Health Consultation

Exposure Investigation Report

Evaluation of Fish Consumption from Lake Nacimiento

KLAU/BUENA VISTA MINES

PASO ROBLES, SAN LUIS OBISPO COUNTY, CALIFORNIA

EPA FACILITY ID: CA1141190578

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

California Department of Health Services
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Summary

The watershed of Lake Nacimiento has several abandoned or inactive mercury mines. The Klau/Buena Vista Mines have been identified as the major source of mercury in Lake Nacimiento sediment. The water is safe to drink and recreate in. However, mercury in the sediment has been converted to methylmercury by organisms living in the sediment and then there has been bioaccumulation of methylmercury in fish in the lake.

During an exposure investigation conducted by the California Department of Health Services (CDHS) with the Agency for Toxic Substances and Disease Registry (ATSDR) and the Office of Environmental Health Hazard Assessment (OEHHA) in February/March 2006, elevated levels of mercury were found in six species of fish from Lake Nacimiento. The mercury levels in the fish pose a health hazard. Based on a more limited assessment of organic pesticides, polychlorinated biphenyls, and polybrominated diphenyl ethers in fish from Lake Nacimiento, these chemicals do not pose a health hazard from consumption of the fish.

The information from the exposure investigation was combined with mercury tissue levels in Lake Nacimiento fish from two other sampling efforts conducted in the 1980s and 1990s, to provide the basis for new fish consumption recommendations for Lake Nacimiento.

1. ATSDR and CDHS recommend the county issue a revised interim fish advisory for Lake Nacimiento, containing the following advice:
   - Women of childbearing age, pregnant or breastfeeding women, and children 17 years and younger should not eat any fish meals of catfish, bluegill or other sunfish, carp, crappie, white bass or any black bass (spotted bass, largemouth bass).
   - Women beyond childbearing age and men should not eat any fish meals of white bass or any black bass (spotted bass, largemouth bass)
   - Women beyond childbearing age and men should eat no more than 1 fish meal/week, of catfish, bluegill or other sunfish, carp, crappie
2. ATSDR and CDHS recommend the Office of Environmental Health Hazard Assessment should issue a state advisory for Lake Nacimiento.

San Luis Obispo County are working with CDHS and OEHHA to implement the revising and reissuing of the fish advisory for Lake Nacimiento. CDHS will be conducting a number of outreach activities in order to educate anglers, nearby residents and visitors to the lake of the fish consumption recommendations. These outreach activities include: public service announcements on area Spanish radio stations, mailings to permanent and seasonal residents around the lake, postings at all boat launches around the lake, and postings in boat clubs and neighborhood associations newletters and websites, posting on the county and the CDHS web site, and conducting a train-the trainer for health educators and community health workers serving the English and Spanish-speaking communities.

Background

Lake Nacimiento is located 17 miles northwest of Paso Robles in the northern part of San Luis Obispo County (Figure 1). The reservoir was formed by the construction of the Nacimiento Dam in 1957 (2). Monterey County Water Resource built the reservoir to replenish the Salinas Valley groundwater. The lake has an irregular shoreline of 165 miles and is often called a dragon because of its outline. The maximum depth of the lake is 175 feet, with annual fluctuations ranging from 30 to 70 feet depending upon the water demand and the replenishment needs. At maximum size, the lake has a surface area of 5,440 acres (3).

During the summer months, the lake is used primarily for boating, swimming, water skiing and personal water craft. During the winter months, fishing is more prevalent. Fish present in Lake Nacimiento include spotted bass, crappie, channel catfish, carp, and white bass.

Lake Nacimiento is situated in the Santa Lucia Range of the California Coast ranges (2). The coast ranges are characterized by many strong and complex fault zones that have pushed enormous blocks of older Franciscan rocks to the surface. In the Franciscan zones, cinnabar rock contains mercury combined with sulfur. A 16-mile long by 4-mile wide cinnabar deposit is located within the Lake Nacimiento watershed.

The Lake Nacimiento watershed encompasses 82 square miles (52,480 acres). Land use in the watershed is reported to be about 50% grazing, 47% open space, 1% housing, 1% camping, 1% inactive mines (2). Most of the land in the watershed is publicly owned as Hunter Liggett Military Reservation and Los Padres National Forest.

Several abandoned or inactive mercury mines have operated in the watershed of Lake Nacimiento including, Klau Mine, Buena Vista Mine (formerly known as the Mahoney Mine), Bonanza Group Mines, Pine Mountain Group, and Sycamore Creek Mine (2). These mines affect various areas of the watershed leading to Lake Nacimiento: Las Tablas Creek; the Western Shore drainages including Tobacco Creek; and the mainstream of the Nacimiento River (2). In work conducted by the Central Coast Regional Water Quality Control Board, the Las Tablas Creek watershed was identified as the primary source of mercury contamination in Lake Nacimiento, and the Klau/Buena Vista Mines as the primary sources of mercury in the Las Tablas Creek watershed (2). In the early 1900s, Klau Mine was the fourth largest producer of mercury in the state (2).

The U.S. Environmental Protection Agency (EPA) named the the Klau and Buena Vista Mines to the National Priority List (Superfund) in April 2006 (4). Through its cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR), the California Department of Health Services (CDHS), Environmental Health Investigations Branch (EHIB) is conducting health assessment activities at the Klau/Buena Vista Mines. The focus of this health consultation is the mercury levels in the fish at Lake Nacimiento and the potential health impacts of eating the fish. Other exposure and health concerns related to the Klau/Buena Vista Mines and their downstream impacts will be further evaluated in a health assessment to be released in early 2007.

The combination of abandoned mercury mines, naturally-occurring geologic deposits that were never mined, a dam east of Klau Mine that was made of mercury-rich materials, and roads in the vicinity of some of the mines that were paved with mine wastes have resulted in a large amount of mercury being deposited in the lake (2). Since the mercury associates itself with the sediment and not the water column, the water in the Lake Nacimiento meets drinking water standards.

Mercury coming from the watershed is taken up by microscopic organisms (benthic organisms) that live in the sediment and they change it to another form of mercury (organic methylmercury). The bioaccumulation (buildup) of organic mercury in the web of organisms then results in high levels of organic mercury in the fish that are large enough for people to consume. Organic mercury is known to affect the nervous system especially of developing fetuses and children (see inset for more information about the health concerns from organic mercury exposure).

The health concerns related to consuming fish were recognized in the late 1980s. Fish sampling was conducted in the late 1980s and early 1990s, and fish advisories for the lake were issued in the early 1990s. A fish advisory for large mouth bass is listed in the California Department of Fish and Game (CDFG), Sport Fishing Regulations booklet (see Appendix C of Appendix D in this document). In addition to this advice, San Luis Obispo County released a fish advisory for all fish in Lake Nacimiento: this extended the same fish consumption recommendations to all other species in the lake.

Health Hazards of Organic Mercury

When a person eats fish containing organic mercury (methylmercury), the organic mercury is well absorbed and goes throughout the body, reaching the largest concentration in the kidney. Methylmercury is able to cross the placenta and the blood brain barrier. Thus methylmercury can accumulate in the fetus and brain, causing toxic effects.

Human toxicity of methylmercury has been well studied following several epidemics of human poisoning resulting from consumption of highly contaminated fish (Japan) or seed grain (Iraq) (1). “Minamata Disease” was first described from the high methylmercury intake that occurred in Japan. Minamata Disease is described by neurological signs and symptoms such as loss of sensation in the hands and feet, loss of gait coordination, slurred speech, sensory deficits including blindness and mental disturbances. Death occurred to some. A similar pattern of disease occurred in the epidemic in Iraq. In both epidemics, maternal consumption of methylmercury contaminated food sometimes resulted in mild or no toxicity in the mother. However, the children later developed cerebral palsy and/or mental retardation.

Land Use Near the Lake

Monterey County Water Resources Agency owns the land next to the shore and around the eastern end of the lake. It leases space to Waterworlds Resort which owns and operates Lake Nacimiento Resort (located at the throat of the dragon, Figure 2) (5). The resort has a boat launch ramp, a marina, a fish cleaning station, 330 camping spaces, 19 lodge units, a general store and a restaurant. The resort is open year round with more limited hours for some of the facilities. According to county records, the maximum number of visitors on a peak weekend is approximately 20,000 (5). Fishing contest days are scheduled primarily in the winter and autumn months (6). Between January and December 2004, 486 competitors participated in fishing contests at Lake Nacimiento over 13 contest days (7).

Recreational activity at Lake Nacimiento consists generally of individual and group-sponsored fishing in the winter and water sports activities in the summer. Attendance varies accordingly. The average annual number of visitors to Lake Nacimiento according to the county for an 8-year period from 1994 to 2001 was 202,700 (5). The months with the highest attendance are May, June, and July.

The rest of the Lake Nacimiento shoreline is privately owned and nominally developed (Nacimiento Area Plan). Heritage Ranch and Oak Shores are two residential associations on the lake (6). Many individually owned and developed homes on large lots (5 to 120 acres) are located along portions of the south shore (north of Towne Creek and Running Deer Ranch, south of Towne Creek), as are several private clubs (Cal-Shasta, Tri-Counties, and South Shore Village Club) with vacation homes or trailer sites developed on acreages in common ownership (3). Similar north shore developments include the Bee Rock area residences, Laguna Vista Boat Club, and the North Shore Boat and Ski Club. The residential areas and the clubs have boat launches and docks. Many of the residential areas were first developed to be vacation or retirement homes. As of 2000, the population in the area around Lake Nacimiento was approximately 3,200 (8).

Community Concerns

CDHS assessed fish consumption habits and advisory awareness among the following segments of the community: residents living near the Klau/Buena Vista mines, Las Tablas Creek, Lake Nacimiento, anglers, and possible subsistence anglers in the city of Paso Robles.

CDHS communicated with residents living near the Klau/Buena Vista mines, along Las Tablas Creek, and along Lake Nacimiento through mail and/or home visits. These community members tended to be long-term residents of the area and aware of a fish advisory at the lake. Their concerns related to the Klau/Buena Vista mines deal with exposure pathways other than fish consumption and will be reviewed in an upcoming public health assessment.

CDHS spoke with six anglers fishing at Lake Nacimiento in early March 2006. Anglers reported knowledge of a fish advisory for the lake. They reported practicing catch-and-release as well as eating some of their catch such as crappie and spotted bass. They reported eating fish out of Lake Nacimiento less than once a month. One angler reported sharing his catch from Lake Nacimiento with children or women of childbearing age. Anglers stated that on-site signage is the best way to communicate information about fishing and health.

The primary points of entry to Lake Nacimiento are a private resort, private homes, private boat clubs, and gated communities (3, 5). CDHS investigated the presence of subsistence anglers by conducting outreach at a food bank and the Women, Infant, and Children's (WIC) center in the city of Paso Robles. CDHS identified a lack of advisory awareness primarily among monolingual Spanish-speaking community members. They reported eating fish from Lake Nacimiento such as white bass, carp, crappie, and spotted bass less than once a month. One English-speaking respondent reported eating largemouth bass fished at Lake Nacimiento in the last 10 years. Although no subsistence anglers were found, some community members were consuming fish from Lake Nacimiento and were unaware of a fish advisory for the lake.

English- and Spanish-speakers listed several ways of receiving information about fishing and health. English-speaking community members suggested information dissemination through on-site signage, English language newspaper notices, and flyers at stores that sell fishing gear. They also suggested distributing flyers at motels for anglers who visit from out of the area. Spanish-speakers suggested bilingual on-site signage and Spanish radio outreach as the best mechanisms to deliver information about fishing and health. The current on-site posting is written in English.

All anglers and community members stated that they eat fish from Lake Nacimiento less than once per month. However, five of these consumption incidences involved children or women of childbearing age, for whom the advisory is more restrictive. Although some members of the community proclaimed general awareness of fish advisories, CDHS did not ask them to recall the content or advice contained in advisories in general or for Lake Nacimiento in particular. A recent finding suggests that although community members may report being generally aware of fish advisories, their recall may not always correlate with specific advisory information (5). Health education via the means suggested by the community is warranted. In addition, CDHS will distribute educational materials at the food bank and WIC office visited.

Most Spanish-speakers interviewed were unaware of fish advisories. Additional education about fish contamination and advisories is warranted in the Spanish-speaking monolingual community. CDHS will train health educators who work with the Spanish speaking community in San Luis Obispo County on fish contamination issues and the Lake Nacimiento advisory.

Previous Fish Data from Lake Nacimiento

As part of the Toxic Substance Monitoring Program (TSMP) of the State Water Resources Control Board (now called the SWAMP program), fish were periodically collected from Lake Nacimiento starting in 1981 to 1996 (9). This dataset includes 74 analyses for mercury representing five species: large mouth bass, white bass, carp, channel catfish, and black crappie. Of the 74 analyses, only 52 analyses were from fish large enough to be considered legal/consumable (OEHHA). Seven other metals have been tested for at least once in the fish collected as part of TSMP (the number in parentheses is the number of analyses for that metal): arsenic (3), cadmium (3), copper (1), nickel (7), lead (8), selenium (9), and zinc (7). None of the other metals other than mercury were found at levels of concern for human health consumption (10).

A white bass that was collected in 1981 as a part of the TSMP was analyzed for chlorinated pesticides and polychlorinated biphenyls (PCBs) (9). Most of the organic chemicals were not detected (TSMP). The following chemicals were detected at very low levels and below the EPA's screening levels for these chemicals in fish: a-hexachlorocyclohexane (2 parts per billion [ppb]), p,p-DDE (32 ppb), trans nonachlor (7 ppb), and cis-chlordane (5 ppb) (10).

In 1993, California Polytechnic State University (Cal Poly) in San Luis Obispo was funded by the Central Coast Regional Water Quality Control Board to look at the effects of mercury movement within the Lake Nacimiento watershed (11). As part of this effort, fish were collected from Lake Nacimiento as well as in surface water closer to the mines. The fish were only analyzed for mercury. This data includes 75 mercury analyses from fish of legal/consumable size representing nine species: threadfin shad, white bass, channel catfish, largemouth bass, Sacramento sucker, smallmouth bass, carp, brown bullhead, and bluegill.

Based on the high levels of mercury found in these fish sampling efforts, a state fish advisory for large mouth bass consumption (see Appendix C in Appendix D of this document), and a county fish advisory covering all fish from the lake were issued in the early 1990s.

The mercury levels in fish from the TSMP and the Cal Poly study will be evaluated with the information found from this exposure investigation.

Exposure Investigation

As part of its health assessment activities, CDHS identified the need for additional data documenting the levels of chemicals, specifically mercury, in fish and revisiting the fish advisories. In February 2006, CDHS staff conducted an exposure investigation which consisted of collecting six species of fish from Lake Nacimiento. All fish were analyzed for mercury. Some of the fish were also analyzed for organic chemicals to identify the need for additional information. In this health consultation, CDHS presents the findings of the fish analyses and the need for a revised or reissued fish consumption recommendation. The findings of this health consultation have been developed in consultation with OEHHA that has the responsibility for issuing fish advisories in the state. The county is releasing a revised interim fish advisory with the release of this health consultation.

Fish Sampling and Compositing

CDHS, in consultation with OEHHA and ATSDR, developed a fish sampling workplan prior to sampling (see Appendix D). The species of fish that were targeted and the number of each fish species was based in part on a trip to Lake Nacimiento in January 2006 with DFG, EPA, and county staff. At that time, electroshocking was conducted to ascertain current fish populations. The primary species that were seen at that time included spotted bass, common carp, black crappie, bluegill, and a few sunfish.

The spotted bass was chosen as a targeted species as there was no knowledge of the levels of mercury in the species from either the TSMP or the Cal Poly study. White bass are a popular sport-fishing species, so it was chosen as a targeted species. Crappie, channel catfish, bluegill, and carp were the other species targeted as certain fisher populations catch these species for consumption (Figure 3). Largemouth bass were not targeted as none were found during the January 2006 visit (and none were seen during the fish sample collection either).

In 2006, fish were collected from three different areas of the lake to see if location would influence the levels of mercury in the fish (Figure 4). Fish were collected from Las Tablas Creek as this is the arm of the lake which receives the runoff from the Klau/Buena Vista Mines. Fish were collected from the Narrows which is upstream from the mine input and a popular area for boat fishing. Dip Creek arm was chosen as the third spot as it is near Heritage Ranch where folks can fish from piers and also a popular boat fishing area. At the beginning and the end of fishing, a given location, a latitude, and longitude were recorded.

Using electroshock equipment, DFG and CDHS staff collected fish from the Narrows on the evening of February 28 and the early morning of March 1. Using electroshocking equipment, CDFG, OEHHA, and CDHS staff collected fish from Las Tablas Creek arm on the evening of February 29 and the morning of March 2. Using electroshocking equipment, CDFG, OEHHA, and CDHS staff collected fish from Snake Creek arm on the evening of March 2. Gill netting was also used to catch fish from Snake Creek arm on the evening of March 2 and the morning of March 3.

After being caught, fish were killed by a blunt blow to the head; their fork, total length, and weight were measured and recorded; then they were placed in a bag formed out of heavy duty aluminum foil that was marked with the location the fish was caught, the date, and the fish species. When possible, more than one fish of the same species from the same location were placed in the same bag. The bags were placed on dry ice in a cooler.

The fish were kept on dry ice and delivered to the Fish and Game laboratory in Rancho Cordova on March 4, 2006. Chain of custody forms were completed and signed. CDFG caught white bass from the Las Tablas Arm on March 20, stored them on dry ice, and delivered them to the CDFG lab in Rancho Cordova on March 21.

Table 1 shows the targeted number of fish from each location by species as proposed in the workplan. The actual number of composites and the number and sizes of fish in individual sample composites were decided in consultation with OEHHA and DFG after the collection at the lake was completed (a summary of the composite samples is presented in Appendix E).

The DFG staff processed the fish April 2006. As described in the workplan, the DFG staff took a plug of fish taken above the lateral line of the fish to be used for the individual sample analysis or for compositing with other plugs from the same fish species and same location for a composite sample (the plug dissection is depicted in Figure 5).

Discussion

Chemical Analysis and Quality Assurance

Chemical analyses were done as described in the workplan. All individual and composite samples were analyzed for mercury. The composite of the largest channel catfish and the composite from the largest carp from Las Tablas arm were each analyzed for the organic compounds. The mercury analyses were performed in May and July 2006. The pesticide, PCB congener, and Arochlor analyses were conducted in late August and early September 2006. The PBDE analyses were conducted in late September 2006. The holding times of 40 days after the samples are extracted was exceeded for the organic analyses. This is not considered an issue for these chemicals (Robert Brodberg, personal communication).

The following is a summary of the quality assurance issues for each analysis (the laboratory worksheets including the quality assurance samples are shown in Appendix E and F):

- Mercury analyses. The matrix samples, standard reference material samples, method blank, three calibration blanks, laboratory control standard sample, and sample duplicate for each of the five sets of analyses were well within acceptable range.

- Chlorinated pesticides. The method blank was good. Low recoveries for chlorpyrifos, endosulfan II, endosulfan sulfate, methyoxychlor, and methyl parathion occurred during the laboratory control spike. Low recoveries for endosulfan sulfate and methyoxychlor occurred in the matrix spike. High recoveries occurred for o,p'-DDD and heptachlor epoxide in the standard reference material sample, and low recoveries occurred for hexachlorobenzene in the standard reference material.

- PCBs. The method blank, laboratory control spike, and matrix spike samples were all within acceptable ranges. Three of the 24 surrogate readings in the standard reference material were outside of control limits. The other 21 surrogate readings were within control limits in the standard reference material.

- PBDE. The method blank and matrix samples were well within acceptable ranges. One of the PBDE congeners, PBDE 190, had a low recovery in the laboratory control sample (44%) whereas the other 11 congeners were well within acceptable ranges.

The final data were judged to be good and the data acceptable to be used to evaluate for impact to human health (12).

Comparison of Organic Chemical Results to Screening Values

The screening value approach is recommended by EPA (10) to identify chemical contaminants if fish tissue at concentrations which may be of human health concern for frequent consumers of sport fish. The screening values are not intended as levels at which consumption advisories should be issued but are useful as a guide to identify fish species and chemicals from a data set for which more health evaluation may be needed. OEHHA has developed screening values for some of these same compounds and assumed a fish intake of 21 grams per day (13).

Table 2 shows the organic chemicals that were detected in the two fish caught as part of 2006 fish sampling event and the one fish that was analyzed for chlorinated pesticides and PCBs as part of the TSMP sampling. (The laboratory data worksheets for the pesticides, PCB, and PBDE analyses can be found in Appendix E.) None of the organic chemicals that were detected exceed their screening values.

Even though there have been only a few fish from Lake Nacimiento analyzed for organic chemicals, the lake does not appear to have been heavily impacted by anthropogenic sources of chlorinated pesticides, PCBs, or PBDEs. Perhaps this is not surprising as the watershed has not been used for crop production or industrial activity, and has a low population density (9).

Mercury Levels in Fish from Lake Nacimiento

The arithmetic means of mercury concentrations, length, and sample size for the fish taken from Lake Nacimiento in February/March 2006 as part of this ATSDR Exposure Investigation (EI) are shown in Table 3. The laboratory data worksheets for the mercury analyses are shown in Appendix F. OEHHA's approach to calculating mean concentrations with composite samples is to weight the composite by the number of individual fish in the composite sample, this approach was used for this document as well (weighted data shown in Table 4).

In addition to the level of mercury in a fish being dependent upon the amount of mercury in the fish's environment, other factors such as the age (or length) of fish and the fish species play important roles (1). Fish at the top of the food chain (predatory fish) generally have the highest levels of mercury. The age (or length of the fish for a particular species) is important because the relatively long biological half-life of methylmercury in fish (approximately 2 years) means the concentration of mercury in fish tissue increases with age (length). Additional issues such as environment pH, redox potential, temperature, alkalinity, buffering capacity, suspended sediment load, and geomorphology in individual water bodies also play a role in determining mercury levels in fish (1).

The mercury concentrations in the fish from Lake Nacimiento collected as part of this exposure investigation clearly show that the predatory fish (white bass, spotted bass) have higher amounts of mercury than do the bottom feeders (channel catfish, carp) (Figure 6).

The effect of age (length) on mercury concentrations is shown by species in Figure 6. Some of the species appear to show a clearer pattern between age (length) and mercury levels: white bass, spotted bass, and crappie. Statistically, the mercury concentrations to length for those three species can be best fitted to a line with a Pearson coefficient of correlation greater than 0.5. It is perhaps not surprising that the predatory fish accumulate more mercury as they get older. On the other hand, bottom feeder fish such as the catfish and carp do not bioaccumulate mercury in a pattern clearly related to their age.

Lastly, it appears that across all species, the location at which the fish were caught did not play an important role in determining the mercury concentrations (Figure 6). This may seem surprising given the main mercury source to the lake occurs in the Las Tablas Arm which is downstream of The Narrows, one of the locations where the fish were caught (TMDL, Cal Poly). Fish do move around a water body however; the Narrows is approximately 7 miles upstream from the Las Tablas Arm. White bass, may move miles in order to spawn, however, other fish like channel catfish or crappie are not thought to migrate so widely. Perhaps some of it can be explained by fisherman who catch fish in one location decide to release the fish in another location. Or perhaps, the mercury load in the lake is widely disbursed even upstream and levels of mercury methylation in the sediment may vary across the lake. The mercury sources to the lake have been investigated by sampling tributaries to the lake but the load in the lake has not been studied.

Combining Data Sets

To increase the number of samples upon which a fish consumption recommendation could be based, statistical analyses were run to see if data from the TSMP and Cal Poly sampling efforts could be combined with the data generated from this ATSDR exposure investigation (Tables 3 and 4).

A curvilinear quadratic fit best represented the length/mercury relationship; therefore length was represented by a subset of length and length-square. Mercury concentrations were log-transformed. After accounting for length, the model showed that 2.3% for white bass and 3% for largemouth bass of unique mercury variance is explained by the different data sets. These small influences were significant, never the less the effect was small and so the data from all three sampling efforts was combined.

The multivariate analysis described above also showed that the length (age) of the largemouth bass explained about 39% of the mercury concentrations in the fish; while the effect was larger in the white bass where 72% of the mercury concentration could be explained by the length (age) of the fish.

Table 5 shows the combined data for the mercury concentrations in fish from Lake Nacimiento from the ATSDR EI, TSMP, and the Cal Poly studies. This data will be evaluated for human health impact and fish consumption recommendations.

Revaluation of the Fish Consumption Recommendations (Fish Advisory) at Lake Nacimiento

In consultation with OEHHA, CDHS used the OEHHA guidance tissue levels for mercury/methylmercury to evaluate the appropriate fish consumption guidance needed for each fish species in Lake Nacimiento (Table 2 in Appendix D). OEHHA generally issues site-specific consumption advice beginning at a consumption frequency of 12 meals per month (three times a week). Fish that can be eaten at this frequency represent fish with lower levels of mercury. OEHHA calls fish with lower levels of mercury “Best Choices” and encourages consumption of fish in this category. OEHHA typically uses other consumption frequencies of eight meals a month (two meals per week), four meals a month (one meal per week), one meal a month, and no consumption Table 4 in Appendix D). OEHHA used the older RfD (0.0003 mg/kg/day) to establish guidance tissue levels for “women beyond their childbearing years and men” (8). OEHHA used the newer RfD (0.0001 mg/kg/day) to establish guidance tissue levels for “women of childbearing age and children aged 17 and younger” (8). Using different guidance values for different populations balances the important healthy benefits of eating fish with the knowledge that the methylmercury affects the development of the nervous system which starts in the womb and extends into adolescence.

All fish species with a minimum of 11 samples were compared to the guidance tissue levels to develop consumption guidelines (Table 4 in Appendix D). Common species in Lake Nacimiento that were not sampled or for which there were less than 11 samples (brown bullhead, smallmouth bass, redear sunfish) but are closely related to species that were sampled were included in the safe eating guidelines for the related species with adequate sample sizes (channel catfish, spotted bass, and bluegill, respectively).

Safe Eating Guidelines for Lake Nacimiento

CDHS and OEHHA recommend that "women of childbearing age and children aged 17 years and younger" not eat black bass (spotted bass, largemouth bass, and smallmouth bass) or white bass, bluegill (redear sunfish), black crappie, common carp, or catfish (channel catfish, white catfish, brown bullhead) from Lake Nacimiento.

CDHS and OEHHA recommend that "women beyond their childbearing years and men" not eat black bass (spotted bass, largemouth bass, and smallmouth bass) or white bass. This population could eat one meal per week (four meals per month) of bluegill (redear sunfish), black crappie, common carp, or catfish (channel catfish, white catfish, and brown bullhead).

CDHS provides the following additional information that OEHHA issues as part of its fish advisory information:

> "Consumers should be informed of the potential hazards from eating fish with high mercury concentrations, particularly those hazards relating to the developing fetus and children, as well as the fish species that contain less mercury and therefore provide better options when choosing fish to eat. All individuals, especially women of childbearing age and children aged 17 years and younger, are advised to limit their consumption of high-mercury fish to reduce methylmercury ingestion to a level as close to the RfD as possible. In addition, consumption of fish species that have less restrictive advice (for example, once a week compared to once a month) is encouraged because it allows consumers to eat more fish and thereby experience the benefits of fish consumption while reducing the risk of adverse health effects. Recreational fishers may opt to practice catch-and-release for species that have high levels of mercury.
>
> It is very important to note that if an individual consumes multiple species or catches fish from more than one site, the recommended guidelines for different species and locations should not be combined (i.e., added). For example, if a pregnant woman were to eat a meal of black crappie from Lake Nacimiento, she should not eat any other fish that month. Alternatively, she could eat two meals a week of store-bought fish low in mercury as recommended by the American Heart Association, and the joint advisory from U.S. EPA and FDA (as described below), in place of the meal of sport-caught sunfish.
>
> OEHHA also recommends that "women of childbearing age and children aged 17 and younger**"** follow the Joint Federal Advisory for Mercury in Fish for commercial fish. This advisory recommends that these individuals do not eat shark, swordfish, king mackerel, or tilefish because of their high mercury levels. The federal advisory also states that these individuals can safely eat up to an average of 12 ounces (two average meals) per week of a variety of other cooked fish purchased at stores or restaurants such as shrimp, canned light tuna, wild salmon, pollock, or (farm-raised) catfish. Albacore

> (“white”) tuna is known to contain more mercury than canned light tuna; it is therefore recommended that no more than six ounces of albacore tuna be consumed per week.
>
> For general advice on how to limit your exposure to chemical contaminants in sport fish (e.g., eating smaller fish of legal size), see Appendix G. It should be noted that, unlike the case for many fat-soluble organic contaminants (e.g., DDTs and PCBs), various cooking and cleaning techniques will not reduce the methylmercury content of fish”(8).

The complete recommendations (safe eating guidelines) for consumption of fish from Lake Nacimiento are presented in Appendix B, Figure 7. One of the recommendations in the General Advice on how to limit exposure to chemical contaminants (Appendix G) is to fish in a variety of locations. Lake San Antonio is located approximately 6 miles to the north of Lake Nacimiento. Based on limited fish sampling from that lake as a part of the TSMP, the fish have very low mercury levels (9). Thus, fishing in Lake San Antonio could provide an excellent, nearby fishing hole.

ATSDR Child Health Consideration

ATSDR recognizes that infants and children may be more sensitive to exposures, depending on substance and the exposure situation, than adults in communities with contamination of their water, soil, air, and/or food. This sensitivity is a result of several factors: 1) Children may have greater exposures to environmental toxicants than adults because pound for pound of body weight, children drink more water, eat more food, and breathe more air than adults; 2) Children play outdoors close to the ground which increases their exposure to toxicants in dust, soil, surface water, and in the ambient air; 3) Children have a tendency to stick their hands in their mouths while playing without washing their hands, thus, they may come into contact with, and ingest, potentially contaminated soil particles at higher rates than adults (also, some children possess a behavior trait known as "pica" which causes them to ingest non-food items, such as soil); 4) Children are shorter than adults, which means they can breathe dust, soil, and any vapors close to the ground; 5) Children's bodies are rapidly growing and developing; thus, they can sustain permanent damage if toxic exposures occur during critical growth stages; and 6) Children and teenagers may disregard no trespassing signs and wander onto restricted locations. Because children depend completely on adults for risk identification and management decisions, ATSDR is committed to evaluating their special interests at sites such as the Klau/Buena Vista Mines site as part of the ATSDR Child Health Consideration.

The fish consumption recommendations in this health consultation specifically address exposure and risk to children.

Conclusion

The watershed of Lake Nacimiento has several abandoned or inactive mercury mines. The Klau/Buena Vista Mines have been identified as the major source of mercury in Lake Nacimiento sediment. The water is safe to drink and recreate in. However, mercury in the sediment has been converted to methylmercury by organisms living in the sediment and then there has been bioaccumulation of methylmercury in fish in the lake.

During an exposure investigation conducted by CDHS with ATSDR and OEHHA in February/March 2006, elevated levels of mercury were found in six species of fish from Lake Nacimiento. The mercury levels in the fish pose a health hazard. The information from the exposure investigation was combined with mercury tissue levels in Lake Nacimiento fish from two other sampling efforts conducted in the 1980s and 1990s, to provide the basis for an evaluation of fish consumption recommendations (see recommendations below).

Recommendations

1. The county should issue a revised interim fish advisory for Lake Nacimiento, containing the following advice:
    - Women of childbearing age, pregnant or breastfeeding women, and children 17 years and younger should not eat any fish meals of white bass or any black bass (spotted bass, largemouth bass), catfish, bluegill or other sunfish, carp, or crappie.
    - Women beyond childbearing age and men should not eat any fish meals of white bass or any black bass (spotted bass, largemouth bass).
    - Women beyond childbearing age and men should eat no more than 1 fish meal/week, of catfish, bluegill or other sunfish, carp, crappie.
2. The Office of Environmental Health Hazard Assessment should issue an advisory for Lake Nacimiento.

Public Health Action Plan

The Public Health Action Plan is a collection of activities intended to ensure that this health consultation provides a plan of action to mitigate and to prevent adverse effects on human health resulting from exposure to contamination from the Klau/Buena Vista Mines site. Some activities have already been taken by CDHS, EPA, the county, or the responsibility parties. Others activities are either on-going or planned for the future.

Actions Completed

- CDHS conducted an exposure investigation of the mercury levels in fish from Lake Nacimiento (February/March 2006).

- CDHS assessed the needs of anglers, permanent and seasonal residents around Lake Nacimiento and other nearby populations for their knowledge of the fish advisory at Lake Nacimiento and best mechanisms to conduct outreach with them.

- CDHS distributed fish consumption recommendations at Women, Infants, and Children centers and a food bank (February and March 2006).

Actions Underway

1. The County of San Luis Obispo is working with CDHS and OEHHA to revise and reissue the interim fish advisory for Lake Nacimiento.

2. CDHS in conjunction with ATSDR, OEHHA, and the County of San Luis Obispo County are preparing outreach material to share the fish consumption recommendations:

    - Public service announcement in Spanish to play on radio stations around Paso Robles.
    - Mailing of fish consumption recommendations and general fish consumption advice to all post office boxes around Lake Nacimiento.
    - Working with communities around the lake such as Heritage Ranch, Oak Shores to have the fish consumption recommendations be a permanent addition to their association newsletters.
    - Work with the Monterey County Water District to post signs at public access points along lake (at entrance and cleaning station) and on lake at the bathrooms (signs at lake will be bilingual).
    - Work with residential communities and boat clubs to post signs at the boat launches and fish cleaning stations.
    - Work with neighborhood associations/boat clubs to update their web postings.
    - Modify signs to be used as a flyer for stores and motels.
    - Work with the county and OEHHA to create a press release to San Luis Obispo Tribune.

3. CDHS will conduct a train the trainers for health educators and community health workers serving the area, with particular focus on the Spanish-speaking community.

4. CDHS is conducting a health assessment of other exposure pathways related to the Klau/Buena Vista Mines site.

5. EPA is conducting a site characterization of the Klau/Buena Vista Mines and the areas they have impacted to ascertain what clean-up activities need to take place.

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Certification

The Evaluation of Fish Contamination in Lake Nacimiento, Klau/Buena Vista Mine Site located near Paso Robles, San Luis Obispo County, California Public Health Consultation was prepared by the California Department of Health Services under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

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Division of Public Health Assessment and Consultation
ATSDR

The Division of Public Health Assessment and Consultation, ATSDR, has reviewed this health consultation and concurs with the findings.

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ATSDR

Appendix A. Glossary

Adverse Health Effect
A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR
The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency based in Atlanta, Georgia, that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from contact with chemicals.

Background Concentration
An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.

CERCLA
See Comprehensive Environmental Response, Compensation and Liability Act.

Completed Exposure Pathway
See Exposure Pathway.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
CERCLA was put into place in 1980. It is also known as Superfund. This act concerns releases of hazardous substances into the environment, and the clean up of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

Concern
A belief or worry that chemicals in the environment might cause harm to people.

Concentration
How much of a substance present in a certain amount of soil, water, air, or food.

Contaminant
See Environmental Contaminant.

Dermal Contact
A chemical getting onto your skin. (See Route of Exposure.)

Dose
The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as the amount of substance(s) per body weight per day.

Dose/Response
The relationship between the amount of exposure (dose) and the change in body function or health that result.

Duration
The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant
A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in Background Concentration, or what would be expected.

Environmental Media
Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. Environmental Media is the second part of an Exposure Pathway.

Exposure
Coming into contact with a chemical substance. (For the three ways people can come in contact with substances, see Route of Exposure.)

Exposure Assessment
The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway
A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical. ATSDR defines an exposure pathway as having five parts:
1. Source of Contamination
2. Environmental Media and Transport Mechanism
3. Point of Exposure
4. Route of Exposure
5. Receptor Population

When all five parts of an exposure pathway are present, it is called a Completed Exposure Pathway.

Hazardous Waste
Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Maximum Contaminant Level (MCL)
EPA has issued drinking water standards, or MCLs, for more than 80 contaminants in drinking water. The MCLs are set based on known or anticipated adverse human health effects (that also account for sensitive subgroups, such as, children, pregnant women, the elderly, etc.), the ability of various technologies to remove the contaminant, their effectiveness, and cost of treatment. For cancer risk, EPA generally sets the MCLs at concentrations that will limit an individual risk of cancer from a contaminant to between 1 in 10,000 (low increased excess risk) to 1 in 1,000,000

(no apparent increased excess risk) over a lifetime. As for noncancer effects, EPA estimates an exposure concentration below which no adverse health effects are expected to occur.

Noncancer Evaluation, ATSDR's Minimal Risk Level (MRL), and EPA's Reference Dose (RfD)
The MRL and RfD, are estimates of daily exposure to the human population (including sensitive subgroups), below which noncancer adverse health effects are unlikely to occur. The MRL and RfD only consider noncancer effects. Because they are based only on information currently available, some uncertainty is always associated with the MRL and RfD. "Safety" factors are used to account for the uncertainty in our knowledge about their danger. The greater the uncertainty, the greater the "safety" factor and the lower the MRL or RfD.

When there is adequate information from animal or human studies, MRLs and RfDs are developed for the ingestion exposure pathway. A MRL or RfD is an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse (non-carcinogenic) health effects over a specified duration of exposure. No toxicity values exist for exposure by skin contact. Separate noncancer toxicity values are also developed for different durations of exposure. ATSDR develops MRLs for acute exposures (less than 14 days), intermediate exposures (from 15 to 364 days) and for chronic exposures (greater than 1 year). EPA develops RfDs for chronic exposures (greater than 7 years). Both the MRL and RfD for ingestion are expressed in units of milligrams of contaminant per kilograms body weight per day (mg/kg/day).

NPL
The National Priorities List (which is part of Superfund). A list kept by the United Stated Environmental Protection Agency (EPA) of the most serious, uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

PHA
Public Health Assessment. A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Point of Exposure
The place where someone can come into contact with a contaminated environmental medium (air, water, food, or soil). Examples: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population
A group of people living in a certain area or the number of people in a certain area.

PRP
Potentially Responsible Party. A company, government, or person that is responsible for causing the pollution at a hazardous waste site. PRPs are expected to help pay for the clean up of a site.

Public Health Assessment(s)
See PHA.

Public Health Hazard
The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria
PHA categories given to a site which tell whether people could be harmed by conditions present at the site. The categories are:
1. Urgent Public Health Hazard
2. Public Health Hazard
3. Indeterminate Public Health Hazard
4. No Apparent Public Health Hazard
5. No Public Health Hazard

Route of Exposure
The way a chemical can get into a person's body. There are three exposure routes:
1. Breathing (also called inhalation)
2. Eating or drinking (also called ingestion)
3. Getting something on the skin (also called dermal contact)

Source (of Contamination)
The place from which a chemical comes, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an Exposure Pathway.

Special Populations
People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and the elderly are often considered special populations.

Superfund Site
See NPL.

Toxic
Harmful. Any substance or chemical can be toxic at a certain dose (amount).

Toxicology
The study of the harmful effects of chemicals on humans or animals.

Appendix B. Figures

Figure 1. Vicinity Map of Lake Nacimiento, Klau/Buena Vista Mines, San Luis Obispo, County, California

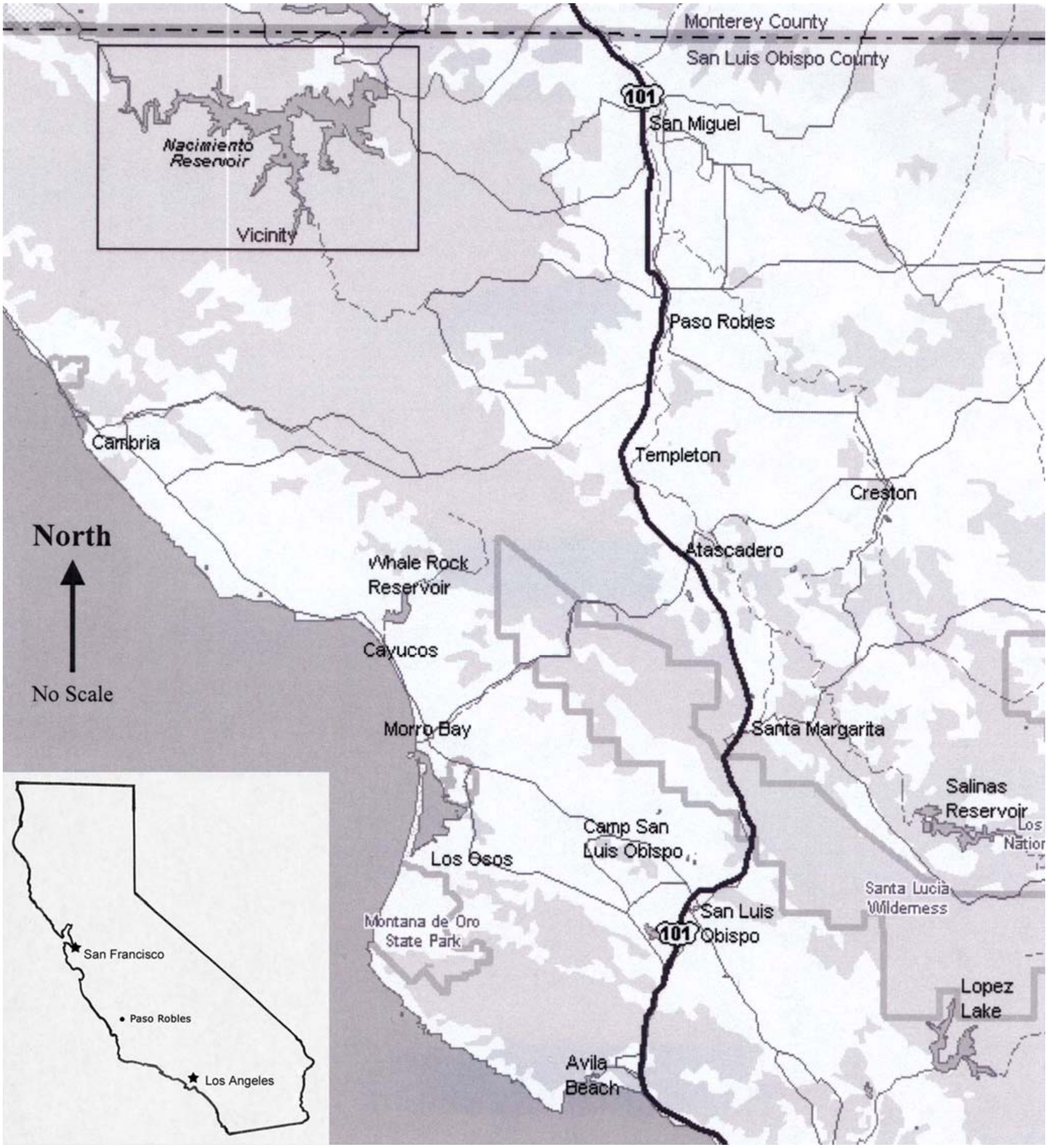


Figure 2. Topographic Map of the Area Around Lake Nacimiento, Klau/Buena Vista Mines, San Luis Obispo County, California

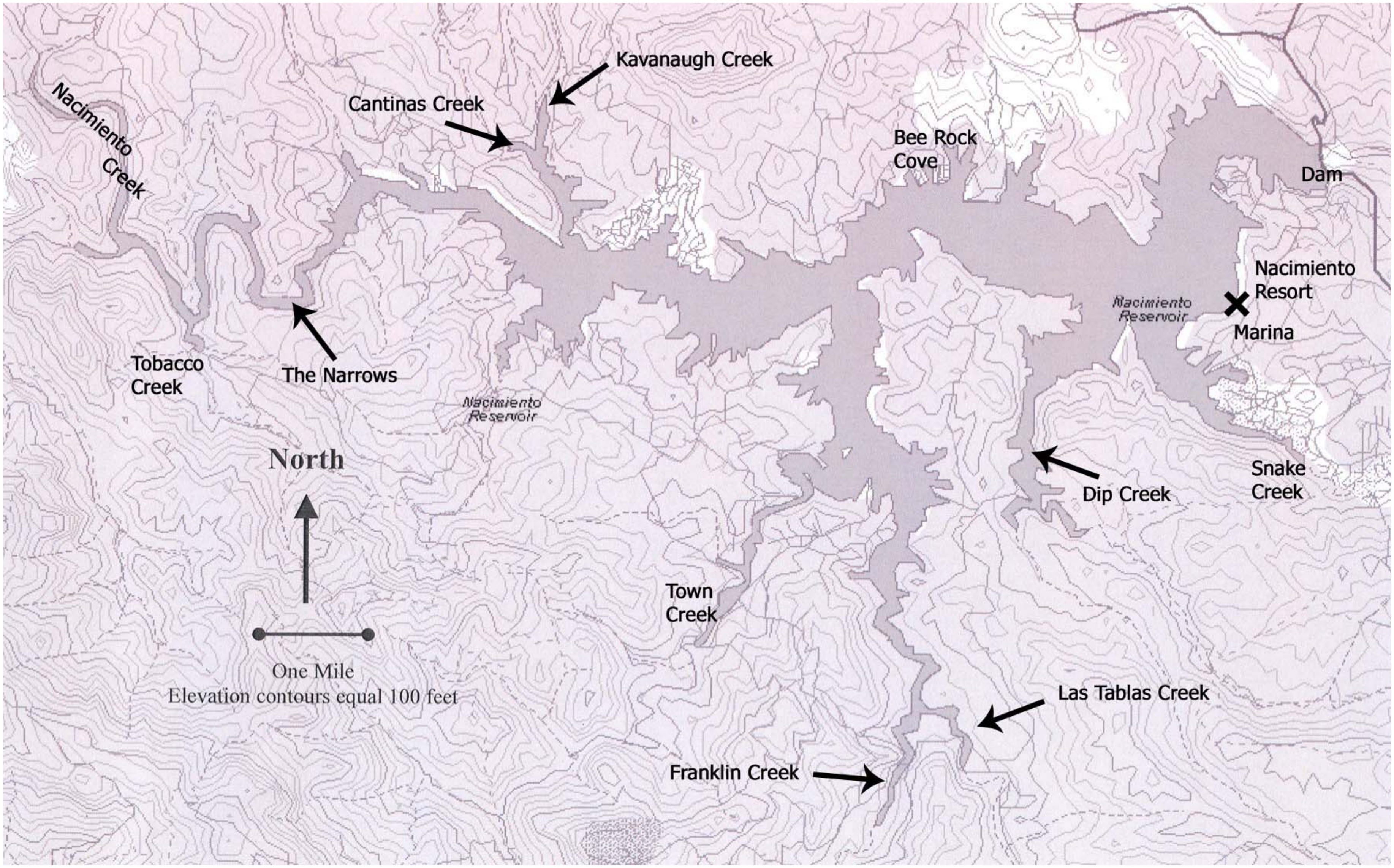
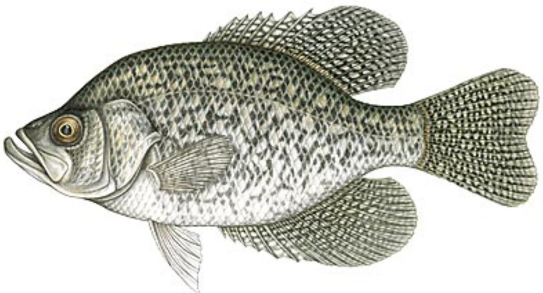
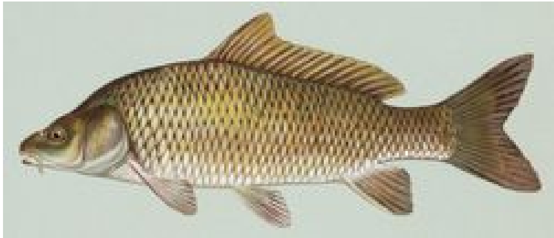


Figure 3. Fish Targeted for the Agency for Toxic Substances and Disease Registry's Exposure Investigation, Klau/Buena Vista Mines, San Luis Obispo County, California
Note: images not to scale

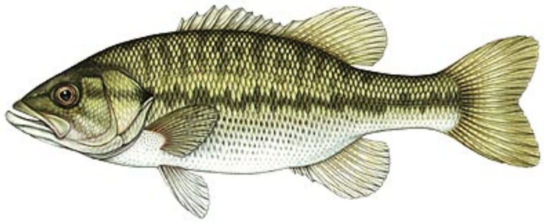


Black Crappie (genus species)



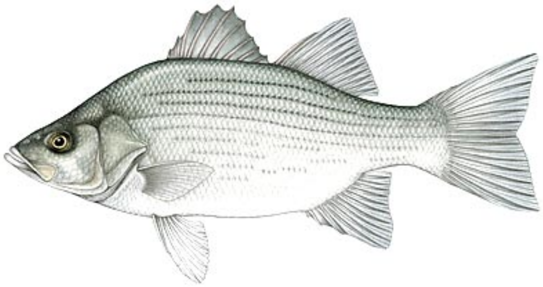
Common Carp (genus species)

Bluegill (Leomarchis macrochilus)



Spotted Bass (genus species)

Channel Catfish (genus species)



White Bass (genus species)

Figure 4. Residential Communities, Including Boat Clubs Located Around Lake Nacimiento, Klau/Buena Vista Mines, San Luis Obispo County, California

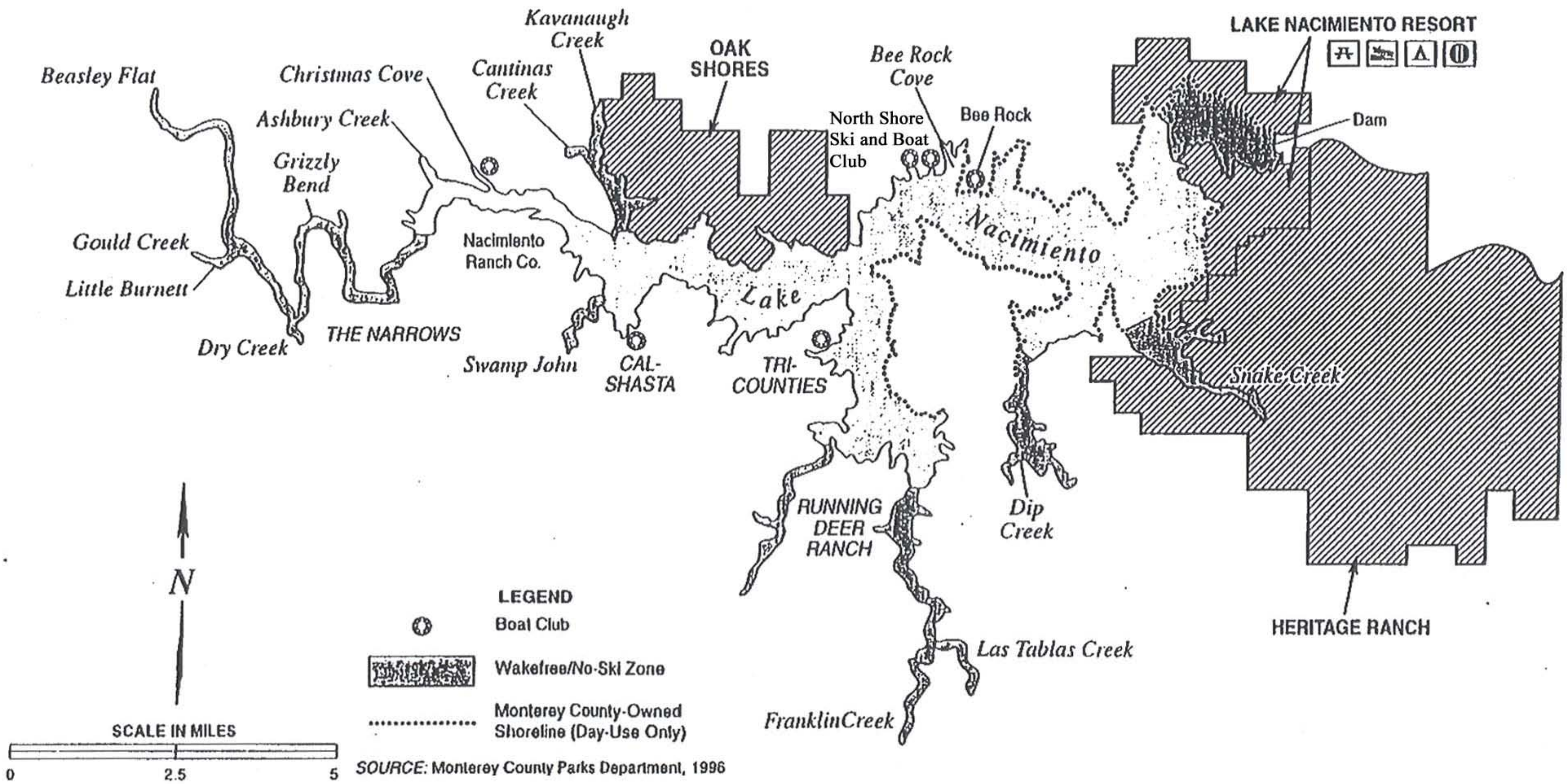
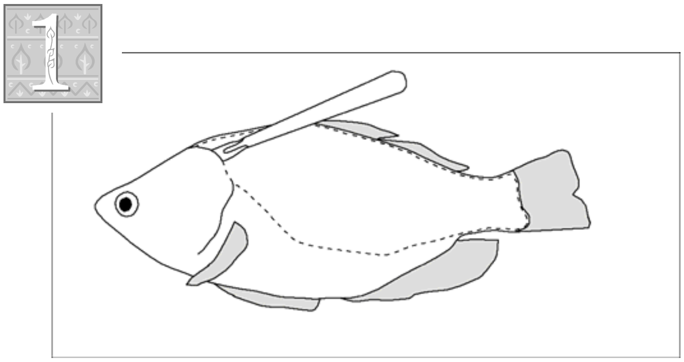
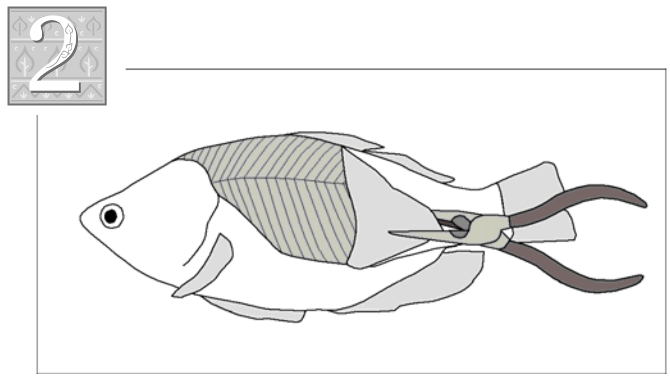


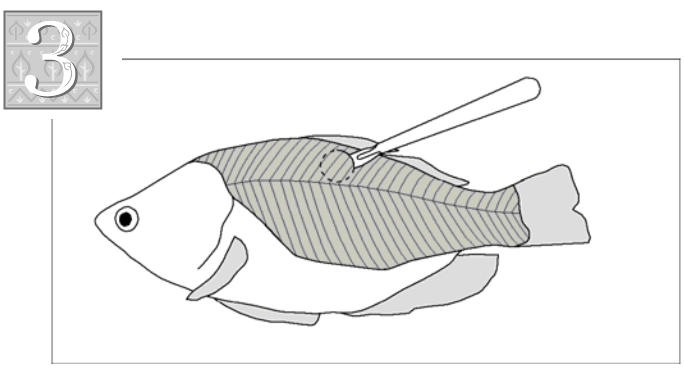
Figure 5. Illustration of Taking a Plug Tissue Sample from a Fish, Klau/Buena Vista Mines, San Luis Obispo County, California



With a scalpel, cut longitudinally starting just posterior to the operculum (gill cover) running dorsally the full length of the fish. Then a vertical incision is made from the start of the first cut, posterior of the operculum, to just above the body cavity. Then a cut is made longitudinally from this point to the caudal end body. All incisions should be through the epidermis.

Using “v” shaped forceps or needle nose pliers, the skin is pulled back, exposing the tissue.





With a fresh blade, a plug of tissue (5 to 7 grams) is cut in the area of exposed tissue, centered below the dorsal fin and above the lateral line.

The plug sample is removed.

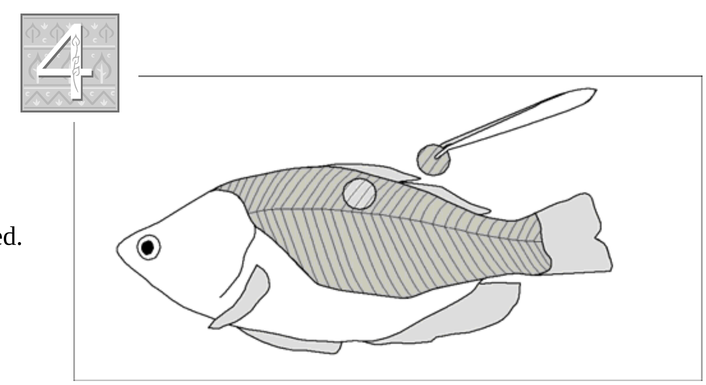


Figure 5. Mean Mercury Concentrations in Fish by Species and by Location from Lake Nacimiento (ATSDR Exposure Investigation) Klau/Buena Vista Mines, San Luis Obispo County, California

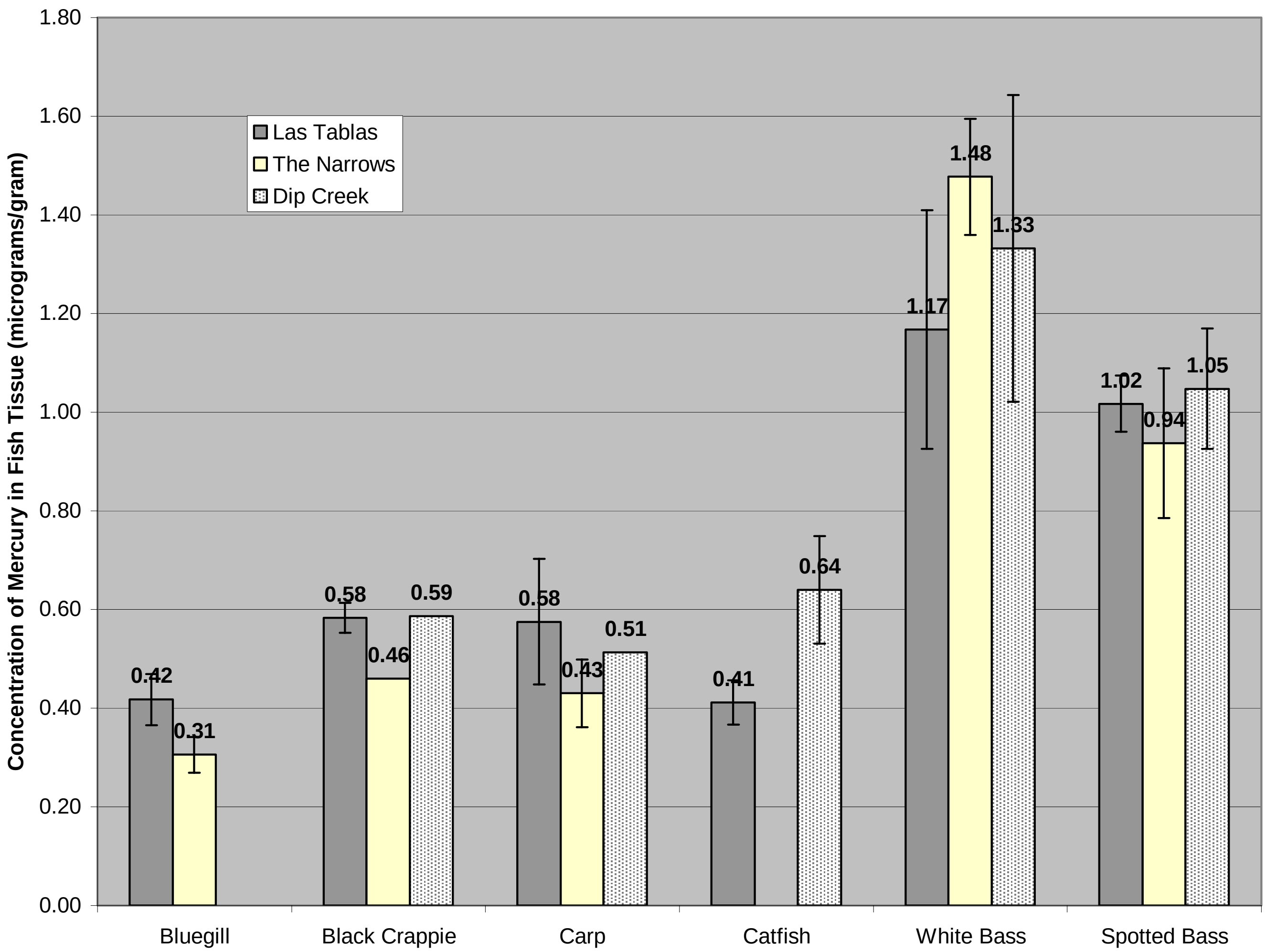
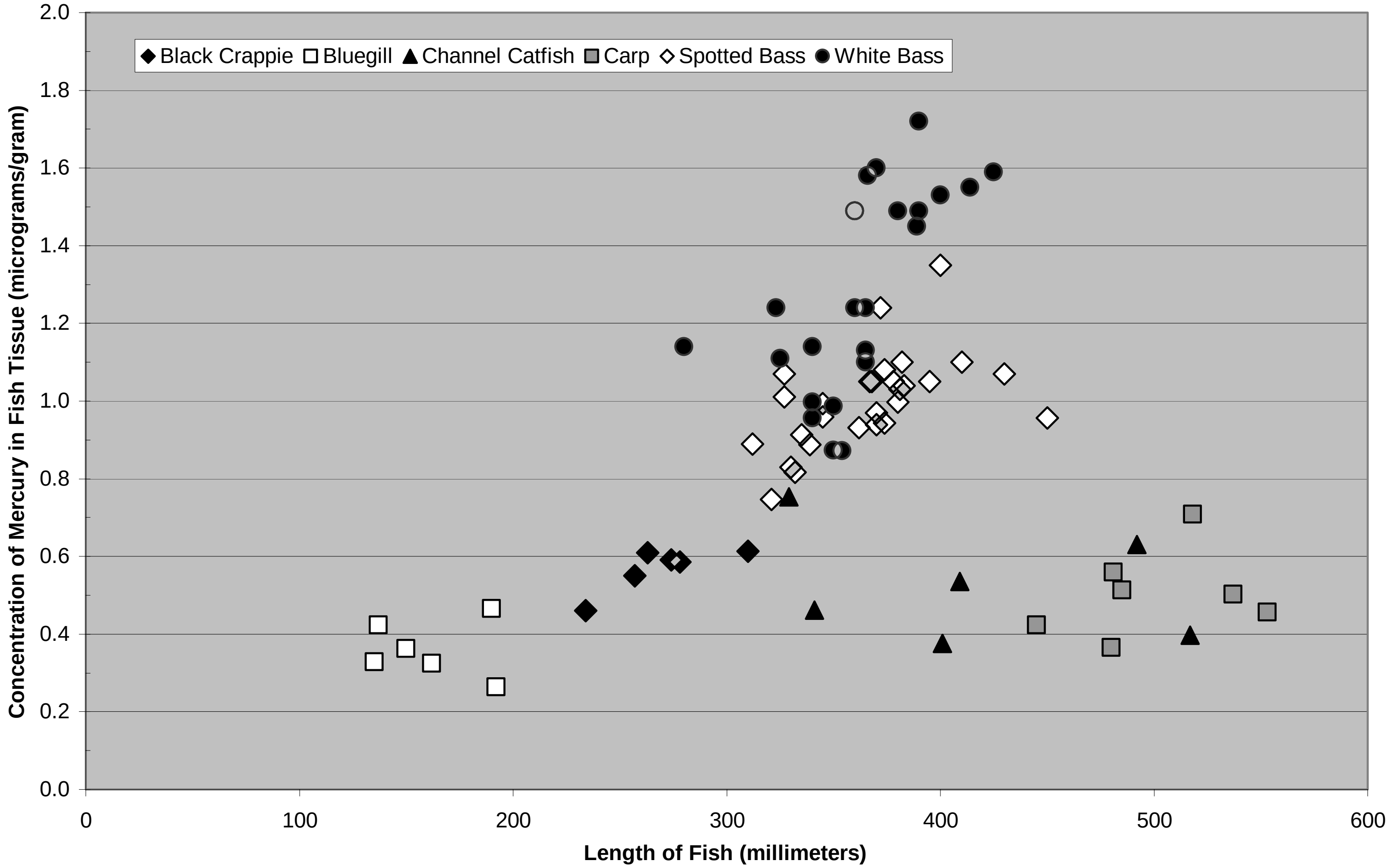


Figure 6. Mercury Concentrations as a Function of the Fish Length Distinguished by Species from Fish Collected from Lake Nacimiento (ATSDR Exposure Investigation), Klau/Buena Vista Mines, San Luis Obispo County, California

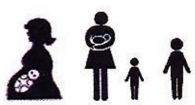


White bass and spotted bass were analyzed individually; other fish species primarily analyzed as composite samples.

Figure 7. Safe Eating Guidelines for Fish Consumption from Lake Nacimiento

PLEASE NOTE: DRINKING OR PLAYING IN THE LAKE WATER IS SAFE.

Fish are nutritious and should be part of a healthy, balanced diet. It is important, however, to choose your fish wisely. The American Heart Association recommends healthy adults eat at least two meals of fish a week. The County of San Luis Obispo recommends that you choose fish to eat that are lower in mercury. Because some types of fish from Lake Nacimiento contain high levels of mercury, the County of San Luis Obispo provides the recommendations below that you can follow to reduce the risks from exposure to methylmercury in fish.



Women of childbearing age, pregnant or breastfeeding women, and children 17 years and younger

AVOID **DO NOT EAT**
White bass or any black bass (spotted bass, largemouth bass) Catfish, bluegill or other sunfish, carp, crappie

Women beyond childbearing age and men

EAT IN MODERATION **No more than 1 meal a week**
Catfish, bluegill or other sunfish, carp, crappie
AVOID **DO NOT EAT**
White bass or any black bass (spotted bass, largemouth bass)

• **CONSIDER THE FISH YOU BUY FROM STORES AND RESTAURANTS.** Women of childbearing age and children can safely eat up to two meals a week of most fish purchased in a store or restaurant, **OR** use this guide for eating fish caught from this water body. In a week when you eat two meals of fish purchased from stores or restaurants, avoid eating fish caught from a local water body. Commercial fish such as shrimp, king crab, scallops, farmed catfish, wild ocean salmon, oysters, tilapia, flounder, and sole generally contain some of the lowest levels of mercury. Women of childbearing age and children should not eat shark or swordfish, which contain the most mercury.

• **FISH FROM OTHER WATER BODIES MAY ALSO CONTAIN MERCURY**. Not all water bodies in California have been tested. With the exception of ocean or river-run salmon or steelhead, which may be consumed more frequently, fish caught from places without an advisory should be eaten in limited amounts.

Appendix C. Tables

Table 1. Fish Sampling Success at Lake Nacimiento (ATSDR Exposure Investigation), Klau/Buena vista Mines, San Luis Obispo County, California

	Sampling Plan		Sampling Results		
Species	**Number of Fish per Location**	**Composite or Individual**	**The Narrows**	**Las Tablas**	**Dip Creek**
White bass	9	9 individual	7 individual	12 individual	5 individual
Spotted bass	9	9 individual	9 individual	9 individual	10 individual
Carp	9	3 fish composite	9 fish: 3 composites	9 fish: 3 composites	3 fish: 1 composite
Channel catfish	9	3 fish composite	None	8 fish: 3 composites	10 fish: 3 composites
Crappie	15	5 fish composite	3 fish: 1 composite and 1 individual	9 fish: 3 composites	3 fish: 1 composite
Bluegill	15	5 fish composite	14 fish: 3 composites	16 fish: 3 composites	None

The Narrows: fish caught beginning N35^{o}44’980”, W12^{o}03’162” to 35^{o}44’73.9”, W121^{o}02’62.6”

Las Tablas Arm: fish caught N35^{o}41’532”, W120^{o}56’829” to N35^{o}42’712”, W120 ^{o}56’992”

Table 2. Organic Compounds in Fish from Lake Nacimiento, Klau/Buena Vista Mines, San Luis Obispo, California

	TSMP-1981	ATSDR-2006	ATSDR-2006	Screening Values
	Las Tablas	Las Tablas	Las Tablas	
	White Bass	Carp	Channel Catfish	
Chlordane, cis	5	1.1	0.91 DNQ	30 for sum of chlordanes*
Chlordane, trans	<5.0	0.472 DNQ	0.435 DNQ	
Nonachlor, trans	7	1.13	1.04	
Dacthal	<5.0	2.6	3.04	33
DDD, o,p'	<10	4.4	<0.764	100 for the sum of DDT and its metabolites*
DDD, p,p'	<10	12.3	2.14	
DDE, o,p'	<10	0.673 DNQ	<0.669	
DDE, p,p'	32	59.5	19.6	
DDMU, p,p'	<15	1.74 DNQ	<1.2	
DDT, o,p'	<10	<1.01	<1.01	
DDT, p,p'	<10	<2.46	<2.46	
Dieldrin	<5	0.941	1.08	2*
Hexachlorocyclohexane, alpha	2	<0.474	<0.474	30*
Hexachlorobenzene	<2.0	<0.297	0.245	20*
Arochlor 1248	<50	<25	<25	20 for the sum of Arochlors*
Arochlor 1254	<50	5 DNQ	5 DNQ	
Arochlor 1260	<50	3 DNQ	3 DNQ	
Total of PCB congeners without DNQ	NA	3.888	2.499	20 for the sum of the congeners*
Total of PCB congeners with DNQ	NA	5.144	3.336	
BDE 28	NA	0.327 DNQ	<0.147	
BDE 47	NA	3.82	3.67	
BDE 100	NA	0.545 DNQ	0.594 DNQ	7 ppb for pentabrominated
BDE 99	NA	<0.195	1.31	
BDE 154	NA	<0.163	0.263 DNQ	
Total of BDE congeners without DNQ	NA	4.692	5.837	20 for the lower brominated BDEs
Total of BDE congeners with DNQ	NA	3.82	4.98	

TSMP: Toxic Substances Monitoring Program.
ATSDR: Agency for Toxic Substances and Disease Registry.
DNQ: detected not quantifiable.
NA: not analyzed.
*OEHHA screening values taken from (13). OEHHA: Office of Environmental Health Hazard Assessment.
The screening value for total lower brominated BDEs developed using ATSDR's intermediate Minimum Risk Level, assuming a 70-kilogram adult ingests 21 grams per day (14).
For Dacthal and pentarominated diphenyl ethers, the screening value was derived from the Environmental Protection Agency's reference dose, assuming a 70-kilogram adult ingests 21 grams of fish per day.

Table 3. Mercury Concentrations and Fish Lengths by Species and by Sampling Effort in Lake Nacimiento (Composites are Not Weighted), Klau/Buena Vista Mines, San Luis Obispo, California

		Mercury Concentration, wet weight (µg/g)				Length* (mm)				Number of Samples	Number of Fish
		Mean	Min	Max	SD	Mean	Min	Max	SD		
ATSDR	Black Crappie	**0.568**	0.460	0.614	0.058	269	234	310	25	6	16
	Bluegill	**0.362**	0.264	0.466	0.073	161	135	192	25	6	30
	Carp	**0.504**	0.365	0.709	0.111	500	445	553	38	7	21
	Channel Catfish	**0.526**	0.376	0.753	0.146	415	329	517	77	6	18
	Spotted Bass	**1.002**	0.747	1.350	0.122	366	312	450	33	28	28
	White Bass	**1.292**	0.872	1.720	0.259	363	280	425	31	24	24
Cal Poly	Bluegill	**0.358**	0.200	0.600	0.133	156	130	202	20	16	16
	Brown Bullhead	**0.245**	0.200	0.290	0.064	232	216	247	22	2	2
	Carp	**0.484**	0.330	0.770	0.161	493	410	559	54	8	8
	Channel Catfish	**0.593**	0.470	0.800	0.149	345	276	403	52	4	4
	Largemouth Bass	**0.756**	0.350	1.230	0.238	347	305	375	23	14	14
	Sacramento Sucker	**0.346**	0.080	0.600	0.156	373	356	405	16	9	9
	Smallmouth Bass	**0.757**	0.540	1.100	0.166	332	308	364	15	10	10
	Threadfin Shad	**0.943**	0.390	1.570	0.540	154	115	168	26	4	4
	White Bass	**0.805**	0.280	1.200	0.276	317	256	380	35	8	8
TSMP	Black Crappie	**0.140**	0.140	0.140	0.000	216	216	216	26	1	6
	Carp	**0.534**	0.150	1.200	0.279	441	343	570	45	20	26
	Channel Catfish	**0.450**	0.310	0.600	0.145	427	377	488	56	3	3
	Largemouth Bass	**1.142**	0.710	1.800	0.316	364	305	442	38	23	33
	White Bass	**1.140**	0.800	1.300	0.207	374	365	380	6	5	27

*Toxic Substances Monitoring Program (TSMP): fork length was first converted to total length.
µg/g: micrograms per gram; mm: millimeter; SD: standard deviation; ATSDR: Agency for Toxic Substance and Disease Registry.

Table 4. Mercury Concentrations and Fish Lengths by Species and by Sampling Effort in Lake Nacimiento (Composites Are Weighted by Number of Fish in Sample), Klau/Buena Vista Mines, San Luis Obispo, California

		Mercury Concentration (µg/gm)		Length* (mm)		Number of Samples	Number of Fish
		Mean	SD	Mean	SD		
ATSDR	Black Crappie	**0.563**	0.055	264	20	6	16
	Bluegill	**0.366**	0.070	163	23	6	30
	Carp	**0.504**	0.105	500	36	7	21
	Channel Catfish	**0.542**	0.146	414	73	6	18
	Spotted Bass	**1.002**	0.122	366	33	28	28
	White Bass	**1.292**	0.259	363	31	24	24
Cal Poly	Bluegill	**0.358**	0.133	156	20	16	16
	Brown Bullhead	**0.245**	0.064	232	22	2	2
	Carp	**0.484**	0.161	493	54	8	8
	Channel Catfish	**0.593**	0.149	345	52	4	4
	Largemouth Bass	**0.756**	0.238	347	23	14	14
	Sacramento Sucker	**0.346**	0.156	373	16	9	9
	Smallmouth Bass	**0.757**	0.166	332	15	10	10
	Threadfin Shad	**0.943**	0.540	154	26	4	4
	White Bass	**0.805**	0.276	317	35	8	8
TSMP	Black Crappie	**0.140**	0.000	216	0	1	6
	Carp	**0.507**	0.256	438	52	20	26
	Channel Catfish	**0.450**	0.145	427	56	3	3
	Largemouth Bass	**1.063**	0.295	359	36	23	33
	White Bass	**1.133**	0.209	373	6	5	27

*Toxic Substances Monitoring Program (TSMP): fork length was first converted to total length.
µg/g: micrograms per gram; mm: millimeter; SD: standard deviation; ATSDR: Agency for Toxic Substances and Disease Registry.

Table 5. Mercury Concentrations/Fish Length by Species for the Three Sampling Efforts Combined (Composites Are Weighted by Number of Fish in Sample), Klau/Buena Vista Mines, San Luis Obispo, California

	Hg, wet weight (µg/g)				Length* (mm)					
	Mean	**Min**	**Max**	**SD**	**Mean**	**Min**	**Max**	**SD**	**Number of Samples**	**Number of Fish**
Black Crappie	**0.477**	0.140	0.614	0.198	251	216	310	28	7	22
Bluegill	**0.363**	0.200	0.600	0.095	160	130	202	22	22	46
Brown Bullhead	**0.245**	0.200	0.290	0.064	232	216	247	22	2	2
Carp	**0.503**	0.150	1.200	0.195	470	343	570	55	35	55
Channel Catfish	**0.539**	0.310	0.800	0.145	405	276	517	71	13	25
Largemouth Bass	**0.971**	0.350	1.800	0.311	355	305	442	33	37	47
Sacramento Sucker	**0.346**	0.080	0.600	0.156	373	356	405	16	9	9
Smallmouth Bass	**0.757**	0.540	1.100	0.166	332	308	364	15	10	10
Spotted Bass	**1.002**	0.747	1.350	0.122	366	312	450	33	28	28
Threadfin Shad	**0.943**	0.390	1.570	0.540	154	115	168	26	4	4
White Bass	**1.153**	0.280	1.720	0.284	361	256	425	30	37	59

*Toxic Substances Monitoring Program (TSMP): fork length was first converted to total length.
Hg: mercury
µg/g: micrograms per gram
mm: millimeter
STD: standard deviation

Appendix D. Agency for Toxic Substances and Disease Registry's Exposure Investigation Workplan

Exposure Investigation

Mercury in Fish at Lake Nacimiento/ Klau/Buena Vista Mines

San Luis Obispo County, California

CA 1141190578

February 2006

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Purpose of the Exposure Investigation

The California Department of Health Services (CADOH) and the Agency for Toxic Substances and Disease Registry (ATSDR) plan to conduct an exposure investigation (EI) to evaluate potential human exposure to mercury contamination in certain edible fish species in Lake Naciemento, CA. During this EI, six species of fish from Lake Nacimiento will be collected and analyzed for mercury contamination. The information collected will allow the CADOH to determine the types of fish that have mercury contamination, the level of contamination, and if the current fish advisory for Lake Nacimiento should be updated.

Background

The Klau/Buena Vista Mines are located at approximately 12 miles west of Paso Robles, California (see Figure 1 in Appendix A). The mines encompass approximately 250 acres, including 5 miles of underground workings, approximately 300,000 tons of mine tailings, overburden, and waste rock and several dilapidated buildings. During the operation of the Klau/Buena Vista Mines between 1868 and 1970, approximately 6.4 million pounds of elemental mercury were produced. Elevated concentrations of arsenic, barium, chromium, cobalt, copper, iron, manganese, mercury, nickel, thallium, vanadium, and zinc have been detected in soil, sediment, and surface water on and near the Klau/Buena Vista Mines. Mercury was detected in Buena Vista Mine tailings at concentrations of up to 12,000 parts (1) per million (ppm) and at the Klau Mine at concentrations of up to 630 ppm (2).

The Klau/Buena Vista Mines are located within the Las Tablas Creek watershed. The Las Tablas watershed is part of the larger watershed for the Nacimiento Reservoir. The Nacimiento Reservoir watershed encompasses approximately 82 square miles (52,480 acres). The two leading sediment mercury sources in the Nacimiento Reservoir watershed identified in the Clean Lakes report are the Buena Vista Mine and the Klau Mine (3).

Surface water and seeps from the Klau Mine discharge into the Klau Branch of Las Tablas Creek. The Klau Branch flows into the South Fork of Las Tablas Creek for approximately ½ mile and then merges with the North Fork of Las Tablas Creek and becomes Las Tablas Creek proper. Las Tablas Creek flows for about 5 ½ miles and then into Harcourt Reservoir. The Harcourt Reservoir was constructed to provide irrigation water for some adjacent land (4). Harcourt Reservoir spills back into Las Tablas Creek and flows into the Las Tablas Creek arm of the Nacimiento Reservoir.

The Buena Vista Mine point source watershed is an enclosed, bedrock valley surrounded by bedrock ridges. It drains to Dodd's Ditch through a single point at a culvert under Klau Mine Road (just East of the intersection of Klau Mine Road and Cypress Mountain Road) (4). The runoff from Buena Vista Mine flows through about 900 feet of this drain ditch between Buena Vista Mine's point source (at the culvert) and the North Fork of Las Tablas Creek (4). Dodd's Ditch, the North Fork, South Fork, and Klau Branch of Las Tablas Creek, and Las Tablas Creek proper are intermittent (2, 4).

Acid mine drainage from the mines has caused significant contamination and ecological impact to the North and South Fork of Las Tablas Creek. Elevated concentrations of aluminum, barium, chromium, cobalt, copper, iron, manganese, mercury, nickel, thallium, vanadium, and zinc have been detected in surface water downstream from the mines.

Nacimiento Reservoir

The Nacimiento Reservoir is located approximately 8.5 miles downstream of the Klau/Buena Vista Mines and was built in the 1950s by Monterey County. It was built for flood control and to provide farmers in the Salinas Valley summertime water via release from the dam that recharges the Salinas Valley groundwater. The reservoir is 18.6 miles long and has 5,727 surface acres and nearly 163 miles of shoreline (5).

At this time the Nacimiento Lake is used as a water source for a couple of small lake-side communities. However, there are future plans for several San Luis Obispo communities to augment their drinking water supplies with water from Lake Nacimiento. In addition, fishing is a popular recreational activity on Nacimiento Reservoir.

Investigators/Collaborators

California Department of Health Services Cooperative Agreement staff will work with the CDC Epidemiological Intelligence Service (EIS) officer, the California Office of Environmental Health Hazard Assessment (OEHHA), the California Department of Fish and Game (Fish and Game), the U.S. Environmental Protection Agency (USEPA), and the ATSDR EI Team to conduct the exposure investigation.

The following describes the investigators and collaborators roles:

Cooperative Agreement staff and CDC EIS officer: will be responsible for project direction and coordination of sampling and analysis; assist Fish and Game with fish collection; transport fish to lab; critically review data and write a report summarizing the EI.

ATSDR EICB (Debra Gable, Allen Robison): will provide project technical assistance. ATSDR will also provide funding for the EI analyses.

OEHHA (Margy Gassel, Bob Brodberg): will assist in designing a sampling plan to collect data for evaluation.

Fish and Game (Michael Hill and Michael Elkins): will advise the project concerning local fishing habits; provide the boat and angler equipment to conduct fish collection; and lead the fish collection.

Fish and Game (Dave Crane): will prepare fish samples for analysis, analyze the samples for mercury and other contaminants of interest; provide data report including quality assurance and quality control approaches.

USEPA Region IX (Michelle Dinezayhe): will advise the project.

Description of Target Population

Lake Nacimiento is a very popular fishing lake in central California. Over 200,000 people visit the lake each year (7), many of these are anglers. The lake is host to twelve fishing derbies during the year. Not only is it a destination for southern California anglers, because it is the only lake in California where white bass can be caught, anglers come from many different areas to fish during the white bass spawning season (March, April, May). While there have been fish collections in the past, it is unclear how many species are contaminated with mercury at a level that could potentially pose a public health hazard.

Exposure Investigation Objectives

The primary objective of this EI is to identify fish species (and associated consumption amounts) in Lake Nacimiento that, if used for human consumption, could potentially pose a public health hazard from mercury contamination.

The secondary objectives of the EI are: 1) to collect new data that will allow OEHHA to update the Lake Nacimiento fish advisory and 2) to use updated mercury levels/hazard interpretation to develop/foster local capacities for health education concerning mercury contamination in fish.

Rational for Environmental Sampling

Fishing is a popular recreational activity on Nacimiento Reservoir. San Luis Obispo County posted health advisories in the Nacimiento Reservoir and Las Tablas Creek area in July 1994, based on mercury levels in largemouth bass. A copy of the health advisory posted in the state fishing guidance can be seen in Appendix C. This fish advisory has not been updated since 1994.

In the 1980s and early 1990s, fish were collected from Lake Nacimiento as part of the state-wide California State Water Resources Board Toxic Substances Monitoring Program (TSMP). The TSMP was a uniform statewide approach to detect trace elements, pesticides, and polychlorinated biphenyls (PCBs) in fish and other aquatic life from fresh, estuarine, and marine waters. The TSMP primarily targeted water bodies with known or suspected impaired water quality. The sample collection for the TSMP was done by the California Fish and Game (Fish and Game) and analyzed at the Fish and Game lab located in Rancho Cordova.

Fish and Game collected largemouth bass, white bass, carp, channel catfish, or crappie from various parts of the Lake Nacimiento watershed starting in 1981 (6). The last fish from Lake Nacimiento were collected in 1996. The TSMP ended in 2003. Depending upon the year, two to six fish were collected. The sampling locations included Snake Creek, Dip Creek, Las Tablas Creek, Cantinas Creek, the Narrows, and Tobacco Creek (Figure 2 in Appendix A). All fish collected were analyzed for eleven metals. Mercury was the only metal detected at a level of health concern. Several fish had levels exceeding 0.93 ppm which would lead to a no consumption recommendation for children under 17 and women of childbearing years, according to state fish advisory guidance (Table 4 in Appendix B). The fish having higher levels tended to be the predator fish.

A white bass collected in 1982 from Las Tablas was analyzed for pesticides and PCBs. Very low levels of a couple of pesticides were detected but well below health concern.

In 1994, researchers from CalPoly collected a total of 120 fish, representing 10 species (3). The fish tissue was analyzed at the Fish and Game lab in Rancho Cordova for total tissue mercury. The fish locations included the upper part of Las Tablas called Harcourt Reservoir, down Las Tablas Creek, at the entrance of Las Tablas River to Lake Nacimiento, along the Nacimiento River above the lake, and at the Marina Forks near the resort and the dam (Figure 2 in Appendix A).

The fish collected in the 1994 study included largemouth bass, smallmouth bass, white bass, threadfin shad, common carp, channel catfish, green sunfish, bluegill sunfish, Sacramento suckers, and brown bullhead (3). CalPoly conclude in their study that elevated mercury levels exist in fish in the Las Tablas Creek drainage. The highest mercury concentrations were detected among the top predators such as bass and the larger (older) fish (3) (Table 2 in Appendix B). Several of the fish exceeded 0.93 ppm, the level at which the state recommends no fish consumption for children under 17 and women of childbearing years (Table 4 in Appendix B). Other mercury levels were high enough to warrant some limited consumption based on current fish advisory guidelines.

Confidentiality

Confidentiality is not an issue with this EI since only fish samples will be collected in Lake Naciemento.

Risk/Benefit Information

There is some limited risk for staff collecting the fish. The collection of the fish will be lead by the Fish and Game staff that has experience and safety procedures in place for fish collection.

Methods

Exposure Investigation Design

The fish sampling and analysis will generally follow the guidance developed by USEPA (8). There are six species identified by Fish and Game staff as being the primary fish caught by anglers at Lake Nacimiento (Personal communication Michael Hill, January 2006). The filet of all fish will be analyzed for mercury. One of the catfish and carp composite samples will be analyzed for pesticides/PCBs and PBDEs to confirm results from the TSMP studies.

Data Collection/Sampling Procedures

Fish and Game biologist Michael Hill will direct the fish collection. He will be assisted by Fish and Game scientific aid Michael Elkins. California Cooperative Agreement staff and OEHHA staff will also assist Mr. Hill. The following fish species will be targeted: white bass, spotted bass, channel catfish, bluegill, crappie, and carp. It is anticipated that electrofishing will be the best method for collecting white bass, spotted bass, bluegill, crappie, and carp. In order to obtain catfish it will be necessary to use jug lines or another similar method.

Spotted bass are the only fish species of the targeted fish to have a limit size: 12 inches (305 millimeters). Only white bass of legal limit will be analyzed. White bass up to a length of 407 millimeters will be sampled, as the lower limit is within 75% of the legal limit.

OEHHA has established minimum recommended fish lengths for the other five species that are targeted in this EI (Table 3 in Appendix B). The minimum recommended lengths were developed considering life histories including growth rates and size at maturity in relation to practical sizes for cooking and eating. The collection team will follow these minimum lengths for selecting fish for analysis.

Composites of certain fish will be used because of the small size of the fish: bluegill and crappie. Composites of channel catfish and carp will also be analyzed as there are additional analyses from the TSMP and Cal Poly study which augment the data that will be collected as part of this EI. Individual samples of spotted bass will be analyzed as there are no other data on this species from the TSMP or the Cal Poly studies. Individual samples of white bass will be conducted since this is an important fish caught for consumption on the lake; there is limited data on this species from the previous studies; and that data does indicate that as a predator fish it is bioaccumulates mercury.

As per USEPA's guidance, fish will only be composited if they are within 75% size of each other (8).

Given the large size of the lake (5,370 acres, 165 miles of rocky, canyon bluffs), 3 locations around the lake will be chosen for sampling locations. These locations also correspond with sampling locations from the 80s and 90s data: Las Tablas Creek, Snake Creek, and Cantinas Creek (Figure 2 in Appendix A). In addition, selection of listed locations will allow for the development of a fish advisory (s) for the entire water body.

Field recordkeeping will follow USEPA guidance (8).

In the field, sources of contamination include sampling gear, grease from ship winches or cables, ship and/or motor vehicle engine exhaust, dust, and ice used for cooling. Efforts will be taken to minimize handling and to avoid sources of contamination. The samples should be double wrapped in aluminum foil and immediately frozen with dry ice in a covered ice chest.

Whole fish will be transported on dry ice to the Fish and Game laboratory in Rancho Cordova. Fish sample preparation, mercury analysis for all individual and composite samples, and organic analyses on a subset of the fish samples will be conducted at the Rancho Cordova lab.

No survey instruments will be used.

Records Management

A record will be kept in the field for each fish caught and tagged with a chain-of-custody label using forms provided in the USEPA guidance (8). The record and the chain of custody tag will include time caught, location of where the fish was caught including latitude and longitude, and length of the fish. Only fish caught in one location will be composited, and those fish to be composited will be indicated on the field record. Fish to be composited will be packed together. The field record and the chain-of-custody tag will use indelible ink.

A field logbook will be used to track any other information that is not recorded on the field record or chain-of-custody label.

California cooperative agreement staff will record arrival time on the field records when the fish arrive at the Rancho Cordova laboratories.

Quality Assurance

Tissue sample preparation: A plug of fish taken above the lateral line of the fish will be extracted and used for the individual sample analysis or for compositing with other plugs from the same fish species and same location for a composite sample. The following is a description of how the plug is obtained: with a scalpel cut longitudinally starting just posterior to the operculum and running dorsally the full length of the fish. Then a vertical incision is made from the start of the first cut, posterior of the operculum, to just above the body cavity. Then a cut is made longitudinally from this point to the caudal end body. All incisions should be just through the epidermis. Using "v" shaped forceps or needle nose pliers, the skin is pulled back exposing the tissue With a fresh blade a plug of tissue (5 to 7 grams) is removed from the area of exposed tissue, centered below the dorsal fin and above the midline.

Mercury analysis summary (10): The homogenized fish tissue is digested with concentrated nitric acid. The mercury ions are reduced to elemental mercury with stannous chloride. The mercury vapor is analyzed by cold vapor atomic spectroscopy. The detection limit for this method is approximately 0.01 µg/g (ppm) (fresh weight). With each set of analyses, there are 2 method blanks, 2 standard reference materials (~ 0.25 g dry tissue - Dorm 2 or NBS 1566a), 2 matrix spike, 2 laboratory control spike, and one duplicate for every 10 samples.

Organic analysis summary (11). This method describes the preparation and analytical detection of trace residue levels of 37 organochlorine pesticides, 48 polychlorinated biphenyls (PCBs) and 4 Arochlors, and 12 polybrominated diphenyl ethers (PBDEs) in fish tissue and sediments by dual column high resolution gas chromatography using electron capture detection.

A known mass of fish (1-5 micrograms) is placed in a priority solution and a solution containing pesticide and PCB surrogate (non-target) compounds is added to the mixture. The organic chemicals are extracted from the homogenized tissue with an acetone\dichloromethane solution using a mechanized system (Dionex Accelerated Solvent Extractor (ASE 200) involving heat and pressure.

The extracted material is dried and then dissolved in a dichloromethane which is then poured on a silica adsorbent (Florosil). The Florisil7 columns are eluted with petroleum ether (PE) (Fraction 1), 6% diethyl ether/PE (Fraction 2), 15% diethyl ether/PE (Fraction 3), and 50% diethyl ether/PE (Fraction 4).

The fractions are concentrated; each fraction is analyzed by dual column high resolution gas chromatography with an electron capture detection system for chemical identification. The following QA/QC samples are run for every twenty samples: a method blank, a duplicate sample, matrix spike, matrix spike duplicate, and two laboratory control spike (surrogate or non-target compounds only and another with target analytes).

Data Analysis and Interpretation

Data from the exposure investigation will be incorporated into the health assessment for the Klau/Buena Vista Mines that is underdevelopment by the California Cooperative Agreement staff. Interpretation will be done to be consistent with state fish advisory practices (see next paragraph) and ATSDR policies. Arithmetic mean methyl mercury level will be used from the fish in three different locations to issue species-specific advisories. This mean will be compared to the guidance levels developed by OEHHA. A sliding scale based on mean methyl mercury level has been predetermined for vulnerable population (i.e. pregnant and nursing mothers, children, verse women not of child barring age and men) when issuing a fish advisory (13) (Table 4 in Appendix B). These species-specific fish consumption recommendations will be become part of the public health assessment.

In addition to the evaluation of the fish by the California Cooperative Agreement staff, OEHHA will evaluate the data to determine a need for a new fish advisory.

The two composite samples of organic analyses will be reviewed to see if additional data is warranted as it two samples will not be enough to define a fish advisory. The values of the organic chemicals will be evaluated using OEHHA's screening values (9) used to determine whether further evaluation is needed.

Limitations of the Exposure Investigation

The main limitation of this EI is that only a small number of fish can be caught and analyzed. All efforts will be made to capture enough edible fish species and numbers of fish per species to achieve the objectives of the exposure investigation.

Estimated Timeline

According to the Fish and Game staff, the ideal time for catching fish in Lake Nacimiento is in February (personal communication Michael Hill January 2006). Therefore, Fish and Game staff are proposing to collect the fish three days the week of February 26th to March 2nd.

The fish sample preparation and mercury analyses are anticipated to be completed by the end of April. The other analyses will also be completed by the end of April.
Data will be analyzed and either included in the public health assessment or in a health consultation and submitted to ATSDR by the beginning of June. Depending upon the length of state and federal review, the results will be released in late summer. A recommendation for fish consumption limitations could be included if needed. Outreach around the fish consumption recommendations would then be assessed and implemented in the fall and winter of 2006.

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Appendix A

Figures

Figure 1. Vicinity Map, Lake Nacimiento, San Luis Obispo, California

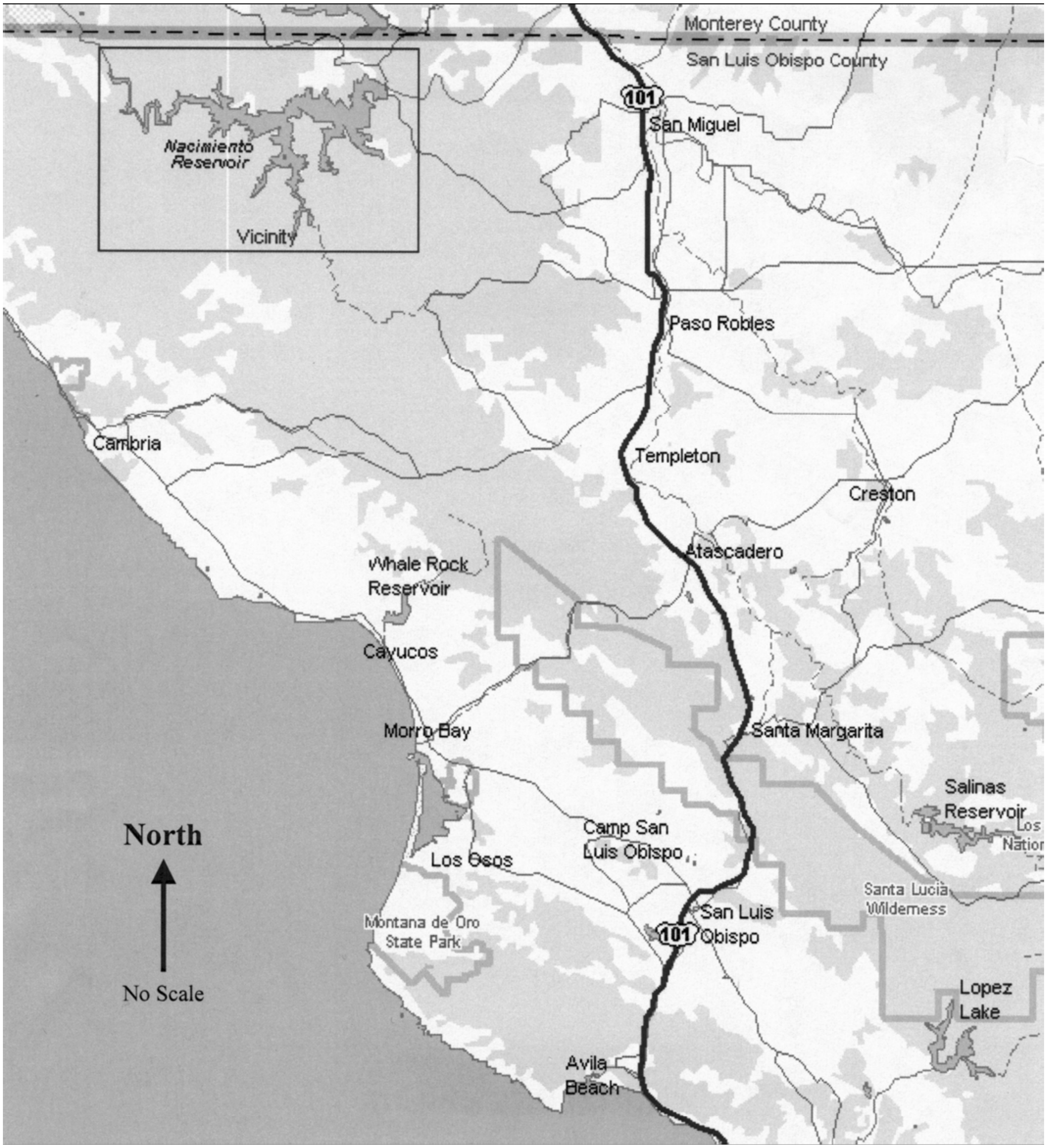
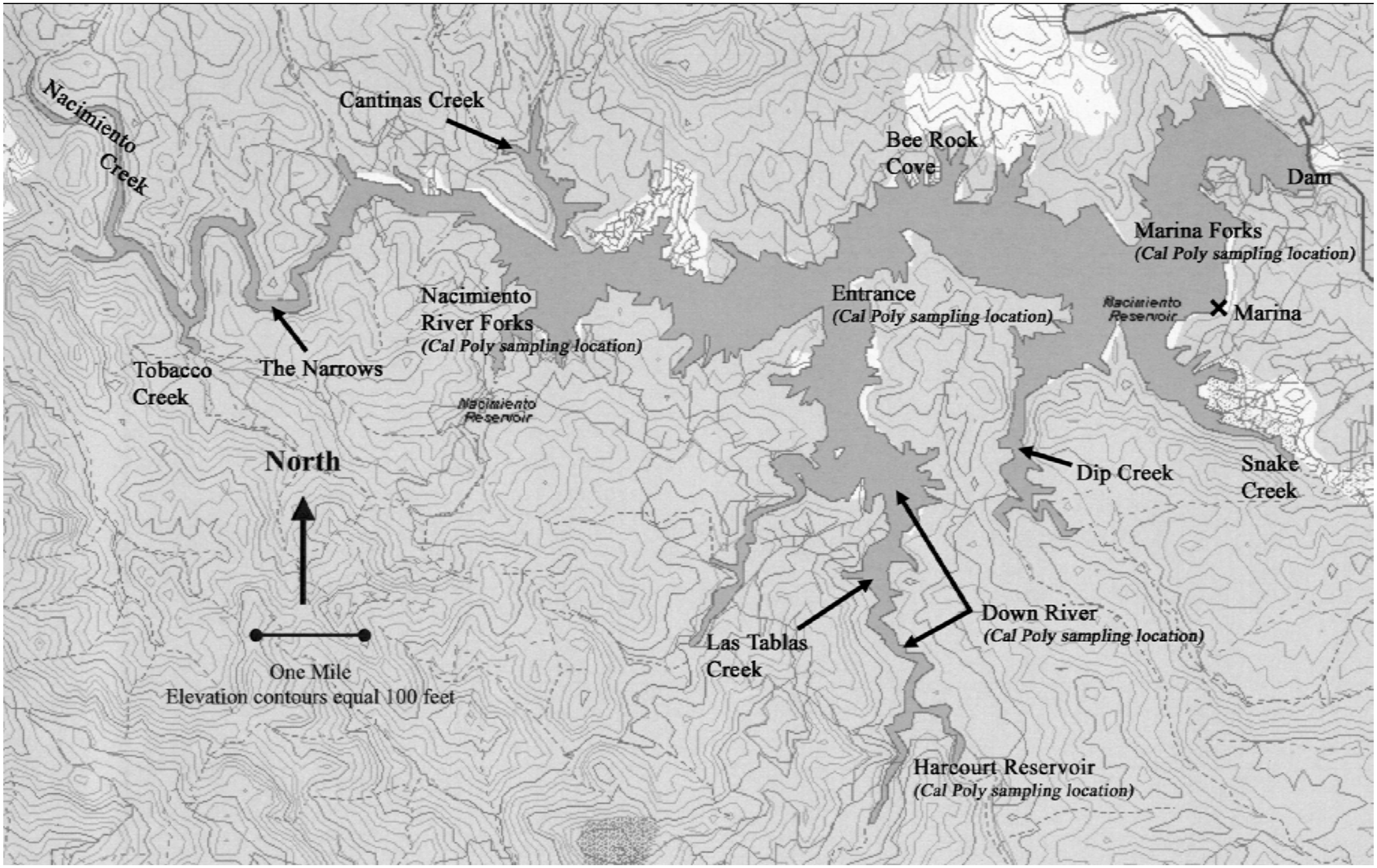


Figure 2. Area Topographical Map with Cal Poly Sampling Locations, Lake Nacimiento, San Luis Obispo, California



Appendix B.

Tables

Table 1. Fish species caught by location around Lake Nacimiento and mercury ranges for those fish- Toxic Substances Monitoring Program data, Klau/Buena Vista Mines, San Luis Obispo County, CA

	Snake Creek	Dip Creek	Bee Rock Cove	Las Tablas	Cantinas Creek	Inlet	Tobacco Creek
1981				1 white bass (1.3)			
1982	6 LMB (0.72-1.2)			4 carp (0.65-1.1) 7 LMB (0.71-1.7)			
1983	6 carp (0.27-0.56) 1 CC (0.31) 8 LMB (0.55-1.2)			2 carp (0.69, 1.2) 9 LMB (0.77-1.8)	5 carp (0.28-0.5) 2 CC (0.6,0.4) 9 LMB (0.27-0.97)		
1984		2 carp (0.15, 0.36) 1 LMB (0.56)	1 white bass (1.1)	1 white bass (0.38)		1 carp (0.5) 1 LMB (0.35)	
1985				1 LMB (0.4) 1 white bass (0.8)			
1986							1 crappie (0.14) 1 LMB (0.37)
1987							
1988							
1989							
1990							
1991		1 white bass (1.2)		1 white bass (1.3)			
1992		1 LMB (0.76)					
1993				1 LMB (0.77)			
1994							
1995							
1996		1 LMB (0.72)		1 LMB (0.99)			

CC= channel catfish; LMB= large mouth bass
Data obtained from (6)

Table 2. Fish caught by location in Lake Nacimiento and range of mercury levels- Cal Poly study, Klau/Buena Vista Mines, San Luis Obispo County, CA

	Harcout Reservoir	**Down River**	**Entrance**	**Marina Forks**	**Nacimiento River Forks**
LMB	4- (0.55-1)	1 (0.54)	2 (0.45, 0.57)	3 (0.36-0.98)	12 (0.26-1)
SMB	None collected	None collected	1 (0.4)	5 (0.56-1.1)	8 (0.54-0.78)
White bass	None collected	None collected	5 (0.68-1.2)	1 (0.68)	
Green sunfish	2- (0.66, 0.68)	None collected	None collected		
Bluegill	4 (0.34- 0.74)	3 (0.53-0.56)	None collected	8 (0.2-0.36)	1 (0.28)
Channel catfish		2 (0.47, 0.6)			
Brown bullhead		1 (0.24)			
Sacramento suckers			2 (0.3-0.5)	4 (0.33-0.44)	2 (0.33, 0.33)
Threadfin shad			2 (0.61-1.2)		1 (0.39)
Carp					6 (0.34-0.77)

LMB= large mouth bass SMB=small mouth bass Approximate sampling locations shown on Figure 2 in Appendix A Data obtained from (3)

Table 3. Fish sizes by species caught in Lake Nacimiento and possible target sizes (in millimeters) for additional sampling based on previous sampling results and minimum limits, Klau/Buena Vista Mines, San Luis Obispo County, CA

	TSMP data	75% range around the smallest fish	75% range around the largest fish	Cal Poly	75% range around the smallest fish	75% range around the largest fish	OEHHA Recommended Minimum Size
Spotted bass	Not sampled			Not targeted			305***
Carp	412, 451, 385, 409, 371, 416, 518, 312, 426, 431, 414, 381, 415, 385, 370, 411, 364, 395, 383, 375	273-485	389-691	466, 508, 436, 436, 508, 466	327-581	381-677	200
White bass	345, 344, 332, 205*, 343, 336	239**-422	259**-460	345, 295*, 305, 288*, 293*, 233*	228**-407	259**-460	250
Crappie	210	158/280		Not targeted			150
Bluegill	Not sampled			150, 145, 140, 135, 151, 135, 125, 147, 192, 124, 160, 129, 140, 146, 133, 148	93^-165	144-256	100
Catfish	328, 424, 361, 392	246/437	318/565	300, 240	180^-320	225-400	200

TSMP- Toxic Substances Monitoring Program
Cal Poly- Caifornia State University at San Luis Obispo
*excluded from range calculation because did not meet minimum legal requirement
**low end of range below legal limit
***legal limit
^low end below recommended minimum size
Data obtained from (3, 6)

Table 4. OEHHA Guidance Tissue Level for Total Mercury or Methylmercury* in Parts per Million (ppm) Wet Weight for Two Population Groups to be Applied to Fish Sampling Collected in Relation to the Klau/Buena Vista Mines, San Luis Obispo County, CA

Population Group	3 Meals/ Week** (90g/day)	2 Meals/ Week (60 g/day)	1 Meal/ Week (30 g/day)	1 Meal/ Month (7.5 g/day)	No consumption
Women of childbearing age and children aged 17 years and younger (1 x 10^{-4} mg/kg/day[1])	<0.08	>0.08-0.12	>0.12-0.23	>0.23-0.93	>0.93
Women beyond their childbearing years and men (3 x 10^{-4} mg/kg/day[2])	<0.023	>0.23-0.35	>0.35-0.70	>0.70-2.80	>2.80

*The values in this table are based on the assumption that 100% of total mercury measured in fish is methylmercury. This may not be true for some shellfish, so methylmercury should also be measured in those species for use in this table.
**OEHHA's general consumption advice protects people who eat up to three meals per week of sport fish. Twelve meals per month is representative of an upper bound consumption rate for frequent fish consumers in California (12). OEHHA begins issuing site-specific consumption advice if data indicate that consumption of twelve meals per month is potentially hazardous.

The following descriptions for the levels of health concern for methyl mercury are from (13):
1. The level of concern for sensitive populations is based on U.S. EPA's current reference dose (RfD). The RfD is based on two reports (14) and (15). Marsh DO (1987) collected and summarized data from 81 mother and child pairs where the child had been exposed to methylmercury *in utero* during the Iraqi epidemic. Maximum mercury concentrations in maternal hair during gestation were correlated with clinical signs in the offspring such as cerebral palsy, altered muscle tone and deep tendon reflexes, and delayed developmental milestones that were observed over a period of several years after the poisoning. Clinical effects incidence tables included in the critique of the risk assessment for methylmercury conducted by U.S. FDA (15) provided dose response data for a benchmark dose approach to the RfD, rather than the previously used NOAEL/LOAEL method. The BMDL was based on a maternal hair mercury concentration of 11 parts per million (ppm). From that, an average blood mercury concentration of 44 µg/L was estimated based on a hair: blood concentration ratio of 250:1. Blood mercury concentration was, in turn, used to calculate a daily oral dose of 1.1 µg/kg-day, using an equation that assumed steady-state conditions and first-order kinetics for mercury. An uncertainty factor of 10 was applied to this dose to account for variability in the biological half-life of methylmercury, the lack of a two-generation reproductive study and insufficient data on the effects of exposure duration on developmental neurotoxicity and adult paresthesias. The oral RfD was then calculated to be $1x10^{-4}$ mg/kg-day, to protect against developmental neurological abnormalities in infants (16). This fetal RfD was deemed protective of infants and sensitive adults.
2. This level of concern (US EPA's old RfD) is based on effects in adults. The first U.S. EPA RfD for methylmercury was developed in 1985 and set at 3x10-4 mg/kg-day (16). This RfD was based, in part, on a World Health Organization (WHO) report summarizing data obtained from several early epidemiological studies on the Iraqi and Japanese methylmercury poisoning outbreaks (17). WHO found that the earliest symptoms of methylmercury intoxication (paresthesias) were reported at blood and hair concentrations ranging from 200-500 µg/L and 50-125 µg/g, respectively, in adults. In cases where ingested mercury dose could be estimated (based, for example, mercury concentration in contaminated bread and number of loaves consumed daily), an empirical correlation between blood and/or hair mercury concentrations and onset of symptoms was obtained. From these studies, WHO determined that methylmercury exposure equivalent to long-term daily intake of 3-7 µg/kg body weight in adults was associated with an approximately 5 percent prevalence of paresthesias (17). U.S. EPA further cited a study by Clarkson et al. (1976) to support the range of blood mercury concentrations at which paresthesias were first observed in sensitive members of the adult population. This study found that a small percentage of Iraqi adults exposed to methylmercury-treated seed grain developed paresthesias at blood levels ranging from 240 to 480 µg/L. The low end of this range was considered to be a LOAEL and was estimated to be equivalent to a dosage of 3 µg/kg-day. U.S. EPA applied a 10-fold uncertainty factor to the LOAEL to reach what was expected to be the NOAEL. Because the LOAEL was observed in sensitive individuals in the population after chronic exposure, additional uncertainty factors were not considered necessary for exposed adults (16).

Appendix C

State Fish Advisory for Lake Nacimiento

Lake Nacimiento (San Luis Obispo County)

Because of elevated mercury levels, no one should eat more than four meals per month of largemouth bass from Lake Nacimiento. Women who are pregnant or may become pregnant, nursing mothers, and children under age six should not eat largemouth bass from the area.

Appendix E. Laboratory Data Sheets of the Pesticide, PCB, and PBDE Analyses from the Agency for Toxic Substances and Disease Registry's Exposure Investigation Fish Sampling from Lake Nacimiento

Organochlorine Pesticide Analyses for Two Fish from Lake Nacimiento with Some Quality Assurance Results

Surrogate Corrected	Method Detection Limit	Reporting Limit	Method Blank BS 427	Method Detection Limit	Reporting Limit	L-129-06-22 Las Tables Carp	Method Detection Limit	Reporting Limit	L-129-06-25 Las Tables CCF
	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet
aldrin	0.259	0.995	ND	0.259	0.99	ND	0.259	0.995	ND
chlordane, cis	0.712	0.995	ND	0.712	0.99	1.10	0.712	0.995	0.91 DNQ
chlordane, trans	0.402	0.995	ND	0.402	0.99	0.472 DNQ	0.402	0.995	0.435 DNQ
chlordene, alpha	0.275	0.498	ND	0.275	0.495	ND	0.275	0.498	ND
chlordene, gamma	0.255	0.498	ND	0.255	0.495	ND	0.255	0.498	ND
chlorpyrifos	0.832	0.995	ND	0.832	0.99	ND	0.832	0.995	ND
dacthal	0.629	0.995	ND	0.629	0.99	2.60	0.629	0.995	3.04
DDD, o,p'	0.764	0.995	ND	0.764	0.99	4.40	0.764	0.995	ND
DDD, p,p'	0.896	0.995	ND	0.896	0.99	12.3	0.896	0.995	2.14
DDE, o,p'	0.669	1.99	ND	0.669	1.98	0.673 DNQ	0.669	1.99	ND
DDE, p,p'	0.573	1.99	ND	0.573	1.98	59.5	0.573	1.99	19.6
DDMU, p,p'	1.2	2.99	ND	1.2	2.97	1.74 DNQ	1.2	2.99	ND
DDT, o,p'	1.01	2.99	ND	1.01	2.97	ND	1.01	2.99	ND
DDT, p,p'	2.46	4.98	ND	2.46	4.95	ND	2.46	4.98	ND
diazinon	6.73	19.9	ND	6.73	19.8	ND	6.73	19.9	ND
dieldrin	0.418	0.498	ND	0.418	0.495	0.941	0.418	0.498	1.08
endosulfan I	1.07	1.99	ND	1.07	1.98	ND	1.07	1.99	ND
endosulfan II	2.71	4.98	ND	2.71	4.95	ND	2.71	4.98	ND
endosulfan sulfate	2.71	4.98	ND	2.71	4.95	ND	2.71	4.98	ND
endrin	0.935	1.99	ND	0.935	1.98	ND	0.935	1.99	ND
HCH, alpha	0.474	0.498	ND	0.474	0.495	ND	0.474	0.498	ND
HCH, beta	0.613	0.995	ND	0.613	0.99	ND	0.613	0.995	ND
HCH, gamma	0.338	0.498	ND	0.338	0.495	ND	0.338	0.498	ND
heptachlor	0.513	0.995	ND	0.513	0.99	ND	0.513	0.995	ND

Surrogate Corrected	Method Detection Limit	Reporting Limit	Method Blank BS 427	Method Detection Limit	Reporting Limit	L-129-06-22 Las Tables Carp	Method Detection Limit	Reporting Limit	L-129-06-25 Las Tables CCF
	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet	ng/g Wet
heptachlor epoxide	0.501	0.995	ND	0.501	0.99	ND	0.501	0.995	ND
hexachlorobenzene	0.107	0.299	ND	0.107	0.297	ND	0.107	0.299	0.245 DNQ
methoxychlor	1.47	2.99	ND	1.47	2.97	ND	1.47	2.99	ND
mirex	0.939	1.49	ND	0.939	1.49	ND	0.939	1.49	ND
nonachlor, cis	0.975	0.995	ND	0.975	0.99	ND	0.975	0.995	ND
nonachlor, trans	0.386	0.995	ND	0.386	0.99	1.13	0.386	0.995	1.04
oxadiazon	0.931	0.995	ND	0.931	0.99	ND	0.931	0.995	ND
oxychlordane	0.366	0.995	ND	0.366	0.99	ND	0.366	0.995	ND
parathion, ethyl	0.836	1.99	ND	0.836	1.98	ND	0.836	1.99	ND
parathion, methyl	1.51	3.98	ND	1.51	3.96	ND	1.51	3.98	ND
tedion	0.732	1.99	ND	0.732	1.98	ND	0.732	1.99	ND
Moisture			-88			76.1			75.1
Lipid			-88			4.84			6.43
Surrogate % Recovery			% Recovery			% Recovery			% Recovery
DDD*, p,p'			74.5			82.6			87.5
DBCE			59.1			73.7			70.4

All of the samples were qualified with "H." A holding time violation has occurred.

Laboratory Control Spike Results from the Organochlorine Pesticide Analyses

Surrogate Corrected	Laboratory Control Spike BS 427 ng/g Wet	Laboratory Control Spike Percent Recovery	Qualifier	LCS Expected Value ppb (ng/g)
aldrin	9.78	97.8		10.0
chlordane, cis	10.5	105		10.0
chlordane, trans	10.2	102		10.0
chlordene, alpha	9.37	93.7		10.0
chlordene, gamma	9.77	97.7		10.0
chlorpyrifos	12.8	42.7	EUM	30.0
dacthal	9.48	94.8		10.0
DDD, o,p'	20.6	103		20.0
DDD, p,p'	19.2	96.0		20.0
DDE, o,p'	18.1	90.5		20.0
DDE, p,p'	18.0	90.0		20.0
DDMU, p,p'	36.4	91.0		40.0
DDT, o,p'	18.3	91.5		20.0
DDT, p,p'	17.4	87.0		20.0
diazinon	188	94.0		200
dieldrin	10.7	107		10.0
endosulfan I	20.5	103		20.0
endosulfan II	7.32	36.6	EUM	20.0
endosulfan sulfate	7.23	36.2	EUM	20.0
endrin	13.8	138		10.0
HCH, alpha	4.66	93.2		5.00
HCH, beta	10	100		10.0
HCH, gamma	4.8	96.0		5.00
heptachlor	7.68	76.8		10.0
heptachlor epoxide	10.1	101		10.0
hexachlorobenzene	5.75	57.5		10.0
methoxychlor	9.26	18.5	EUM	50.0
mirex	29	96.7		30.0
nonachlor, cis	10.1	101		10.0
nonachlor, trans	10.2	102		10.0
oxadiazon	32.9	110		30.0
oxychlordane	10.3	103		10.0
parathion, ethyl	26.5	66.3		40.0
parathion, methyl	12.8	42.7	EUM	30.0
tedion	20.2	101		20.0
Moisture	-88			
Lipid	-88			
Surrogate % Recovery	% Recovery			
DDD*, p,p'	71.1			
DBCE	56.3			

Matrix Spike Results from the Organochlorine Pesticide Analyses

Surrogate Corrected	L-160-06 05-4403 C2	L-160-06 05-4403 C2	RPD	L-160-06 05-4403 C2 MS	Qualifier	L-160-06 05-4403 C2 MSD	Qualifier	L-160-06 05-4403 C2 MS	L-160-06 05-4403 C2 MSD
	Matrix Spike	Matrix Spike Duplicate		% Recovery		% Recovery		Expected Value	Expected Value
	ng/g Wet	ng/g Wet						ppb (ng/g)	ppb (ng/g)
aldrin	2	2.12	5.8	101		107		1.98	1.99
chlordane, cis	2.09	2.16	3.3	101		104		2.08	2.09
chlordane, trans	2.25	2.32	3.1	104		107		2.17	2.18
chlordene, alpha	1.89	2.01	6.2	95.5		101		1.98	1.99
chlordene, gamma	1.95	2.07	6.0	98.5		104		1.98	1.99
chlorpyrifos	3.21	2.6	21.0	54.0		43.6	GB	5.94	5.97
dacthal	1.74	1.82	4.5	87.9		91.5		1.98	1.99
DDD, o,p'	3.94	4.13	4.7	99.4		104		3.97	3.99
DDD, p,p'	4.03	3.99	1.0	91.5		90.0		4.37	4.39
DDE, o,p'	3.6	3.79	5.1	90.9		95.2		3.96	3.98
DDE, p,p'	10.9	10.9	0.0	84.6		84.2		11.5	11.5
DDMU, p,p'	7.76	8.2	5.5	98.0		103		7.92	7.96
DDT, o,p'	3.49	3.73	6.6	88.1		93.7		3.96	3.98
DDT, p,p'	3.49	3.58	2.5	81.9		83.7		4.21	4.23
diazinon	40.5	41.1	1.5	102		103		39.6	39.8
dieldrin	2.09	2.11	1.0	93.0		93.6		2.23	2.24
endosulfan I	3.67	3.81	3.7	92.7		95.7		3.96	3.98
endosulfan II	2.01	2.05	2.0	50.8		51.5		3.96	3.98
endosulfan sulfate	1.36	1.52	11.1	34.3	GB	38.2	GB	3.96	3.98
endrin	2.83	2.86	1.1	143		144		1.98	1.99
HCH, alpha	0.986	1.03	4.4	93.7		97.7		1.05	1.05
HCH, beta	1.91	1.84	3.7	96.5		92.5		1.98	1.99

Surrogate Corrected	L-160-06 05-4403 C2	L-160-06 05-4403 C2	RPD	L-160-06 05-4403 C2 MS	Qualifier	L-160-06 05-4403 C2 MSD	Qualifier	L-160-06 05-4403 C2 MS	L-160-06 05-4403 C2 MSD
	Matrix Spike	Matrix Spike Duplicate		% Recovery		% Recovery		Expected Value	Expected Value
	ng/g Wet	ng/g Wet						ppb (ng/g)	ppb (ng/g)
HCH, gamma	0.965	1.01	4.6	97.5		102		0.99	1.00
heptachlor	1.6	1.72	7.2	80.8		86.4		1.98	1.99
heptachlor epoxide	2.28	2.38	4.3	109		113		2.11	2.12
hexachlorobenzene	1.44	1.49	3.4	71.3		73.4		2.01	2.02
methoxychlor	3.19	2.79	13.4	32.2	GB	28.0	GB	9.90	9.95
mirex	5.4	5.73	5.9	90.9		96.0		5.94	5.97
nonachlor, cis	2.22	2.18	1.8	112		110		1.98	1.99
nonachlor, trans	2.25	2.32	3.1	96.7		99.7		2.32	2.33
oxadiazon	6.36	6.56	3.1	107		110		5.94	5.97
oxychlordane	2.16	2.29	5.8	102		108		2.13	2.14
parathion, ethyl	5.31	5.99	12.0	67.0		75.3		7.92	7.96
parathion, methyl	3.14	3.46	9.7	52.9		58.0		5.94	5.97
tedion	3.98	4.01	0.8	101		101		3.96	3.98
Moisture	78.4	78.2							
Lipid	0.333	0.334							
Surrogate % Recovery	% Recovery	% Recovery		% Recovery		% Recovery			
DDD*, p,p'	76.5	72.9		76.5		72.9			
DBCE	65.3	67.6		65.3		67.6			

Quality Assurance Results from the Organochlorine Pesticide Analyses

Surrogate Corrected	Method Detection Limit	Reporting Limit	1588a Cert. Conc.	+/-	95% CI Ranges		70-130% of the 95% Confidence Interval		SRM 1588a BS 427	Percent Recovery	Qualifier
	ng/g Wet	ng/g Wet			Lower	Upper			ng/g		
chlordane, cis	35.8	100	167	5	162	172	113.40	223.60	164	98.2	
DDD, o,p'	38.4	100	36.3	1.4	34.9	37.7	24.43	49.01	58.8	162	GBC
DDD, p,p'	45	100	254	11	243	265	170.10	344.50	216	85.0	
DDE, o,p'	33.6	200	22	1	21	23	14.70	29.90	24.3	110.5	
DDE, p,p'	28.8	200	651	11	640	662	448.00	860.60	460	70.7	
DDT, o,p'	50.8	300	156	4.4	151.6	160.4	106.12	208.52	147	94.2	
DDT, p,p'	124	500	524	12	512	536	358.40	696.80	494	94.3	
dieldrin	21	50	156	4.5	151.5	160.5	106.05	208.65	150	96.2	
HCH, alpha	23.8	50	85.3	3.4	81.9	88.7	57.33	115.31	58.5	68.6	
HCH, gamma	17	50	24.9	1.7	23.2	26.6	16.24	34.58	19.7	79.1	
heptachlor epoxide	25.2	100	31.6	1.5	30.1	33.1	21.07	43.03	44.1	140	GBC
hexachlorobenzene	5.4	30	157.8	5	152.8	162.8	106.96	211.64	69.1	43.8	GBC
nonachlor, cis	49	100	94.8	2.8	92	97.6	64.40	126.88	69.4	73.2	
nonachlor, trans	19.4	100	215	7.9	207.1	222.9	144.97	289.77	129	60.0	GBC
Moisture									-88		
Lipid									-88		
Surrogate % Recovery									% Recovery		
DDD*, p,p'									100		
DBCE									59.9		

Polychlorinated Biphenyl (PCB) Analyses for Two Fish from Lake Nacimiento with Some Quality Assurance Results

Surrogate Corrected	Method Detection Limit	Reporting Limit	Method Blank BS 427	Method Detection Limit	Reporting Limit	L-129-06-22 Las Tables Carp	Method Detection Limit	Reporting Limit	L-129-06-25 Las Tables CCF
PCB Congeners	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**
8	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
18	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
27	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
28	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
29	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
31	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
33	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
44	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
49	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
52	0.1	0.2	ND	0.1	0.2	0.153 DNQ	0.1	0.2	ND
56	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
60	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
66	0.1	0.2	ND	0.1	0.2	0.103 DNQ	0.1	0.2	0.128 DNQ
70	0.1	0.2	ND	0.1	0.2	0.175 DNQ	0.1	0.2	0.109 DNQ
74	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
87	0.1	0.2	ND	0.1	0.2	0.141 DNQ	0.1	0.2	ND
95	0.1	0.2	ND	0.1	0.2	0.244	0.1	0.2	0.108 DNQ
97	0.1	0.2	ND	0.1	0.2	0.111 DNQ	0.1	0.2	ND
99	0.1	0.2	ND	0.1	0.2	0.244	0.1	0.2	0.238
101	0.1	0.2	ND	0.1	0.2	0.438	0.1	0.2	0.230
105	0.1	0.2	ND	0.1	0.2	0.1 DNQ	0.1	0.2	0.103 DNQ
110	0.1	0.2	ND	0.1	0.2	0.316	0.1	0.2	0.178 DNQ
114	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
118	0.1	0.2	ND	0.1	0.2	0.268	0.1	0.2	0.271
128	0.1	0.2	ND	0.1	0.2	0.104 DNQ	0.1	0.2	0.103 DNQ
137	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
138	0.1	0.2	ND	0.1	0.2	0.529	0.1	0.2	0.494
141	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
149	0.1	0.2	ND	0.1	0.2	0.331	0.1	0.2	0.108 DNQ

Surrogate Corrected	Method Detection Limit	Reporting Limit	Method Blank BS 427	Method Detection Limit	Reporting Limit	L-129-06-22 Las Tables Carp	Method Detection Limit	Reporting Limit	L-129-06-25 Las Tables CCF
PCB Congeners	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**	**ng/g**
151	0.1	0.2	ND	0.1	0.2	0.106 DNQ	0.1	0.2	ND
153	0.1	0.2	ND	0.1	0.2	0.800	0.1	0.2	0.723
156	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
157	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
158	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
170	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
174	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
177	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
180	0.1	0.2	ND	0.1	0.2	0.382	0.1	0.2	0.29
183	0.1	0.2	ND	0.1	0.2	0.112 DNQ	0.1	0.2	ND
187	0.1	0.2	ND	0.1	0.2	0.336	0.1	0.2	0.253
189	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
194	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
195	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
200	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
201	0.1	0.2	ND	0.1	0.2	0.151 DNQ	0.1	0.2	ND
203	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
206	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
209	0.1	0.2	ND	0.1	0.2	ND	0.1	0.2	ND
PCB 1248	10	25	ND	10	25	ND	10	25	ND
PCB 1254	4	10	ND	4	10	5 DNQ	4	10	5 DNQ
PCB 1260	1	10	3 DNQ	1	10	3 DNQ	1	10	3 DNQ
Moisture			-88			76.1			75.1
Lipid			-88			4.84			6.43
Surrogate			%R			%R			%R
209-L			78.6			79.3			80.3

All of the samples were qualified with "H". A holding time violation has occurred.

Laboratory Control Spike Results from the Polychlorinated Biphenyl Analyses

Surrogate Corrected	Laboratory Control Spike BS 427	% Recovery
	ng/g	
8	3.13	62.6
18	3.60	72.0
27	3.63	72.6
28	3.83	76.6
29	3.52	70.4
31	3.88	77.6
33	4.25	85.0
44	4.84	96.8
49	4.70	94.0
52	4.77	95.4
56	4.58	91.6
60	4.10	82.0
66	4.36	87.2
70	4.75	95.0
74	4.04	80.8
87	4.76	95.2
95	5.44	109
97	4.93	98.6
99	5.00	100
101	5.19	104
105	3.74	74.8
110	4.89	97.8
114	3.58	71.6
118	3.62	72.4
128	4.56	91.2
137	4.70	94.0
138	4.64	92.8
141	4.84	96.8
149	4.89	97.8
151	4.90	98.0
153	4.67	93.4
156	3.48	69.6
157	3.71	74.2
158	4.42	88.4
170	4.54	90.8
174	4.75	95.0
177	4.75	95.0
180	4.55	91.0
183	4.71	94.2
187	4.76	95.2
189	4.02	80.4
194	4.75	95.0

Surrogate Corrected	Laboratory Control Spike BS 427	% Recovery
	ng/g	
195	4.72	94.4
200	5.03	101
201	5.25	105
203	5.02	100
206	4.80	96.0
209	4.71	94.2
Surrogate	%R	
209-L	74.4	

Matrix Spike Results from the Polychlorinated Biphenyl Analyses

Surrogate Corrected	L-160-06 05-4403 C2	L-160-06 05-4403 C2	Relative Percent	L-160-06 05-4403 C2 MS	L-160-06 05-4403 C2 MSD	L-160-06 05-4403 C2 MS	L-160-06 05-4403 C2 MSD
	Matrix Spike	Matrix Spike Duplicate	Difference	% Recovery	% Recovery	Expected Value	Expected Value
	ng/g Wet	ng/g Wet				ppb (ng/g)	ppb (ng/g)
8	0.692	0.582	17.3	69.9	58.5	0.99	0.995
18	0.762	0.664	13.7	77.0	66.7	0.99	0.995
27	0.766	0.7	9.0	77.4	70.4	0.99	0.995
28	0.888	0.838	5.8	80.8	75.4	1.078	1.083
29	0.768	0.721	6.3	77.6	72.5	0.99	0.995
31	0.858	0.808	6.0	83.7	78.3	1.019	1.024
33	0.902	0.873	3.3	88.7	85.3	1.014	1.019
44	1.08	1.03	4.7	102.7	97.2	1.053	1.058
49	1.16	1.08	7.1	105.5	96.9	1.106	1.111
52	1.17	1.1	6.2	98.1	90.6	1.189	1.194
56	1.18	1.07	9.8	115.5	103.8	1.027	1.032
60	1.08	0.979	9.8	109.1	98.4	0.99	0.995
66	1.26	1.09	14.5	106.3	88.6	1.198	1.203
70	1.19	1.1	7.9	106.2	96.6	1.129	1.134
74	1.12	1.03	8.4	102.4	92.9	1.096	1.101
87	0.999	1.04	4.0	91.2	94.9	1.086	1.091
95	1.36	1.29	5.3	116.3	108.6	1.199	1.204
97	1.06	1.08	1.9	97.5	99.0	1.085	1.09
99	1.41	1.42	0.7	101.3	101.8	1.397	1.402
101	1.46	1.48	1.4	95.8	97.3	1.502	1.507
105	0.929	0.893	4.0	74.2	70.3	1.184	1.189
110	1.15	1.15	0.0	88.0	87.5	1.269	1.274
114	0.786	0.789	0.4	79.4	79.3	0.99	0.995
118	1.27	1.18	7.3	76.6	67.1	1.502	1.507
128	1.1	1.08	1.8	96.4	93.9	1.136	1.141
137	1.01	1.05	3.9	99.6	103.1	1.014	1.019
138	1.69	1.6	5.5	97.7	88.1	1.713	1.718

Surrogate Corrected	L-160-06 05-4403 C2	L-160-06 05-4403 C2	Relative Percent	L-160-06 05-4403 C2 MS	L-160-06 05-4403 C2 MSD	L-160-06 05-4403 C2 MS	L-160-06 05-4403 C2 MSD
	Matrix Spike	Matrix Spike Duplicate	Difference	% Recovery	% Recovery	Expected Value	Expected Value
	ng/g Wet	ng/g Wet				ppb (ng/g)	ppb (ng/g)
141	1.1	1.07	2.8	106.3	102.7	1.038	1.043
149	1.29	1.26	2.4	105.9	102.3	1.232	1.237
151	1.13	1.12	0.9	108.8	107.2	1.043	1.048
153	2.04	1.95	4.5	98.0	88.4	2.06	2.065
156	0.869	0.874	0.6	81.5	81.6	1.052	1.057
157	0.892	0.837	6.4	87.7	81.7	1.014	1.019
158	1.03	1.05	1.9	98.2	99.7	1.048	1.053
170	1.02	1.03	1.0	92.1	92.7	1.098	1.103
174	1.04	1.02	1.9	100.2	97.7	1.038	1.043
177	1.03	1.04	1.0	100.3	100.8	1.027	1.032
180	1.3	1.21	7.2	100.7	91.2	1.293	1.298
183	1.13	1.15	1.8	102.7	104.2	1.103	1.108
187	1.29	1.3	0.8	101.8	102.3	1.272	1.277
189	0.868	0.801	8.0	87.7	80.5	0.99	0.995
194	1.11	1.11	0.0	105.1	104.5	1.06	1.065
195	1.05	0.993	5.6	105.3	99.0	0.998	1.003
200	1.13	1.13	0.0	113.1	112.6	1.00	1.005
201	1.13	1.15	1.8	108.7	110.2	1.044	1.049
203	1.18	1.17	0.9	115.2	113.6	1.03	1.035
206	1.05	1.05	0.0	102.7	102.2	1.023	1.028
209	0.973	0.96	1.3	98.3	96.5	0.99	0.995
Moisture	78.4	78.2					
Lipid	0.333	0.334					
Surrogate	%R	%R		%R	%R		
209-L	73.3	76.9		73.3	76.9		

Quality Assurance Results from the Polychlorinated Biphenyl Analyses

Surrogate Corrected	Method Detection Limit	Reporting Limit	SRM 1588a	+/-	95% CI Ranges		70-130% of the 95% Confidence Interval		SRM 1588a BS 427	%R	Qualifier
	ng/g	ng/g	Cert. Conc.		Lower	Upper			ng/g		
18 reference conc	5	20	*8.1*	*2.2*	*5.9*	*10.3*	*4.13*	*13.39*	5.4	*66.7*	NC,SC
28	5	20	28.32	0.6	27.77	28.87	19.44	37.53	22.7	80.2	SC
31	5	20	8.33	0.3	8.1	8.61	5.64	11.19	7.6	91.2	SC
33 reference conc	5	20	*3.3*	*1.4*	*1.9*	*4.7*	*1.33*	*6.11*	4.61	*140*	NC,SC
44	5	20	35.1	1.4	33.7	36.5	23.59	47.45	33.1	94.3	SC
49	5	20	29.9	0.8	29.1	30.74	20.34	39.96	33.0	110	SC
52	5	20	83.3	2.3	81	85.6	56.70	111.28	82.3	98.8	SC
66	5	20	54.7	1.5	53.2	56.2	37.24	73.06	55.5	101	SC
70/76 reference conc	5	20	*27*	*4*	*23*	*31*	*16.10*	*40.30*	29.1	*108*	NC,SC
74 reference conc	5	20	*40*	*4*	*36*	*44*	*25.20*	*57.20*	34.8	*87.0*	NC,SC
87	5	20	56.3	1.1	55.2	57.4	38.64	74.62	55.0	97.7	SC
95	5	20	36.5	1.1	35.4	37.6	24.78	48.88	63.0	173	GBC,SC
97 reference conc	5	20	*42*	*4*	*38*	*46*	*26.60*	*59.80*	30.6	*72.9*	NC,SC
101	5	20	126.5	4.3	122.2	130.8	85.54	170.04	139	110	SC
105	5	20	60.2	2.3	57.9	62.5	40.53	81.25	48.8	81.1	SC
110	5	20	76	2	74	78	51.80	101.40	71.4	93.9	SC
118	5	20	176.3	3.8	172.5	180.1	120.75	234.13	134	76.0	SC
128	5	20	47	2.4	44.6	49.4	31.22	64.22	36.5	77.7	SC
137 reference conc	5	20	*16*	*2*	*14*	*18*	*9.80*	*23.40*	11.2	*70.0*	NC,SC
138/163/164	5	20	263.5	9.1	254.4	272.6	178.08	354.38	197	74.8	SC
141 reference conc	5	20	*24*	*4*	*20*	*28*	*14.00*	*36.40*	36.3	*151*	NC,SC
149	5	20	105.7	3.6	102.1	109.3	71.47	142.09	79.8	75.5	SC
151	5	20	54.8	2.1	52.7	56.9	36.89	73.97	43.3	79.0	SC
153	5	20	273.8	7.7	266.1	281.5	186.27	365.95	269	98.2	SC
156	5	20	27.3	1.8	25.5	29.1	17.85	37.83	17.1	62.6	GBC,SC
158 reference conc	5	20	*21*	*2*	*19*	*23*	*13.30*	*29.90*	19.7	*93.8*	NC,SC

Surrogate Corrected	Method Detection Limit	Reporting Limit	SRM 1588a	+/-	95% CI Ranges		70-130% of the 95% Confidence Interval		SRM 1588a BS 427	%R	Qualifier
	ng/g	ng/g	Cert. Conc.		Lower	Upper			ng/g		
170	5	20	46.5	1.1	45.4	47.6	31.78	61.88	33.6	72.3	SC
174 reference conc	5	20	*41*	*10*	*31*	*51*	*21.70*	*66.30*	18.4	*44.9*	NC,SC
177 reference conc	5	20	*4.9*	*0.8*	*4.1*	*5.7*	*2.87*	*7.41*	5.88	*120*	NC,SC
180	5	20	105	5.2	99.8	110.2	69.86	143.26	101	96.2	SC
183	5	20	31.21	0.6	30.59	31.83	21.41	41.38	28.3	90.7	SC
187/159/182	5	20	35.23	0.8	34.40	36.06	24.08	46.88	47.4	135	GBC,SC
189 reference conc	5	20	*2.9*	*0.6*	*2.3*	*3.5*	*1.61*	*4.55*	1.9	*65.5*	NC,SC
194	5	20	15.37	0.6	14.76	15.98	10.33	20.77	12.8	83.3	SC
195 reference conc	5	20	*4.6*	*0.6*	*4*	*5.2*	*2.80*	*6.76*	3.12	*67.8*	NC,SC
201	5	20	12.18	0.5	11.72	12.64	8.20	16.43	13.2	108	SC
206 reference conc	5	20	*3.4*	*1.6*	*1.8*	*5*	*1.26*	*6.50*	3.88	*114*	NC,SC
209 reference conc	5	20	*3.5*	*1*	*2.5*	*4.5*	*1.75*	*5.85*	2.46	*70.3*	NC,SC
Moisture										-88	
Lipid										-88	
Surrogate										%R	
209-L										79.0	

Results Qualifier for the Pesticide and Polychlorinated Biphenyl Analyses

ResQualCode	ResQualifier	Type1	Type2	Type3
<	Less Than	Lab	Tox	
=	Equal To	Lab	Tox	
>	Greater Than	Lab	Tox	
DNQ	Detected Not Quantifiable	Lab		
M	Male Adult	Tox		
NAS	No Adult Survival	Tox		
ND	Not Detected	Lab	Field	Tox
NR	Not Reported - Data Not Reported	Lab	Field	Tox
PA	Present/Absent	Lab		
SU	Surrogate	Lab		

Quality Assurance (QA) LookUp Codes Accompanying the Pesticide and Polychlorinated Biphenyl Results

QACode	QACodeDescr	Type1	Type2	Type3	Active
BB	Sample > 4x spike concentration	Lab			TRUE
BE	Low surrogate recovery; analyzed twice	Lab			TRUE
BRK	No concentration sample container broken	Lab	Tox		TRUE
BS	Insufficient sample available to follow standard QC procedures	Lab	Tox		TRUE
BT	Insufficient sample to perform the analysis	Lab	Tox		TRUE
BY	Sample received at improper temperature	Lab	Tox		TRUE
BY,H	Received at improper temperature, Holding Time violation	Lab	Tox		TRUE
BY,H,TW	Received at improper temperature, Holding Time violation, Deviations in water quality parameters	Tox			TRUE
BY,TW	Sample received at improper temperature, Minor deviations in water quality parameters	Tox			TRUE
C	Calculated value 1/2 distance between MDL and RL	Lab			TRUE
C,LC	Calculated value 1/2 distance between MDL and RL; Laboratory Contamination	Lab			TRUE
CJ	Analyte concentration is in excess of the instrument calibration	Lab			TRUE
CQA	Concentration not reported for QA sample only % Recovery reported	Lab			TRUE
CS	QC criteria not met due to analyte concentration near RL	Lab			TRUE
CS,IL	RPD exceeds laboratory control limit; QC criteria not met due to analyte concentration near RL	Lab			TRUE
CT	QC criteria not met due to high level of analyte concentration	Lab			TRUE
D	EPA Flag - Analytes analyzed at a secondary dilution	Lab			TRUE
DB	QA results outside of acceptance limits due to matrix effects	Lab			TRUE
DF	Reporting limits elevated due to matrix interferences	Lab			TRUE
DS	Batch Quality Assurance data from another project	Lab	Tox		TRUE
EEC	Estimate / exceeds calibration	Lab	Field		TRUE
EU	LCS is outside of acceptance limits. MS/DMS are accept., no corr.	Lab			TRUE
EU,GN,H,SC	EU,GH,H,SC; see QACodeLookUp List for complete definition	Lab			FALSE
FD	Dry Site	Field			TRUE
FIF	Instrument Failure	Field			TRUE
FLV	Velocity too low to be measured	Field			TRUE
FPF	Probe Failure	Field			TRUE
FS	Too Shallow for probe measurement	Field			TRUE
FUD	Unable to deploy instrument	Field			TRUE
GB	Matrix spike recovery not within control limits	Lab			TRUE
GB,H,IL,SC	GB,H,IL,SC; see QACodeLookUp List for complete definition	Lab			TRUE

QACode	QACodeDescr	Type1	Type2	Type3	Active
GB,R	Matrix spike recovery not within control limits; Rejected	Lab			TRUE
GN	Surrogate recovery is outside of control limits	Lab			TRUE
GN,H	Surrogate recovery is outside of control limits; A holding time violation has occurred	Lab			TRUE
GN,H,SC	Surrogate recovery is outside of control limits; A holding time violation has occurred; Surrogate Corrected value	Lab			TRUE
GN,H,SC,UJ	GN,H,SC,UJ; see QACodeLookUp List for complete definition	Lab			TRUE
GR	Internal standard recovery is outside method recovery limit	Lab			TRUE
H	A holding time violation has occurred	Lab	Tox		TRUE
H,DF	Holding Time violation, Reporting limits elevated due to matrix interferences	Lab			TRUE
H,HS,SC	A holding time violation has occurred; Spike analyte recovery is outside stated control limits; Surrogate Corrected value	Lab			TRUE
H,HT,GN,SC,SCR	H,HT,GN,SC,SCR; see QACodeLookUp List for complete definition	Lab			TRUE
H,HT,SC,SCR	H,HT,SC,SCR; see QACodeLookUp List for complete definition	Lab			TRUE
H,SC	A holding time violation has occurred; Surrogate Corrected value	Lab			TRUE
H,SC,SCR	A holding time violation has occurred; Surrogate Corrected value; Screening level analysis	Lab			TRUE
H,SC,UJ	A holding time violation has occurred; Surrogate Corrected value; Analyte was not detected above the reported sample quantitation limit. See QA CodeLookUp List for complete definition	Lab			TRUE
H,TL	A holding time violation has occurred, Minor deviations in test conditions (temp, light)	Tox			TRUE
H,TW	A holding time violation has occurred, Minor deviations in water quality parameters	Tox			TRUE
HH	Result exceeds linear range; concentration may be understated	Lab	Field		TRUE
HR	Post-digestion spike	Lab			TRUE
HS	Spike analyte recovery is outside stated control limits	Lab			TRUE
HT	Analytical value calculated using results from associated tests	Lab			TRUE
IL	RPD exceeds laboratory control limit	Lab			TRUE
IM	Method does not include this analyte as part of compound list	Lab			TRUE
IS	Reporting limit elevated due to pres. of analyte in method blank	Lab			TRUE
IU	Percent Recover exceeds laboratory control limit	Lab			TRUE
J	Estimated value - EPA Flag	Lab	Field	Tox	TRUE
JA	Analyte positively identified but quanitation is an estimate	Lab			TRUE
LC	Laboratory Contamination	Lab			TRUE
M	A matrix effect is present	Lab			TRUE
N	Tentatively Identified Compound	Lab			TRUE
NC	Analyte concentration not certifiable in Certified Reference Material	Lab			TRUE
NMDL	No Method Detection Limit reported from laboratory	Lab			TRUE

QACode	QACodeDescr	Type1	Type2	Type3	Active
NR	Not Recorded	Lab	Field		TRUE
P	Evidence analyte present	Lab			TRUE
R	Data rejected - EPA Flag	Lab	Field	Tox	TRUE
RE	Elevated reporting limits due to limited sample volume	Lab			TRUE
SC	Surrogate Corrected Value	Lab			TRUE
SCR	Screening level analysis	Lab			TRUE
TA	Ammonia data not acceptable	Tox			TRUE
TC	Conductivity data not acceptable	Tox			TRUE
TD	DO data not acceptable	Tox			TRUE
TH	Hardness data not acceptable	Tox			TRUE
TK	Alkalinity data not acceptable	Tox			TRUE
TL	Minor deviations in test conditions (temp, light)	Tox			TRUE
TP	pH data not acceptable	Tox			TRUE
TR	Test conditions not acceptable (temp, light)	Tox			TRUE
TW	Minor deviations in water quality parameters	Tox			TRUE
UJ	Analyte was not detected above the reported sample quantitation limit.Reported quantitation limit is approx. & may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample	Lab			TRUE
X	None - No QA Qualifier	Lab	Field	Tox	TRUE

Polybrominated Biphenyl Ether Analyses (BDEs) for Two Fish from Lake Nacimiento with some Quality Assurance Results

Surrogate Corrected	MDL ng/g Wet	RL ng/g Wet	Method Blank BS 427 ng/g Wet	MDL ng/g Wet	RL ng/g Wet	L-129-06-22 Las Tables Carp ng/g Wet	MDL ng/g Wet	RL ng/g Wet	L-129-06-25 Las Tables CCF ng/g Wet	MDL ng/g Wet	RL ng/g Wet
BDE 17	0.138	0.597	ND	0.138	0.594	ND	0.138	0.597	ND	0.138	0.594
BDE 28	0.147	0.597	ND	0.147	0.594	0.327 DNQ	0.147	0.597	ND	0.147	0.594
BDE 47	0.195	0.796	ND	0.194	0.792	3.82	0.195	0.796	3.67	0.194	0.792
BDE 66	0.134	0.597	ND	0.133	0.594	ND	0.134	0.597	ND	0.133	0.594
BDE 100	0.156	0.597	ND	0.155	0.594	0.545 DNQ	0.156	0.597	0.594 DNQ	0.155	0.594
BDE 99	0.196	0.796	ND	0.195	0.792	ND	0.196	0.796	1.31	0.195	0.792
BDE 85	0.176	0.796	ND	0.175	0.792	ND	0.176	0.796	ND	0.175	0.792
BDE 154	0.164	0.597	ND	0.163	0.594	ND	0.164	0.597	0.263 DNQ	0.163	0.594
BDE 153	0.184	0.796	ND	0.183	0.792	ND	0.184	0.796	ND	0.183	0.792
BDE 138	0.199	0.796	ND	0.198	0.792	ND	0.199	0.796	ND	0.198	0.792
BDE 183	0.296	1.19	ND	0.294	1.19	ND	0.296	1.19	ND	0.294	1.19
BDE 190	0.435	1.79	ND	0.432	1.78	ND	0.435	1.79	ND	0.432	1.78
Surrogate (%Rec)			% Recovery			% Recovery			% Recovery		
p,p'DDD*			74.5			82.6			87.5		

L-160-06 05-4403 Comp2 Matrix Spike ng/g Wet	MDL ng/g Wet	RL ng/g Wet	L-160-06 05-4403 C2 Matrix Spike Duplicate ng/g Wet	MDL ng/g Wet	RL ng/g Wet	Laboratory Control Spike BS 427 ng/g Wet
0.836	0.138	0.597	0.878	0.695	3.00	3.93
0.941	0.147	0.597	0.947	0.740	3.00	4.16
1.24	0.195	0.796	1.26	0.978	4.00	4.32
0.876	0.134	0.597	0.906	0.673	3.00	3.97
0.980	0.156	0.597	0.988	0.785	3.00	4.04
0.928	0.196	0.796	0.947	0.985	4.00	3.91
0.823	0.176	0.796	0.809	0.885	4.00	3.63
0.954	0.164	0.597	0.974	0.823	3.00	4.52
0.850	0.184	0.796	0.837	0.926	4.00	3.64
0.809	0.199	0.796	0.761	1.00	4.00	3.42
0.823	0.296	1.19	0.796	1.49	6.00	3.70
0.538	0.435	1.79	0.471	2.18	9.00	2.20
% Recovery			% Recovery			% Recovery
76.5			72.9			71.1

All of the samples were qualified with "H." A holding time violation has occurred.

Quality Assurance for Polybrominated Biphenyl Ether Analyses (BDEs)

05-4403 C2 MS	**05-4403 Comp2 MS**	**05-4403 Comp2 MSD**	**Relative**	**05-4403 Comp2 MS**	**05-4403 Comp2 MSD**	**Qualifier**	**05-4403 Comp2 MS Expected Value**	**05-4403 Comp2 MSD Expected Value**
Surrogate Corrected	**ng/g Wet**	**ng/g Wet**	**Percent Difference**	**% Recovery**	**% Recovery**		**Wt Corrected Calc.Recov.+Unspiked sample ppb (ng/g)**	**Wt Corrected Calc.Recov.+Unspiked sample ppb (ng/g)**
BDE 17	0.836	0.878	4.9	84.4	88.2		0.990	0.995
BDE 28	0.941	0.947	0.6	95.1	95.2		0.990	0.995
BDE 47	1.24	1.26	1.6	94.2	95.4		1.316	1.321
BDE 66	0.876	0.906	3.4	88.5	91.1		0.990	0.995
BDE 100	0.980	0.988	0.8	99.0	99.3		0.990	0.995
BDE 99	0.928	0.947	2.0	92.2	93.7		1.006	1.011
BDE 85	0.823	0.809	1.7	83.1	81.3		0.990	0.995
BDE 154	0.954	0.974	2.1	96.4	97.9		0.990	0.995
BDE 153	0.850	0.837	1.5	85.9	84.1		0.990	0.995
BDE 138	0.809	0.761	6.1	81.7	76.5		0.990	0.995
BDE 183	0.823	0.796	3.3	83.1	80.0		0.990	0.995
BDE 190	0.538	0.471	13.3	54.3	47.3	GB	0.990	0.995
Surrogate (%Rec)	% Recovery	% Recovery		% Recovery	% Recovery			
p,p'DDD*	76.5	72.9		76.5	72.9			

Additional Quality Assurance Results for Polybrominated Biphenyl Ether (BDE) Analyses

Surrogate Corrected	LCS BS 427 ng/g Wet	LCS BS 427 (% Recovery)	Qualifier
BDE 17	3.93	78.6	
BDE 28	4.16	83.2	
BDE 47	4.32	86.4	
BDE 66	3.97	79.4	
BDE 100	4.04	80.8	
BDE 99	3.91	78.2	
BDE 85	3.63	72.6	
BDE 154	4.52	90.4	
BDE 153	3.64	72.8	
BDE 138	3.42	68.4	
BDE 183	3.70	74.0	
BDE 190	2.20	44.0	EUM
Surrogate (%Rec)	% Recovery		
p,p'DDD*	71.1		

Quality Assurance (QA) LookUp Codes Accompanying the BDE Results

QACode	QACodeDescr	Type1	Type2	Type3	Active
BB	Sample > 4x spike concentration	Lab			TRUE
BE	Low surrogate recovery; analyzed twice	Lab			TRUE
BLM	Compound unidentified or below the RL due to overdilution	Lab			TRUE
BRK	No concentration sample container broken	Lab	Tox		TRUE
BRKA	Sample container broken but analyzed	Lab			TRUE
BS	Insufficient sample available to follow standard QC procedures	Lab	Tox		TRUE
BT	Insufficient sample to perform the analysis	Lab	Tox		TRUE
BY	Sample received at improper temperature	Lab	Tox		TRUE
CJ	Analyte concentration is in excess of the instrument calibration; considered estimated	Lab	Field		TRUE
CQA	Concentration not reported for QA sample only % Recovery reported	Lab			TRUE
CS	QC criteria not met due to analyte concentration near RL	Lab			TRUE
CT	QC criteria not met due to high level of analyte concentration	Lab			TRUE
D	EPA Flag - Analytes analyzed at a secondary dilution	Lab			TRUE
DB	QA results outside of acceptance limits due to matrix effects	Lab			TRUE
DF	Reporting limits elevated due to matrix interferences	Lab			TRUE
DO	Coelution	Lab			TRUE
DRM	Spike amount less than 5X the MDL				TRUE
DS	Batch Quality Assurance data from another project	Lab	Tox		TRUE
EU	LCS is outside of acceptance limits. MS/DMS are accept., no corr.	Lab			TRUE
EUM	LCS is outside of acceptance limits.				FALSE
F	Sample mistakenly filtered				FALSE
FCL	Field calibration not performed within 24 hours before use	Field			TRUE
FD	Dry Site	Field			TRUE
FDC	Drift check not acceptable				TRUE
FDP	Field duplicate RPD above QC limit	Lab			FALSE
FIF	Instrument/Probe Failure	Field			TRUE
FLV	Velocity too low to be measured	Field			TRUE
FNM	no documentation of the field measurement collection exists	Field			TRUE
FS	Too Shallow for probe measurement	Field			TRUE
FUD	Unable to deploy instrument	Field			TRUE
GB	Matrix spike recovery not within control limits	Lab			TRUE
GBC	CRM analyte recovery not within control limits	Lab			TRUE
GN	Surrogate recovery is outside of control limits	Lab			TRUE
GR	Internal standard recovery is outside method recovery limit	Lab			TRUE
H	A holding time violation has occurred	Lab	Tox		TRUE
H24	Holding time was > 24 hours for Bacteria tests only	Lab			TRUE
H6	Holding time was > 6 hrs but < 24 hours for Bacteria tests only	Lab			TRUE
HH	Result exceeds linear range; concentration may be understated	Lab			TRUE

QACode	QACodeDescr	Type1	Type2	Type3	Active
HR	Post-digestion spike	Lab			TRUE
HS	Spike analyte recovery is outside stated control limits	Lab			TRUE
HT	Analytical value calculated using results from associated tests	Lab			TRUE
IF	Sample result is greater than reported value	Lab			TRUE
IL	RPD exceeds laboratory control limit	Lab			TRUE
IM	Method does not include this analyte as part of compound list	Lab			TRUE
IP	Analyte detected in method, trip, or equipment blank	Lab			FALSE
IS	Reporting limit elevated due to pres. of analyte in method blank	Lab			TRUE
IU	Percent Recovery exceeds laboratory control limit	Lab			TRUE
J	Estimated value - EPA Flag	Lab	Field	Tox	TRUE
JA	Analyte positively identified but quantitation is an estimate	Lab			TRUE
LC	Laboratory Contamination	Lab			TRUE
M	A matrix effect is present	Lab			TRUE
N	Tentatively Identified Compound	Lab			TRUE
NC	Analyte concentration not certifiable in Certified Reference Material	Lab			TRUE
NMDL	No Method Detection Limit reported from laboratory	Lab			TRUE
NR	Not Recorded	Lab	Field		TRUE
P	Evidence analyte present	Lab			TRUE
PG	Calibration verification outside control limits				TRUE
PJ	Result from re-extract/re-anal to confirm original MS/MSD result				FALSE
PJM	Result from re-extract/re-anal to confirm original result	Lab	Tox		TRUE
QAX	When the native sample for the MS/MSD is not included in the batch reported	Lab			TRUE
R	Data rejected - EPA Flag	Lab	Field	Tox	TRUE
RE	Elevated reporting limits due to limited sample volume	Lab			TRUE
SC	Surrogate Corrected Value	Lab			TRUE
SCR	Screening level analysis	Lab			TRUE
TA	Ammonia data not acceptable	Tox			TRUE
TC	Conductivity data not acceptable	Tox			TRUE
TD	DO data not acceptable	Tox			TRUE
TH	Hardness data not acceptable	Tox			TRUE
TK	Alkalinity data not acceptable	Tox			TRUE
TL	Minor deviations in test conditions (temp, light)	Tox			TRUE
TP	pH data not acceptable	Tox			TRUE
TR	Test conditions not acceptable (temp, light)	Tox			TRUE
TW	Minor deviations in water quality parameters	Tox			TRUE
UJ	Analyte was not detected above the reported sample quantitation limit.Reported quantitation limit is approx. & may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample	Lab			TRUE
X	None - No QA Qualifier	Lab	Field	Tox	TRUE

Appendix F. Laboratory Data Sheets of Mercury Analyses from the Agency for Toxic Substances and Disease Registry's Exposure Investigation Fish Sampling from Lake Nacimiento

Mercury (Hg) Results—Fish from Lake Nacimiento

Laboratory Number	Sample Date	Sample Site	Sample Identification	Length mm	Fish Lengths (mm) for the composite samples	Hg, wet weight oncentration, µg/g	COC #	QA Batch	Percent Moisture	Hg, dry weight concentration, µg/g
L-129-06-60	2/28/06	Narrows	BCR 01	310		0.614	47	071806-Hg	78.8	2.89
L-129-06-84	3/3/06	Dip Creek	BCR COMP 1	278	305, 300, 229	0.586	15, 15, 14	072106-Hg	78.8	2.77
L-129-06-29	3/2/06	Las Tablas Creek	BCR COMP 1	274	286, 268, 267	0.591	49, 2, 44	051706-Hg	79.5	2.89
L-129-06-61	2/28/06	Narrows	BCR COMP 1	234	243, 240, 220	0.460	46, 51, 45	072106-Hg	78.5	2.14
L-129-06-30	3/1/06	Las Tablas Creek	BCR COMP 2	263	265, 264,260	0.609	51, 46, 45	051706-Hg	78.8	2.87
L-129-06-31	3/1/06	Las Tablas Creek	BCR COMP 3	257	260, 260, 250	0.550	47, 50, 48	051706-Hg	79.3	2.66
L-129-06-32	3/1/06	Las Tablas Creek	BG COMP 01	190	214, 195, 186, 185, 182, 180	0.466	11, 37, 12, 14, 36, 35	051706-Hg	78.9	2.21
L-129-06-33	3/1/06	Las Tablas Creek	BG COMP 02	150	155 (2), 150, 147, 145	0.363	16, 19, 18, 17, 13	051706-Hg	78.5	1.69
L-129-06-34	3/1/06	Las Tablas Creek	BG COMP 03	137	145, 142, 140, 132, 125	0.424	15, 21, 20, 22, 23	051706-Hg	79.0	2.02
L-129-06-62	2/28/06	Narrows	BG COMP 1	192	215, 195, 185, 183, 180	0.264	37, 39, 30, 43, 31	072106-Hg	78.5	1.23
L-129-06-63	2/28/06	Narrows	BG COMP 2	162	180, 175, 165, 145, 145	0.325	36, 33, 40, 35, 41	072106-Hg	78.5	1.51
L-129-06-64	2/28/06	Narrows	BG COMP 3	135	143, 135, 132, 130	0.328	34, 38, 29, 32	072106-Hg	79.1	1.57
L-129-06-81	3/3/06	Dip Creek	CCF COMP 1	492	525, 495, 455	0.631	1, 9, 5	072106-Hg	76.2	2.65
L-129-06-25	3/1/06	Las Tablas Creek	CCF COMP 1	517	535, 515, 500	0.397	38, 24, 39	051706-Hg	75.7	1.63
L-129-06-82	3/3/06	Dip Creek	CCF COMP 2	409	450, 398, 380	0.536	8, 13, 6	072106-Hg	76.3	2.27
L-129-06-26	3/2/06	Las Tablas Creek	CCF COMP 2	401	424, 395, 385	0.376	1, 41, 40	051706-Hg	76.2	1.58
L-129-06-83	3/3/06	Dip Creek	CCF COMP 3	329	340, 335, 330, 310	0.753	2, 3, 7, 4	072106-Hg	78.2	3.45
L-129-06-27	3/1/06	Las Tablas Creek	CCF COMP 3	341	375, 307	0.462	43, 42	051706-Hg	77.9	2.10
L-129-06-80	3/2/06	Dip Creek	CP COMP 1	485	510, 480, 465	0.513	6, 11, 12	072106-Hg	77.8	2.31

Laboratory Number	Sample Date	Sample Site	Sample Identification	Length mm	Fish Lengths (mm) for the composite samples	Hg, wet weight concentration, µg/g	COC #	QA Batch	Percent Moisture	Hg, dry weight concentration, µg/g
L-129-06-22	3/1/06	Las Tablas Creek	CP COMP 1	553	580,550, 530	0.456	33, 26, 31	051706-Hg	75.9	1.90
L-129-06-57	2/28/06	Narrows	CP COMP 1	537	580, 535, 495	0.502	22, 24, 28	072106-Hg	81.3	2.68
L-129-06-23	3/1/06	Las Tablas Creek	CP COMP 2	518	525, 520, 510	0.709	25, 29, 28	051706-Hg	77.4	3.14
L-129-06-58	2/28/06	Narrows	CP COMP 2	480	485, 480, 475	0.365	27, 25, 26	072106-Hg	76.3	1.54
L-129-06-24	3/1/06	Las Tablas Creek	CP COMP 3	481	497, 480, 465	0.560	34, 32, 27	051706-Hg	75.3	2.27
L-129-06-59	2/28/06	Narrows	CP COMP 3	445	460, 440, 435	0.423	20, 23, 21	072106-Hg	79.2	2.04
L-129-06-70	3/2/06	Dip Creek	SB 01	400		1.35	2	051706-Hg	76.8	5.80
L-129-06-13	3/1/06	Las Tablas Creek	SB 01	450		0.956	2	051206-Hg	77.5	4.25
L-129-06-42	2/28/06	Narrows	SB 01	410		1.10	11	072806-Hg	76.4	4.65
L-129-06-71	3/2/06	Dip Creek	SB 02	395		1.05	5	051706-Hg	77.2	4.61
L-129-06-14	3/1/06	Las Tablas Creek	SB 02	430		1.07	1	051206-Hg	77.3	4.69
L-129-06-43	2/28/06	Narrows	SB 02	372	372 *	1.24	1	072806-Hg	77.4	5.46
L-129-06-72	3/2/06	Dip Creek	SB 03	383		1.04	4	051706-Hg	77.0	4.54
L-129-06-15	3/1/06	Las Tablas Creek	SB 03	382		1.10	6	051206-Hg	77.8	4.97
L-129-06-44	2/28/06	Narrows	SB 03	370		0.940	7	072806-Hg	77.2	4.11
L-129-06-73	3/2/06	Dip Creek	SB 04	378		1.05	1	051706-Hg	77.0	4.58
L-129-06-16	3/1/06	Las Tablas Creek	SB 04	381		1.03	3	051206-Hg	78.1	4.73
L-129-06-45	2/28/06	Narrows	SB 04	345	345**	0.959	2	072806-Hg	77.1	4.18
L-129-06-74	3/2/06	Dip Creek	SB 05	368		1.05	8	051706-Hg	77.1	4.59
L-129-06-17	3/1/06	Las Tablas Creek	SB 05	380		0.997	5	051206-Hg	76.7	4.28
L-129-06-46	2/28/06	Narrows	SB 05	339		0.888	3	072806-Hg	77.1	3.88
L-129-06-75	3/2/06	Dip Creek	SB 06	367		1.05	10	051706-Hg	78.5	4.87

Laboratory Number	Sample Date	Sample Site	Sample Identification	Length mm	Fish Lengths (mm) for the composite samples	Hg, wet weight oncentration, µg/g	COC #	QA Batch	Percent Moisture	Hg, dry weight concentration, µg/g
L-129-06-18	3/1/06	Las Tablas Creek	SB 06	374		0.943	4	051206-Hg	78.4	4.38
L-129-06-47	2/28/06	Narrows	SB 06	335		0.913	8	072806-Hg	77.4	4.03
L-129-06-76	3/2/06	Dip Creek	SB 07	362		0.931	3	051706-Hg	79.4	4.52
L-129-06-19	3/1/06	Las Tablas Creek	SB 07	374		1.08	8	051206-Hg	77.3	4.74
L-129-06-48	2/28/06	Narrows	SB 07	332		0.817	6	072806-Hg	78.1	3.73
L-129-06-77	3/2/2006***	Dip Creek	SB 08	345		0.993	16	072106-Hg	77.3	4.38
L-129-06-20	3/1/06	Las Tablas Creek	SB 08	370		0.969	7	051206-Hg	77.5	4.30
L-129-06-49	2/28/06	Narrows	SB 08	330		0.830	15	072806-Hg	77.5	3.69
L-129-06-78	3/2/06	Dip Creek	SB 09	327		1.07	7	072106-Hg	78.0	4.86
L-129-06-21	3/1/06	Las Tablas Creek	SB 09	327		1.01	10	051706-Hg	76.8	4.36
L-129-06-50	2/28/06	Narrows	SB 09	321		0.747	10	072806-Hg	77.0	3.25
L-129-06-79	3/2/06	Dip Creek	SB 10	312		0.889	9	072106-Hg	77.3	3.92
L-129-06-65	3/2/2006***	Dip Creek	WB 01	425		1.59	10	072106-Hg	78.1	7.26
L-129-06-01	3/2/06	Las Tablas Creek	WB 01	414		1.55	3	051206-Hg	79.2	7.45
L-129-06-66	3/2/2006***	Dip Creek	WB 02	390		1.72	11	072106-Hg	79.4	8.32
L-129-06-02	3/20/06	Las Tablas Creek	WB 02	400		1.53	1	051206-Hg	78.0	6.94
L-129-06-67	3/2/2006***	Dip Creek	WB 03	365		1.24	13	072106-Hg	77.2	5.46
L-129-06-03	3/20/06	Las Tablas Creek	WB 03	390		1.49	3	051206-Hg	79.2	7.17
L-129-06-68	3/2/2006***	Dip Creek	WB 04	340		0.998	12	072106-Hg	78.3	4.59
L-129-06-04	3/20/06	Las Tablas Creek	WB 04	280		1.14	5	051206-Hg	75.9	4.75

Laboratory Number	Sample Date	Sample Site	Sample Identification	Length mm	Fish Lengths (mm) for the composite samples	Hg, wet weight oncentration, µg/g	COC #	QA Batch	Percent Moisture	Hg, dry weight concentration, µg/g
L-129-06-69	3/2/2006***	Dip Creek	WB 05	325		1.11	14	072106-Hg	77.1	4.86
L-129-06-05	3/20/06	Las Tablas Creek	WB 05	365		1.10	7	051206-Hg	77.0	4.77
L-129-06-06	3/20/06	Las Tablas Creek	WB 06	365		1.13	9	051206-Hg	75.9	4.70
L-129-06-07	3/1/06	Las Tablas Creek	WB 07	360		1.24	52	051206-Hg	75.1	4.99
L-129-06-08	3/2/06	Las Tablas Creek	WB 08	354		0.872	4	051206-Hg	76.9	3.78
L-129-06-09	3/20/06	Las Tablas Creek	WB 09	350		0.874	2	051206-Hg	77.1	3.81
L-129-06-10	3/20/06	Las Tablas Creek	WB 10	350		0.987	6	051206-Hg	77.1	4.30
L-129-06-11	3/20/06	Las Tablas Creek	WB 11	340		0.957	4	051206-Hg	76.3	4.03
L-129-06-12	3/20/06	Las Tablas Creek	WB 12	340		1.14	8	051206-Hg	74.7	4.52
L-129-06-35	2/28/06	Narrows	WB01	389		1.45	18	071806-Hg	77.9	6.57
L-129-06-36	2/28/06	Narrows	WB02	380		1.49	16	071806-Hg	77.8	6.71
L-129-06-37	2/28/06	Narrows	WB03	370		1.60	19	071806-Hg	75.9	6.65
L-129-06-38	2/28/06	Narrows	WB04	366		1.58	17	071806-Hg	77.2	6.95
L-129-06-39	2/28/06	Narrows	WB05	360		1.49	50	071806-Hg	78.2	6.83
L-129-06-40	2/28/06	Narrows	WB06	360		1.49	48	071806-Hg	77.5	6.62
L-129-06-41	2/28/06	Narrows	WB07	323		1.24	49	071806-Hg	77.0	5.42

* 37.2 on COC
** 34.5 on COC
*** 3/2/06 on COC
Note: Lab Number L-161-06 was combined with L-129-06. Samples L-129-06 51-56 (SB 4,5,9,12-14, 2/28/06) could not be located.
Shaded area: not sure of exact COC # for each composite.

Quality Assurance (QA) Summary for Mercury Analyses

WPCL lab number: L-129-06
No. of samples received: 83
Date received: 03/04/06
Received by: Glenn Sibbald
Lab storage location: Hatchery Freezer
Analyst: Cerasela Onuta

Certified Reference Material (CRM) (Tissue)	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
Date of Analysis	05/12/06	05/17/06	07/18/06	07/21/06	07/28/06
Preparation Date	05/10/06	05/16/06	07/17/06	07/20/06	07/27/06
Lab Batch	051206-Hg	051706-Hg	071806-Hg	072106-Hg	072806-Hg
CRM Identification	IPS-DORM-05-06	IPS-DORM-05-06	IPS-DORM-05-06	IPS-DORM-05-06	IPS-DORM-05-06
True Value (ug/g)	4.64 ± 0.26	4.64 ± 0.26	4.64 ± 0.26	4.64 ± 0.26	4.64 ± 0.26
Laboratory Result (ug/g)	4.15	4.34	4.08	4.32	4.17
Laboratory Result Duplicate (ug/g)	4.11	4.05	4.18	4.39	4.25
% Recovery	89.5	93.4	88.0	93.1	89.8
% Recovery Duplicate	88.6	87.4	90.1	94.6	91.5
RPD	1.06	6.73	2.41	1.62	1.90

Matrix Spike (MS) Sample Identification	**IWS-Hg-06-721**	**IWS-Hg-06-720**	**IWS-Hg-06-774**	**IWS-Hg-06-774**	**IWS-Hg-06-774**
Laboratory Matrix Spike Sample Identification	**L-129-06-1**	**L-129-06-21**	**L-278-06-06 (non-project sample)**	**L-129-06-57**	**L-129-06-42**
MS actual value dry (ug/g)	8.49	5.34	1.09	3.66	5.76
MSD actual value dry (ug/g)	7.85	5.36	1.02	3.51	5.80
MS expected value (ug/g)	8.03	5.44	1.09	3.72	5.49
MSD expected value (ug/g)	8.04	5.43	1.08	3.71	5.50
MS % of expected value	106	98.2	99.8	98.2	105
MSD % of expected value	97.6	98.8	95.3	94.5	105
RPD	7.83	0.39	5.92	4.21	0.64

Sample Duplicate Identification	L-129-06-20	L-129-06-76	L-278-06-25 (non-project sample)	L-129-06-84	L-129-06-50
Sample Value Dry Weight Concentration (ug/g)	4.25	4.61	0.066	2.79	3.31
Duplicate Value Dry Weight Concentration (ug/g)	4.25	4.43	0.072	2.76	3.19
Average Sample Value (ug/g)	4.30	4.52	0.069	2.77	3.25
Sample Value Wet Weight Concentration (ug/g)	0.957	0.950	0.018	0.590	0.760
Duplicate Value Wet Weight Concentration (ug/g)	0.981	0.912	0.020	0.583	0.733
Average Sample Value (ug/g)	0.969	0.931	0.019	0.586	0.747
RPD	2.38	4.08	9.22	1.08	3.64

Laboratory Control Standard (LCS) Identification	IWS-Hg-06-721	IWS-Hg-06-720	IWS-Hg-06-774	IWS-Hg-06-774	IWS-Hg-06-774
True Value (ug/L)	5.00	10.0	8.00	8.00	8.00
LCS % of expected value	99.7	108	96.2	101	97.6

Instrument Quality Control	IWS-Hg-06-762	IWS-Hg-06-765	IWS-Hg-06-789	IWS-Hg-06-790	IWS-Hg-06-797
Calibration Verification Standard True Value	10.0	10.0	10.0	10.0	10.0
Reporting Limit (ug/L)	0.50	0.50	0.50	0.50	0.50
Method Detection Limit (ug/L)	0.10	0.10	0.10	0.10	0.10
Method Blank (ug/L)	ND	ND	ND	ND	ND
Initial Calibration Blank (ug/L)	ND	ND	ND	ND	ND
Initial Calibration Verification (ug/L)	10.3	11.2	9.73	10.3	9.97
Continue Calibration Blank (ug/L)	ND	ND	ND	ND	ND
Continue Calibration Verification (ug/L)	9.62	11.0	9.37	10.2	9.69
Final Calibration Blank (ug/L)	ND	ND	ND	ND	ND
Final Calibration Verification (ug/L)	9.56	10.8	10.1	9.59	9.88

RPD = Relative Percent Difference
ug/L = wet weight, instrument values

Mercury Analyses: Reporting Limit (RL) and Minimum Detection Limit (MDL)

Laboratory Number	Sample Identification	RL for dry weight	MDL for dry weight	RL for wet weight	MDL for wet weight
L-129-06-01	WB 01	0.058	0.012	0.012	0.002
L-129-06-02	WB 02	0.056	0.012	0.011	0.002
L-129-06-03	WB 03	0.060	0.013	0.012	0.003
L-129-06-04	WB 04	0.052	0.013	0.010	0.003
L-129-06-05	WB 05	0.052	0.012	0.010	0.002
L-129-06-06	WB 06	0.053	0.013	0.011	0.003
L-129-06-07	WB 07	0.049	0.012	0.010	0.002
L-129-06-08	WB 08	0.053	0.012	0.011	0.002
L-129-06-09	WB 09	0.053	0.012	0.011	0.002
L-129-06-10	WB 10	0.053	0.012	0.011	0.002
L-129-06-11	WB 11	0.054	0.013	0.011	0.003
L-129-06-12	WB 12	0.050	0.013	0.010	0.003
L-129-06-13	SB 01	0.056	0.013	0.011	0.003
L-129-06-14	SB 02	0.054	0.012	0.011	0.002
L-129-06-15	SB 03	0.058	0.013	0.012	0.003
L-129-06-16	SB 04	0.058	0.013	0.012	0.003
L-129-06-17	SB 05	0.052	0.012	0.010	0.002
L-129-06-18	SB 06	0.060	0.013	0.012	0.003
L-129-06-19	SB 07	0.054	0.012	0.011	0.002
L-129-06-20	SB 08	0.057	0.013	0.011	0.003
L-129-06-21	SB 09	0.053	0.012	0.011	0.002
L-129-06-22	CP COMP 1	0.052	0.013	0.011	0.003
L-129-06-23	CP COMP 2	0.055	0.012	0.011	0.002
L-129-06-24	CP COMP 3	0.051	0.012	0.010	0.002
L-129-06-25	CCF COMP 1	0.051	0.012	0.010	0.002
L-129-06-26	CCF COMP 2	0.054	0.013	0.011	0.003
L-129-06-27	CCF COMP 3	0.059	0.013	0.012	0.003
L-129-06-29	BCR COMP 1	0.059	0.012	0.012	0.002
L-129-06-30	BCR COMP 2	0.059	0.013	0.012	0.003
L-129-06-31	BCR COMP 3	0.059	0.012	0.012	0.002
L-129-06-32	BG 01	0.057	0.012	0.011	0.002
L-129-06-33	BG 02	0.056	0.012	0.011	0.002
L-129-06-34	BG 03	0.058	0.012	0.012	0.002
L-129-06-35	WB01	0.056	0.012	0.011	0.002
L-129-06-36	WB02	0.057	0.013	0.011	0.003
L-129-06-37	WB03	0.052	0.013	0.010	0.003
L-129-06-38	WB04	0.056	0.013	0.011	0.003
L-129-06-39	WB05	0.056	0.012	0.011	0.002
L-129-06-40	WB06	0.054	0.012	0.011	0.002
L-129-06-41	WB07	0.053	0.012	0.011	0.002
L-129-06-42	SB 01	0.052	0.012	0.010	0.002
L-129-06-43	SB 02	0.055	0.012	0.011	0.002

Laboratory Number	Sample Identification	RL for dry weight	MDL for dry weight	RL for wet weight	MDL for wet weight
L-129-06-44	SB 03	0.056	0.013	0.011	0.003
L-129-06-45	SB 04	0.054	0.012	0.011	0.002
L-129-06-46	SB 05	0.057	0.013	0.011	0.003
L-129-06-47	SB 06	0.056	0.013	0.011	0.003
L-129-06-48	SB 07	0.059	0.013	0.012	0.003
L-129-06-49	SB 08	0.056	0.013	0.011	0.003
L-129-06-50	SB 09	0.054	0.013	0.011	0.003
L-129-06-57	CP COMP 1	0.063	0.012	0.013	0.002
L-129-06-58	CP COMP 2	0.053	0.013	0.011	0.003
L-129-06-59	CP COMP 3	0.058	0.012	0.012	0.002
L-129-06-60	BCR 01	0.057	0.012	0.011	0.002

Laboratory Number	Sample Identification	RL for dry weight	MDL for dry weight	RL for wet weight	MDL for wet weight
L-129-06-61	BCR COMP 1	0.059	0.013	0.012	0.003
L-129-06-62	BG COMP 1	0.059	0.013	0.012	0.003
L-129-06-63	BG COMP 2	0.059	0.013	0.012	0.003
L-129-06-64	BG COMP 3	0.062	0.013	0.012	0.003
L-129-06-65	WB 01	0.060	0.013	0.012	0.003
L-129-06-66	WB 02	0.059	0.012	0.012	0.002
L-129-06-67	WB 03	0.054	0.012	0.011	0.002
L-129-06-68	WB 04	0.056	0.012	0.011	0.002
L-129-06-69	WB 05	0.056	0.013	0.011	0.003
L-129-06-70	SB 01	0.055	0.013	0.011	0.003
L-129-06-71	SB 02	0.055	0.013	0.011	0.003
L-129-06-72	SB 03	0.053	0.012	0.011	0.002
L-129-06-73	SB 04	0.053	0.012	0.011	0.002
L-129-06-74	SB 05	0.055	0.013	0.011	0.003
L-129-06-75	SB 06	0.060	0.013	0.012	0.003
L-129-06-76	SB 07	0.062	0.013	0.012	0.003
L-129-06-77	SB 08	0.058	0.013	0.012	0.003
L-129-06-78	SB 09	0.055	0.012	0.011	0.002
L-129-06-79	SB 10	0.053	0.012	0.011	0.002
L-129-06-80	CP COMP 1	0.054	0.012	0.011	0.002
L-129-06-81	CCF COMP 1	0.052	0.012	0.010	0.002
L-129-06-82	CCF COMP 2	0.051	0.012	0.010	0.002
L-129-06-83	CCF COMP 3	0.058	0.013	0.012	0.003
L-129-06-84	BCR COMP 1	0.060	0.013	0.012	0.003

Appendix G. General Advice for Sport Fish Consumption

You can reduce your exposure to chemical contaminants in sport fish by following the recommendations below. Follow as many of them as you can to increase your health protection. This general advice is not meant to take the place of advisories for specific areas, but should be followed in addition to them. Sport fish in most water bodies in the state have not been evaluated for their safety for human consumption. This is why we strongly recommend following the general advice given below.

Fishing Practices

- Chemical levels can vary from place to place. Your overall exposure to chemicals is likely to be lower if you eat fish from a variety of places rather than from one usual spot that might have high contamination levels.

- Be aware that the Office of Environmental Health Hazard Assessment (OEHHA) may issue new advisories or revise existing ones. Consult the Department of Fish and Game regulations booklet or check with OEHHA on a regular basis to see if there are any changes that could affect you.

Consumption Guidelines

- Fish Species. Some fish species have higher chemical levels than others in the same location. If possible, eat smaller amounts of several different types of fish rather than a large amount of one type that may be high in contaminants.

- Fish Size. Smaller fish of a species will usually have lower chemical levels than larger fish in the same location because some of the chemicals may accumulate as the fish grows. It is advisable to eat smaller fish (of legal size).

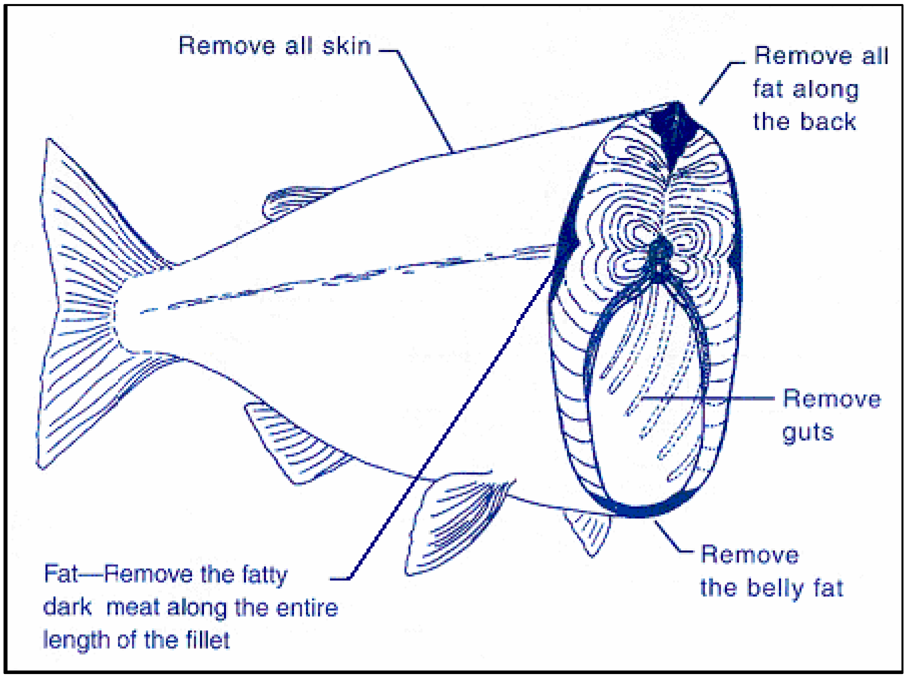
Fish Preparation and Consumption

- Eat only the fillet portions. Do not eat the guts and liver because chemicals usually concentrate in those parts. Also, avoid frequent consumption of any reproductive parts such as eggs or roe.

- Many chemicals are stored in the fat. To reduce the levels of these chemicals, skin the fish when possible and trim any visible fat.

- Use a cooking method such as baking, broiling, grilling, or steaming that allows the juices to drain away from the fish. The juices will contain chemicals in the fat and should be thrown away. Preparing and cooking fish in this way can remove 30 to 50 percent of the chemicals stored in fat. If you make stews or chowders, use fillet parts.

- Raw fish may be infested by parasites. Cook fish thoroughly to destroy the parasites.



Advice for Pregnant Women, Women of Childbearing Age, and Children

Children and fetuses are more sensitive to the toxic effects of methylmercury, the form of mercury of health concern in fish. For this reason, OEHHA's advisories that are based on mercury provide special advice for women of childbearing age and children. Women should follow this advice throughout their childbearing years. The U.S. Food and Drug Administration (FDA) is responsible for the safety of commercial seafood. Most commercial fish have relatively low amounts of methylmercury and can be eaten safely in moderate amounts. However, several types of fish such as large, predatory, long-lived fish have high levels of methylmercury, and could cause overly high exposure to methylmercury if eaten often.

In 2004, FDA and the U.S. Environmental Protection Agency (EPA) issued a Joint Federal Advisory for Mercury in Fish advising women who are pregnant or could become pregnant, nursing mothers, and young children not to eat shark, swordfish, king mackerel, or tilefish. The federal advisory also recommends that these individuals can safely eat up to an average of 12 ounces (two average meals) per week of a variety of other cooked fish purchased in stores or restaurants, such as shrimp, canned light tuna, salmon, pollock, or (farm-raised) catfish. Albacore ("white") tuna is known to contain more mercury than canned light tuna; it is therefore recommended that no more than six ounces of albacore tuna be consumed per week.

In addition, the federal advisory recommends that women who are pregnant or may become pregnant, nursing mothers, and young children consume no more than one meal per week of locally caught fish, when no other advice is available, and eat no other fish that week. The federal advisory can be found at http://www.cfsan.fda.gov/~dms/admehg.html or http://www.epa.gov/ost/fishadvice/advice.html.