Power Plants

Technology Forcing

Recognizing the potential and need for more protective technologies–particularly in light of past regulatory inadequacies and increasing pressure on our environment–many environmental statues are technology forcing. This is the reason that permits, for example, must be renewed regularly, to adapt to changing circumstances to protect our environment and human health. Highlighting this is the fact that new discharges are now prohibited that exceed 4°F above the natural temperature of the receiving water. The record of the SBPP is far worse than that, yet the SBPP continues to degrade the environment and Duke is requesting to perpetuate this situation into the foreseeable future.

In fact, it is important to recognize that 'NPDES' stands for National Pollutant Discharge ***Elimination*** System, as elimination of water pollution was the stated goal of the federal Clean Water Act. Too often, this concept gets lost and interpretations in the law seem to confuse elimination with continuation of discharges. While it is understandable that time is needed in adjusting to more stringent standards, thirty years is hardly an appropriate acclimation period. We are currently 20 years behind Congress' goal in enacting the CWA to achieve fishable, swimmable water by 1983. Unfortunately, instead of moving in that direction, the original goal often gets lost in the face of cheaper, more convenient solutions. **We must now work toward reaching the original promise of the Clean Water Act.**

Repower/Replace = New Plant Requirements

Today a generating station like the South Bay Power Plant, which uses large volumes of sea water for cooling, would never be permitted to operate in the shallow, enclosed, marine environment of south San Diego Bay. Assuming that a new plant is to be constructed, a major issue is what legal designation will the new plant be given and the subsequent level of discharge limitations under which that plant will be operating.

The California Thermal Plan, adopted by the State Board, was created with the objective of controlling thermal pollution and enhancing water quality in California.[157] It applies to thermal discharges statewide, but has not been updated since 1975. Under the Thermal Plan, a *"new discharge*" is defined as: *any discharge (a) which is not presently taking place unless waste discharge requirements have been established and construction as defined in Paragraph 10 [definition of "existing discharge"] has commenced prior to adoption of this plan or (b) which is presently taking place and for which a material change is proposed but no construction as defined in Paragraph 10 has commenced prior to adoption of this plan.*

A "new discharger" is subject to (1) more stringent new source performance standards, resulting in less thermal pollution to the Bay and (2) the California Environmental Quality Act

[157] *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California*, State Water Resources Control Board, adopted 1975.

(CEQA) [158] becoming a part of the Regional Board's decision making process in issuing a new permit. However, if a reconstructed plant is judged to be an existing discharge rather than a new discharge, it can operate under the standards set for the previous plant, which are much less stringent[159] and devastation to the Bay will continue far into the future, in violation of the intent of the Thermal Plan and the Clean Water Act.

Legal Interpretation of the "new discharge" issue

The State Board has issued two legal memoranda clarifying the designations given to completely reconstructed power plants. The interpretation of "new" discharges in these two memos is completely contradictory. Reconciling the memos is impossible. Although the State Board dismisses the inconsistency, claiming the first memo was based on incorrect assumptions of fact, the only feasible explanation is the perceived power shortage, resulting sudden demand for power, and intense political pressure around the time the second memo was drafted. Anyone living in San Diego in Spring of 2001 remembers the intense political pressure that was occurring during the perceived power crunch. Governor Davis essentially instructed agencies to soften regulation by issuing Executive Order D-22-01, in order to encourage a higher rate of power production. The second memo's appearance only two months after issuance of the EO is meaningful.

As stated in a State Board legal memo dated March 24, 1999, to be *"consistent with the intent of the original thermal policy, . . . if a new power plant is built, the project proponents will have the opportunity to design the plant to meet the more stringent thermal limits for a new discharge."* [160] Clearly then, a reconstructed power plant should have to meet more stringent discharge limits. The policy behind the first memo was based on a reconstructed power plant's ability to update cooling technology and decrease thermal discharges. More specifically, the rationale behind the memo dated March 24, 1999 is given:

> *"Existing thermal discharges were grandfathered-in in the original thermal policy for two reasons. First, it was felt that the investment that would be needed to upgrade the existing facilities to meet more stringent thermal limitations might not be justified, given their age. Second, the turbines, condensers, and cooling systems in these facilities were designed for a particular design temperature. . . .* ***New facilities, on the other hand, could be built with a different condenser design that could enable these facilities to meet the thermal limitations for a new discharge****."* [161] (Emphasis added)

[158] *Ibid.. See also* 40 C.F.R. § 122.29(d)(4).
[159] Correspondence between David Maul and Craig M. Wilson, Nov. 3, 2000, p. 5.
[160] *Ibid.,* March 24, 1999, p. 7.
[161] Legal Memorandum issued by Craig M. Wilson dated March 24, 1999, p. 7.

It is clear that the goal of the Thermal Plan was not to support the status quo but rather to promote the incorporation of efficiency into rebuilding while minimizing the aggregate impact on the environment.

A complete shift of position was seen in the second memo issued by the State Board on April 4, 2001.[162] There, the earlier memo is dismissed, and an entirely different claim is made that reconstructed power plants are *"existing sources"* if their discharge experiences *"no material change."* In this memo, material change was read very narrowly, allowing reconstructed power plants to easily surpass the *"new discharge"* designation, thus eliminating their duty to update their cooling structures. The State Board stated that they based their change in position on incorrect assumptions of fact.[163] However, considering the sequence of events, it seems clear that the shift in position had more to do with making power generation more convenient in order to fulfill increased demand and comply with Executive Order D-22-01 than to rectify incorrect assumptions of fact.

Consequently, the validity of the second memo and stance on the status of reconstructed plants, must be seriously questioned. Reconstructed power plants should be considered "new dischargers" and subject to more stringent discharge limitations. This belief is further bolstered if and when the State Board properly lists South San Diego Bay as an impaired waterbody under section 303(d) for the impacts to beneficial uses highlighted above. Once listed, the Regional Board must implement a TMDL for the Bay, which will necessitate much more stringent requirements for the SBPP.

D. Rationale for a Strengthened Discharge Permit for the SBPP and 303(d) Listing of South San Diego Bay as an impaired waterbody

Fundamental Flaw in Regulation of the discharges of the SBPP must be Remedied

The California Thermal Plan requires protection of beneficial uses in enclosed bays. Already in 1967, two years after it began operation, the plant was considered by the U.S. Department of the Interior to be one of two sources of pollution in the South Bay.[164] Yet, the Regional Board has continually made the finding that thermal discharges have not impacted beneficial uses in the Bay, which include habitat for many species of wildlife. One of the reasons for this finding is that the discharge zone of the SBPP has historically been considered

[162]Legal Memorandum issued by Craig M. Wilson dated April 4, 2001.

[163]*Ibid.*, p. 83, footnote 1.

[164]Parrish and Mackenthum. 1968. *San Diego Bay. An Evaluation of the Benthic Environment. October 1967.* Biology and Chemistry Section, Technical Advisory & Investigations Branch, Federal Water Pollution Control Administration, U. S. Department of Interior. p. 21, iv

part of the plant and the Bay (meaning the beneficial uses did not have to be fully protected or considered).

There is a bitter irony here. While, in the past, the Bay has been considered part of the power plant, the reverse is actually the case. In most cases, a waste stream created by a discharger (and separate from the natural waterway) is discharged into a waterbody. The regulatory structure is designed to minimize or eliminate the impacts of this added waste stream on the receiver waterway. However, in this case, the power plant essentially **diverts the bay into the plant**, adds chemicals **for the purpose of killing marine life**, adds waste heat to the bay water in the plant at a level high enough to be toxic to marine life, then returns this heavily altered and degraded water to the Bay. In this case, there is no denying that the chlorine that the power plant adds to the Bay water causes ecological damage–**it is added for that very reason.** This fundamental perception of how the Bay water is damaged is missing from the permitting and regulatory process. It also fails to limit the number of organisms destroyed through impingement or entrainment.

Simply put, the Regional Board can no longer make a finding that there are no significant impacts on beneficial uses as a result of the power plant discharge. In fact, beneficial uses are, and will continue to be, significantly impacted by the elevated temperature discharges and chlorination of bay water by the South Bay Power Plant.

Proposed Permit Monitoring Regime Does Not Assess Impacts or Require Mitigation for Damage

The proposed NPDES permit renewal for the SBPP falls far short of what is needed to comply with permitting requirements. Several important constituents and impacts are not monitored for. Others may be monitored for but have no limits specified and so are unenforceable. For example, there are no receiving water limitations for dissolved oxygen (DO) or temperature in the current permit. The discharge water is not monitored for DO at all. Storm water discharges are not monitored for toxicity. There is not regular monitoring for the metals that are known to exist in the discharge. Chlorination of discharge water is done daily but only monitored every two weeks.

Temperature is also not adequately assessed or limited. Even though, between 1974 and 2000, average discharge temperatures have risen over 10°F in both summer and winter, the heat limit is specified as delta temperature (change between intake and discharge temperatures) but there is no maximum temperature that the discharge water can exceed. Permitted increases in temperature between intake water and water discharged from the SBPP have risen from 12.5°F to 15°F during the time the power plant has operated. Since Duke's request in June, 2001 for an even higher limit (increase to 23°F which was later withdrawn), this issue has become even more urgent. It is clear that the potential exists for discharge temperatures as high as 107° or higher

with even more damaging impacts to the bay. A maximum limit, in addition to a delta change limit, must be included in the permit.

Another significant issue related to regulating the power plant relates to where discharges occur, are monitored, and where compliance is assessed. Today, the actual monitoring and compliance points are located far from the actual point of discharge. All constituents monitored in the discharge, except temperature, are monitored about 100 feet from the actual point of discharge. Temperature compliance is assessed 300 yards from the actual point of discharge. One serious problem is this practice does not assess the actual conditions of the discharge and it allows a large dilution of the impacts before compliance is determined. This equates with a de-facto mixing zone for the power plant. While the law allows for mixing zones, certain demonstrations must be made by the discharger before permission for a mixing zone is granted. No such zone has been formally granted by the Regional Board. The historic method of regulating the plant and assessing compliance is still the basis of the new permit and is grossly outdated. There is a critical need to revise and update the monitoring regime and monitoring locations in this next permit.

Storm Water Requirements need to be strengthened and updated in the permit

When the Regional Board renewed the NPDES permit for the commercial shipyards on San Diego Bay in 1997, stronger storm water requirements than required in the General Industrial Storm water permit were added to the General Waste Discharge Requirements for Shipyards. These included diversion of 1/4 inch storm water from high risk areas and toxicity testing of storm water.[165] Similar requirements were previously added in the Commercial Boatyard permit. The SBPP is also a large industrial facility on San Diego Bay and should have the same strengthened permit requirements for monitoring storm water in its renewed permit.

Additional Regulatory Requirements

The SBPP has diverted metal cleaning wastes and low volume wastes to the Chula Vista sewer system. Because of this, they have requested that their current monitoring program be discontinued. However, they have stated in their application for permit renewal that some chemicals continue to be discharged due to the erosion of metal surfaces. The chemicals mentioned include: barium, chromium, copper, lead, nickel, and zinc.[166] SBPP has requested that semiannual monitoring continue to monitor this erosion effect. Semiannual monitoring is not enough. In Appendix H, Table 2C of the SBPP Application for Permit Renewal, chemicals that have been detected in SBPP's effluent are listed. All of the above chemicals, with the exception of zinc, have an effluent value that is greater than the influent value. This is cause for

[165]Waste Discharge Requirements for Discharges from Ship Construction, modification, repair, and maintenance Facilities and Activities located in the San Diego Region. Order 97-36, pp. 14-15

[166]SBPP Application for Permit Renewal, Appendix F, p. 5.

concern. Monthly monitoring is needed, with a Pollution Minimization Program implemented, if appropriate.

Other chemicals must also be included in permitting and monitoring program. Duke lists the following potential chemicals in the discharge in the permit application:

- Rhodamine WT liquid
- Nalco 8322 corrosion inhibitor
- Spectrus NX1103 - for microbial control

In addition, a review of chemicals listed in Duke's complete chemical inventories reported to the County Hazardous Materials Disclosure database should be analyzed for inclusion. Further, halomethanes are a break-down product of chlorine use. Other dischargers that chlorinate, such as Sea World, are required to monitor for these products[167] but the SBPP is not.

South San Diego Bay should be Listed on the 303(d) List

South San Diego Bay is a shallow, sensitive marine environment and critical fisheries nursery area, highly vulnerable to heat, chemicals, and other pollution. Use of once-though water cooling has had a devastating impact on this ecosystem and is causing significant impact to marine life in South San Diego Bay every day. Depending on the tides, the power plant uses up to 20% of water in South Bay every day for cooling and significant multiple recirculation occurs.

This use of bay water severely impacts the marine life (beneficial uses) in South San Diego Bay in multiple ways. The power plant cooling system kills early life stages of marine plants and animals and microscopic organisms through entrainment into the plant. The cooling process heats the water to temperatures that can reach over 100ºF, a lethal temperature for fishes, and other marine life. Heated water has been found to artificially accelerate growth rates of some species. These same species produced fewer young and had shortened life-spans. The higher water temperature also decreases the amount of dissolved oxygen in the water and, at the same time, increases the metabolic rate of animals which increases their oxygen demand. The high water temperatures and reduced oxygen in the water may prevent juvenile halibut from settling in South Bay, one of the important, remaining nursery areas.

The SBPP also discharges dead plants, fishes, shellfish and other organisms back into the Bay; the decay of these plants and animals further reduces oxygen levels. The cooling system kills larger fish and invertebrates by trapping them on the intake rack and screens. Eelgrass may be negatively impacted by the additional turbidity and suspended solids that the plant causes in the discharge area.

[167] Order No. 2000-25,NPDES Permit No. CA 0107336, Waste Discharge Requirements for Sea World San Diego, San Diego County, Discharge to Mission Bay, April 12, 2000.

The use of chlorine is also a severe impact. Chlorine is highly toxic to marine life and large volumes are used to prevent marine life from attaching to pipes in the cooling water system. Heavy use of chlorine presents elevated risks of fish kills if chlorination valves get stuck open. Chlorine by-products are also of serious concern and are unmonitored and unassessed.

Compromised Data

These impacts, over the period of 40 years, are cumulatively significant. The status of the science on the impacts, however, is highly suspect for two reasons. First, virtually all of the data collected on the impacts of the plant use a baseline of ecological health during time periods when the plant was in operation. This skews the data to protect a status quo that is already damaged by plant operations. Second, virtually all of the studies were funded in whole or in-part by the power plant operators. Scientific assessment funded by a discharger with a very significant interest in the outcome renders the studies and the conclusions, highly suspect. Independent studies based on the baseline of ecological conditions prior to operation of the cooling system must be conducted before we know the full impact of the cooling water discharges on San Diego Bay.

All of these elements combine to support the need for a stronger discharge permit and for listing of South San Diego Bay as impaired for heat, chlorine, and copper.

E. Agency Recommendations

The member organizations of the San Diego Bay Council, representing 22,000 San Diegans, are committed to act through community involvement, regulatory participation, and legal action, to ensure that the South Bay Power Plant is torn down and its damaging impacts to sensitive South San Diego Bay are ended. To this end, we make the following recommendations to the agencies involved with siting and permitting power plants.

State Water Resources Control Board

, The State Board should ensure that the updated Thermal Plan provides more protective requirements for Thermal discharges into state waters. The update should re-designate San Diego Bay as an estuary and/or strengthen the protections in the Thermal Plan for enclosed bays. The new Thermal Plan should require dry-cooling for all coastal power plants. It should specify that all repowered plants are to be considered new discharges for purposes of permitting.

, The State Board should add the waters of South San Diego Bay to the 303 (d) list as impaired for heat, chlorine, and copper.

Regional Water Quality Control Board

, Regional Board should specifically address requirements on any replacement plant for the SBPP and make clear the intent of the Board for any future proposal. This could be accomplished through a condition in the new NPDES permit or a resolution requiring any reconstruction/repower during this permit duration to carry a "new discharge" designation and, thus, subject to much more stringent requirements.

, Regional Board should strengthen the NPDES permit, increase monitoring, and require mitigation for damage caused by the operation of the SBPP in order to ensure protection of beneficial uses in San Diego Bay. The new permit should move closer to the elimination of water quality impacts from the power plant discharges as soon as possible. Essential changes include: establish limits and monitoring requirements for dissolved oxygen and all constituents present in the discharge such as metals and chlorine by-products; relocation of the compliance point to the real point of discharge (i.e. end of the pipe); set maximum temperature limits for the discharge; establish impingement and entrainment limits; establish sediment monitoring; and increase frequency of chlorine monitoring.

, Regional Board should ensure that storm water requirements should be incorporated into the renewed permit and strengthened to include, at a minimum, acute toxicity and diversion of storm water from high risk areas.

San Diego Unified Port District

If the Port has the ability to renegotiate the lease for the power plant, the Port should ensure that any operator is held to hard and fast deadlines for removal of the SBPP and a requirement for any new plant on Port District tidelands to utilize dry-cooling. The Port should maintain some measure of public control over operation of the plant.

California Energy Commission

CEC should require all new and repowered plants to use dry-cooling as the system that impacts air and water quality the least and reduces use of hazardous materials.

National Marine Fisheries Service

NMFS should determine all actions that should be taken to rehabilitate the South Bay habitat for sea turtles once the discharge from the SBPP is removed. This should include a plan

for returning the South Bay to more natural conditions and restoration of eelgrass beds for foraging.

San Diego Regional Energy Office

The SDREO should recommend an aggressive Regional Energy Strategy that aggressively pursues conservation, efficiency, and clean renewable energy to the maximum extent possible for the San Diego/Tijuana region.

References

Application for Renewal of the NPDES Permit for Duke Energy South Bay LLC's South Bay Power Plant. 2001. Submitted to the San Diego Regional Water Quality Control Board.

Applied Science Associates. 1988. *Proposed Effluent Limit for Residual Chlorine for the South Bay Power Plant.* (This document is labeled "for settlement purposes only.")

Backman, T.W, and D.C. Barilotti. 1976. "Irradiance reduction: effects on standing crops of the eelgrass *Zostera marina* in a coastal lagoon." *Marine Biology* 34:33-40.

Border Power Plant Working Group. August 22, 2001. *Urgent Need for Bilateral Agreement Between the United States and Mexico Regarding Sustainable Environmental Requirements for New Power Plants in the Border Region.* Letter to the Honorable Colin Powell and Dr. Jorge Castaneda *et al.*

Boreman, John and C. Phillip Goodyear. 1978. *An Empirical Transport Model for Evaluating Entrainment of Aquatic Organisms By Power Plants.* Power Plant Project, Office of Biological Services, Fish and Wildlife Service, U. S. Department of Interior.

California Regional Water Quality Control Board,.San Diego Region. *Fact Sheet, Tentative Order No. 2001-283, Waste Discharge Requirements, South Bay Power Plant.*

California Regional Water Quality Control Board, San Diego Region Order No. 96-05, NPDES Permit No. Ca0001368, Waste Discharge Requirements For San Diego Gas And Electric Company South Bay Power Plant, San Diego County

Clarke, J. and W. Brownell. 1973. "Electric Power Plants in the Coastal Zone: Environmental Issues." *American Littoral Society Special Publication.* Volume 7, as cited in Lawler, Matusky & Skelly Engineers.

Capuzzo, Judith M. 1979. "The Effects of Temperature on the Toxicity of Chlorinated Cooling Waters to Marine Animals - A Preliminary Review." *Marine Pollution Bulletin.* Vol 10. pp.45-47.

Capuzzo, Judith M., Joel . Goldman, John A. Davidson and Sarah A. Lawrence. 1977. "Chlorinated Cooling Waters in the Marine Environment: Development of Effluent Guidelines" in *Marine Pollution Biology,* Vol. 8, No. 7. pp. 161-163.

Dougherty, Bill Ph.D. *Comments on the EPA's Proposed Regulation on Cooling Water Intake Structures for New Facilities*, prepared by Bill Dougherty, Ph.D., *et al.*, Tellus Institute, November 8, p.18

EA Engineering, Science, and Technology. 1995. *South Bay Power Plant Receiving Water Monitoring Program with Emphasis on the Benthic Invertebrate Community (1977-1994).* Prepared for San Diego Gas and Electric Company, San Diego, California.

EA Engineering, Science, and Technology. 1996. *Technical Report on Net/Gross Discharge Limits.* Final Report prepared for San Diego Gas and Electric Co.

Effer, W. R. and J. B. Bryce. 1975. "Thermal Discharge Studies on the Great Lakes - The Canadian Experience." In *Environmental Effects of Cooling Systems at Nuclear Power Plants. Proceedings of a Symposium, Oslo, 26-30 August 1974.* IAEA (Vienna), as cited in Lawler, Matusky & Skelly Engineers.

Ford, R. F. 1968. *Marine organisms of South San Diego Bay and the ecological effects of power station cooling water. A pilot study conducted for the San Diego Gas & Electric Co.* Environmental Engineering Laboratory Tech. Rept.

Ford, R. F., R. L. Chambers, and Merino, J. M. 1970. *Ecological effects of power station cooling water in South San Diego Bay during August 1970. Prepared for the San Diego Gas & Electric Co.* Environmental Engineering Laboratory Tech. Rept.

Ford, R.R., R.L. Chambers, and Merino, J.M. 1971. *Ecological effects of power station cooling water in South San Diego Bay during February-March 1971.* Prepared for the San Diego Gas & Electric Co. Environmental Engineering Laboratory Tech. Rept.

Ford, R.F., R.L. Chambers, Merino, J.M. 1972. *Ecological effects of power plant cooling water in South San Diego Bay during August 1972.* Prepared for the San Diego Gas & Electric Co., Environmental Engineering Laboratory Tech. Rept.

Ford, R.F., and Chambers, R.L. 1973. *Thermal Distribution and biological studies of the South Bay Power Plant.* Prepared for the San Diego Gas & Electric Co., Environmental Engineering Laboratory Tech. Rept.

Ford, R.F., and Chambers, R.L. 1974. *Thermal distribution and biological studies for the South Bay Power Plant.* Prepared for the San Diego Gas & Electric Co.. Environmental Engineering Laboratory Tech. Rept.

Fritz, Eugene S., Paul J. Rago, and Ishwar P. Murarka. 1980. *Strategy for Assessing Impacts of Power Plants on Fish and Shellfish Populations.* Power Plant Project, Office of Biological Services, Fish and Wildlife Service, U. S Department of the Interior.

Gehrs *et al*, 1974. "Effects of stable chlorine-containing organics on aquatic environments." *Nature.* Vol. 249. pp. 675-676.

Gilbert, N. US Fish and Wildlife Service. J une 6, 2001 Letter to J. Robertus, Regional Water Qualtiy Control Board.

Goodyear, C. Phillip. 1978. *Entrainment Impact Estimates Using the Equivalent Adult Approach.* Power Plant Project, Office of Biological Services, Fish and Wildlife Service, U. S. Department of Interior.

Grimes, C.B., 1971. "Thermal addition studies at the Crystal River steam electric station." *Professional Paper Series.* No. 11. Florida Dept. Nat'l. Resour. Res. Lab. St. Petersburg, FL.

Henderson, P.A. and R.M.H Sealby. 2000. *Technical Evaluation of US Environmental Protection Agency Proposed Cooling Water Intake Regulations for New Facilities.* Pisces Conservation Ltd.

Jolley, R. L. 1975. "Chlorine-containing organic constituents in sewage effluents." *J. Water Poll. Control Fed.* Vol. 47. pp. 601-618.

Kramer, Sharon. 1997. Memorandum to Laura Hunter, Environmental Health Coalition.

Kramer, Sharon Hendrix. 1990. *Habitat Specificity and Ontogenetic Movements of Juvenile California Halibut, Paralichthys californicus, and Other Flatfishes in Shallow Waters of Southern California.* A Dissertation. University of California, San Diego.

Kramer, Sharon Hendrix. 1990. "Distribution and Abundance of Juvenile California Halibut, Paralichthys californicus, in Shallow Waters of San Diego County," in Haugen, Charles (ed.), *The California Halibut, Paralichthys californicus, Resource and Fisheries.* State of California Department of Fish and Game. Fish Bulletin 174. pp. 99-126.

Lawler, Matusky & Skelley Engineers. 1979. *Ecosystem Effects of Phytoplankton and Zooplankton Entrainment.* Prepared for Electric Power Research Institute (EPRI).

Majewski, W. and D. C. Miller, Eds. 1979. *Predicting effects of power plant once-through cooling on aquatic systems.* A Contribution to the International Hydrological Programme, UNESCO.

Martin, M. *et al*, 1977. "Copper toxicity experiments in relation to abalone deaths observed in a power plant's cooling waters." California *Fish and Game.* Vol. 63. pp. 95-100.

MBC Applied Environmental Sciences. 1992. *Distribution of Juvenile California Halibut (Paralichthys Californicus) in Bay and Coastal Habitats of Los Angeles, Orange, and San Diego Counties in 1992.* Final Report.

McDonald, D., P. Dutton, D. Mayer, and K. Merkel. 1994. *A Review of the Green Turtles of South San Diego Bay in Relation to the Operations of the SDG&E South Bay Power Plant.* Doc 94-045-01. Prepared for San Diego Gas & Electric Co., San Diego, CA.

Merino, Jose-Maria. 1981. *A Study of the Temperature Tolerances of Adult Solen rosaceus and Tagelus californianus in South San Diego Bay: The Effects of Power Plant Cooling Water Discharge.* A Dissertation, San Diego State University/University of California Riverside.

Merkel & Associates, Inc. 2000. *Environmental Controls on the Distribution of Eelgrass (Zostera marina L.) in South San Diego Bay: An assessment of the Relative Roles of Light, Temperature, and Turbidity in Dictating the Development and Persistence of Seagrass in a Shallow Back-Bay Environment.*

Merkel and Associates, Inc. 2000. *South Bay Power Plant Cooling Water Discharge Channel Fish Community Characterization Study.* Final Report. Prepared for Duke Energy South Bay LLC.

Merkel, Keith and Scott Jenkins. 1996. *San Diego Gas & Electric South Bay Power Plant NPDES Permit Renewal. South Bay Residence and Recirculation.*

Michael Brandman Associates, Philip Williams & Associates, Ltd., and TRC Environmental Consultants. 1990. *Preliminary Report of City of Chula Vista: (SDG&E) 89-NOI-1.*

NOAA. 1991. *The Light Requirements of Seagrasses.* Results and Recommendations of a Workshop. Technical Memorandum NMFS-SEFC-287.

Parrish and Mackenthum. 1968. *S an Diego Bay. An Evaluation of the Benthic Environment. October 1967.* Biology and Chemistry Section, Technical Advisory & Investigations Branch, Federal Water Pollution Control Administration, U. S. Department of Interior.

Rosegay, Margaret, Pillsbury, Madison and Sutro, LLP Letter from to Craig M. Wilson, State Water Resources Control Board, November 3, 2000.

Roosenburg, W.H. 1969. "Greening and copper accumulation in the American oyster, Crassostrea virginica, in the vicinity of a steam electric generating station." *Chesapeake Sci.* Vol 10. pp. 241-252.

San Diego Gas & Electric Co. 1980. *South Bay Power Plant Cooling Water Intake System Demonstration.* Prepared for: California Regional Water Quality Control Board, San Diego, CA.

SPAWARSYSCEN San Diego. 1999. *Cooling Water System Copper Study.* Final Report.

State Lands Commission. January 29, 1999. Staff Report

State Water Resources Control Board, March 24, 1999. Legal Memorandum, from Craig M. Wilson

Thomas, G.l., R.E. Thorne, and W. C. Acker. 1978. *The Effects of Thermal Discharge on Fish Distribution and Abundance in the Vicinity of the San Onofre Nuclear Generating Station*, Final Report to the Marine Review Committee.

U.S. Department of the Navy, Southwest Division. 1999. *San Diego Bay Integrated Natural Resources Management Plan.* Prepared by Tierra Data Systems.

Weatherley, Alan H., Phillip S. Lake, and Stephen C Rogers. "Zinc Pollution and the Ecology of the Freshwater Environment." In Nriagu, Jerome O., Ed., *Zinc in the Environment; Part I: Ecological Cycling.* John Wiley and Sons, New York

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Environmental Health Coalition - EHC is dedicated to achieving environmental and social justice. We believe that justice is accomplished by empowered communities acting together to make social change. We organize and advocate to protect public health and the environment threatened by toxic pollution. EHC supports broad efforts that create a just society and which foster a healthy and sustainable quality of life.

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San Diego BayKeeper - The San Diego BayKeeper, a nonprofit membership organization, is dedicated to the principal that protecting California's precious coastal waters is the job of every citizen. San Diego BayKeeper is a member of the national Water Keeper Alliance. Our common purpose is to preserve, enhance and protect the state's marine sanctuaries, coastal estuaries, wetlands and bays from illegal dumping, hazardous spills, toxic discharges and habitat degradation.

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San Diego Chapter of the Sierra Club - The Sierra Club's mission is to explore, enjoy, and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resourses; to educate and enlist humanity to protect and restore the quality of the natural and human environment; and to use all lawful means to carry out these objectives.

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San Diego Chapter of the Surfrider Foundation - The Surfrider Foundation is a non-profit environmental organization dedicated to the protection and enjoyment of the world's oceans, waves and beaches for all people, through conservation, activism, research and education.

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Southwest Wetlands Interpretive Association - SWIA is a nonprofit organization dedicated to preservation, restoration and education in the Tijuana. River and its wetlands. SWIA works with federal and state resource agencies dedicated to the protection, enhancement, and interpretation of wetlands.

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Wildcoast - Wildcoast is a partnership-based inter-national conservation team preserving the endangered marine species and coastal wildlands of the Californias.

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