Beacon Solar Energy Project CEC Staff Data Request Set 1, Revised Response to Data Request 14.

This revision to Applicant's Response to California Energy Commission (CEC) Staff Data Request No. 14, dated July 16, 2008, provides additional information regarding the proposed evaporation ponds and associated potential risks to wildlife. This revised response has been prepared, in part, to address questions raised by CEC staff at the public workshop held July 22, 2008, and replaces the original response in its entirety. The original response included information on the risks to wildlife, specifically avian species, design features to minimize risk, a monitoring program to evaluate potential impacts, and remedial actions should an impact be identified. This revised response covers those same issues but also provides supplemental information regarding potential impacts to wildlife issues from selenium and total dissolved solids (TDS) concentrations in the evaporation ponds at the Beacon Solar Energy Project (BSEP).

Data Request 14:

Please provide a more detailed and specific monitoring plan for the evaporation ponds, including:

a. a discussion of the frequency and nature of the monitoring;
b. the elements that will be monitored (e.g., sodium, selenium);
c. resident and migratory species that could be at risk;
d. remedial actions that could be taken if the ponds became a hazard for wildlife; and
e. the events that might trigger implementation of those remedial actions.

Revised Response:

The primary constituents of the evaporation pond water that could have a potential adverse effect on wildlife are selenium and hyper-saline conditions resulting from high TDS concentrations. As noted in the Application for Certification, selenium and elevated levels of TDS have the potential to adversely affect avian species. This discussion includes an evaluation and discussion of both selenium and TDS concentrations in evaporation pond water and an evaluation of ecological risk to wildlife.

Target Species

It is anticipated that birds are the wildlife taxon with the greatest potential to be at risk from constituents in the evaporation ponds. The tortoise-proof perimeter fencing associated with the BSEP Plant Site will restrict most terrestrial wildlife from entering the Plant Site. Any that enter will be unlikely to travel to the evaporation ponds, which will be located approximately 0.25 mile inside the perimeter fence. This analysis, therefore, focuses on risks to avian

species. Species at risk are those with the potential for nesting at the facility, residents of the area that would drink and forage from the ponds or on insects associated with the ponds, and migrants that would use the ponds for a stopover during migration.

To further reduce the potential for impacts from the ponds, a series of avian deterrence measures are being incorporated as Project Design Features (PDFs) into the design and operation of the evaporation ponds to minimize pond access by birds. The use of anti-perching devices around the perimeter of each pond will assist in excluding ravens and other birds from accessing the edge of the ponds to drink any of the water. Additionally, the operational design of the ponds is such that a minimum freeboard of 2 feet will be kept at all times, and the interior sides of the ponds will be at a 33 percent slope (3:1, horizontal:vertical). These PDFs will make it difficult for perching birds and/or shorebirds to access the water and are anticipated to minimize risks to wildlife by minimizing availability of water as a new subsidy.

Because the ponds will remain uncovered to maximize evaporation and to avoid trapping birds under netting or monofilament arrays, it is anticipated that primarily waterfowl, such as ducks and geese, will be able to access the evaporation ponds by landing on the water. Although waterfowl are anticipated to be the highest risk category, other bird groups, such as shorebirds, may be present even though the ponds have been designed to minimize access. Therefore, the response below focuses on both waterfowl and shorebirds.

Water Quality Analysis

To facilitate an understanding of the anticipated water quality within the BSEP ponds and the potential risk to birds, water quality in a similar system at the Harper Lake Solar Electric Generating System (SEGS) site (Harper Lake SEGS) was evaluated. In general, both the BSEP and the Harper Lake SEGS sites use and treat water in a similar manner. Raw water is obtained from groundwater wells primarily for cooling purposes. All or a portion of the water is treated prior to being used in the cooling towers by cold lime water softening (at Harper Lake SEGS) or ion exchange (at BSEP), and treatment chemicals are added for pH control, as biocides, and for scale and corrosion control. Due to the difference in source water concentrations, cooling water is blown down to the ponds after 8 cycles of concentration at Harper Lake SEGS and will be blown down after 15 cycles of concentration at BSEP. However, all of the treated water and wastewater streams from these treatment processes and from cooling water blowdown at both sites, and most of the dissolved selenium and TDS, eventually enter the evaporation ponds. The water quality data and pond management approach at Harper Lake SEGS are therefore useful for understanding the water chemistry and appropriate management approach at BSEP.

The risk to wildlife, specifically avian species, is related to dissolved constituent concentrations in the pond water and not the source water or wastewater discharge into the ponds; therefore,

analysis of wildlife risks focuses on pond water quality. The pond water contains a great number of different dissolved constituents, which are separated into positively and negatively charged ions (cations and anions, respectively). As evaporation takes place, the concentrations of these ions increases until they eventually reach a saturation point and some of the positive and negative ions combine and begin to drop out of solution and crystallize as solid salts. Which ions stay dissolved in the pond water and which ones precipitate at any given time is determined by a complex series of chemical and physical processes that all interact concurrently. These processes include the rate at which new wastewater is added, the evaporation rate, the concentrations of the various dissolved salt ions that make up the TDS and compete with each other to combine into solids, the pond temperature, the amount and chemistry of the already crystallized salt in the ponds, and other factors. Therefore, focusing on the constituent concentrations of source water and wastewater discharge into the ponds does not, in and of itself, provide a mechanism for determining the concentrations in the pond over time. The preferred, and most reliable, method of determining the "equilibrium" concentrations of dissolved ions in an evaporation pond would be to undertake actual laboratory studies where samples of the water are evaporated and analyzed. Since this is not possible, data regarding the performance of an existing pond under similar conditions, in this case Harper Lake SEGS, are used as a reasonable analogy for anticipating evaporation pond water quality at the BSEP, evaluating risk to avian life, and identifying a management strategy.

Source Water (Groundwater) Quality

Both the Harper Lake SEGS and the BSEP use groundwater as the source water for the cooling process. Risk to avian species is related to the concentration of constituents in evaporation pond water and not the source water, but since the constituents in the pond water are derived from the source water, information on the source water quality is discussed below.

Total Dissolved Solids

A comparison of the well water chemistry for the BSEP and Harper Lake SEGS sites is provided in Table BR-14a. Table BR-14a shows that groundwater at Harper Lake SEGS contains a higher concentration of TDS and is of generally poorer quality than water at the BSEP. Harper Lake SEGS well water has a TDS concentration of 2,475 milligrams per liter (mg/L), an amount that is about five times higher than well water at the BSEP, which has a TDS concentration of 550 mg/L. The water at each site is composed of a complex mixture of salt cations and anions that determines which salt species precipitate out at what times and which ones remain in solution as the water evaporates in an evaporation pond. TDS solubility limits (or saltiness of the water before the solids are precipitated out) are therefore dependant on a complex series of interactions between competing solutes that is beyond the scope of this evaluation. In general, however, relative TDS solubility limits can be compared based on the major ion chemistry at each site. The dominant ions at Harper Lake SEGS are sodium

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Table BR-14a

Comparison of Well Water from Harper Lake Site to Beacon Site
Beacon Solar, LLC.

	Concentration in Beacon Well Water (3 Samples)			Concentration in Harper Lake Well Water (7 Samples)			
Constituent	**Mean**	**Minimum**	**Maximum**	**Mean**	**Minimum**	**Maximum**	**Units**
Arsenic (total)	0.0035	0.0030	0.0041	0.0089	0.005	0.011	(mg/L As)
Calcium (total)	47	45	50	170	120	220	(mg/L Ca)
Chloride	15.5	14	18	1052.5	760	1300	(mg/L Cl)
HCO_3 (bicarbonate alkalinity)	257	200	360	115	110	120	(mg/L HCO_3)
Magnesium (total)	11	10	12	29	15	36	(mg/L Mg)
pH	8.00			7.40	7.10	7.60	pH
Selenium (total)	0.00039	0.00031	0.00048	0.00162	0.0013	0.002	(mg/L Se)
Sodium (total)	78	74	84	500	360	610	(mg/L Na)
Sulfate	118	110	124	232.5	180	280	(mg/L SO_4)
Total Dissolved Solids	550	470	550	2,475	1,600	3,100	(ppm)

and chloride (the basic constituents of table salt), whereas the dominant ions at BSEP are sodium and bicarbonate (the basic constituents of bicarbonate of soda). This is relevant because table salt is more than three times as soluble as bicarbonate of soda, which indicates the water in the evaporation ponds at BSEP is expected to have lower TDS concentrations during operation than have been observed at Harper Lake SEGS (Table BR-14a).

Selenium

The selenium concentration in mean well water at Harper Lake SEGS is 0.00162 mg/L, which is approximately four times higher than the selenium concentration at BSEP of 0.00037 mg/L. Nevertheless, selenium concentrations as a fraction of the TDS concentrations are similar at both sites, which indicates that selenium concentrations in the evaporation ponds may be expected to be similar at both sites at equilibrium.

Evaporation Pond Water Quality

The risk to wildlife, specifically avian species, is related to the concentration of constituents in the evaporation pond water and not the source water or wastewater discharge into the ponds; therefore, analysis of wildlife risks focuses on pond water quality. The anticipated concentrations of TDS and selenium in the wastewater discharge to the evaporation ponds at BSEP have been calculated based on the source water chemistry and the use and treatment of the water at the facility. However, as explained above, information regarding anticipated concentrations of dissolved constituents in the BSEP evaporation ponds is based on Harper Lake SEGS data.

Total Dissolved Solids

The concentration of TDS in the wastewater discharge to the BSEP evaporation ponds is calculated to be 5,579 mg/L. As evaporation occurs, the concentration of TDS increases due to the loss of water and corresponding concentration of salts. Based on the source water chemistry at BSEP and Harper Lake SEGS, it is reasonable to assume that, without water level management, TDS concentrations in the evaporation ponds at BSEP will intrinsically be lower than the TDS concentrations observed at Harper Lake SEGS. Samples of evaporation pond water from the Harper Lake SEGS site have been collected and analyzed semiannually for various dissolved constituents since 1998. TDS concentrations associated with these samples range from approximately 94,000 to 270,000 mg/L, with a mean of approximately 164,000 mg/L (Table BR-14b). Average TDS concentrations (or the concentrations in composite samples) detected over time are plotted in Figure BR14-1. No seasonal trend in TDS concentrations is apparent; however, TDS concentrations appear to increase over time.

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Table BR-14b

Harper Lake Evaporation Pond Selenium and Total Dissolved Solids Concentrations
Beacon Solar, LLC.

Date	Evaporation Pond Water Chemistry	
	Selenium (mg/L)	TDS (mg/L)
16-Mar-98	0.0383	94,333
25-Jun-98	0.0383	130,667
11-Sep-98	0.0320	103,667
10-Dec-98	0.0550	113,333
10-Jun-99	0.0523	134,667
1-Dec-99	0.0540	126,667
7-Jun-00	0.0220	130,000
30-Nov-00	0.0400	107,333
28-Nov-01	0.0380	124,333
5-Jun-02	0.0700	170,000
4-Dec-02	0.0387	119,667
12-Jun-03	0.0550	230,000
9-Dec-03	0.0660	180,000
8-Jun-04	<0.015	99,000
14-Dec-04	0.0150	180,000
30-May-05	0.0400	140,000
27-Dec-05	0.0150	230,000
9-Jun-06	<0.50	200,000
19-Dec-06	<0.050	230,000
23-May-07	0.0250	250,000
19-Dec-07	<0.01	250,000
14-Jun-08	<0.050	270,000
Mean Concentration[1]	0.0409	164,258

mg/L = milligrams per liter
TDS = Total Dissolved Solids
[1]Only results for samples in which selenium was detected are used in calculation of mean.

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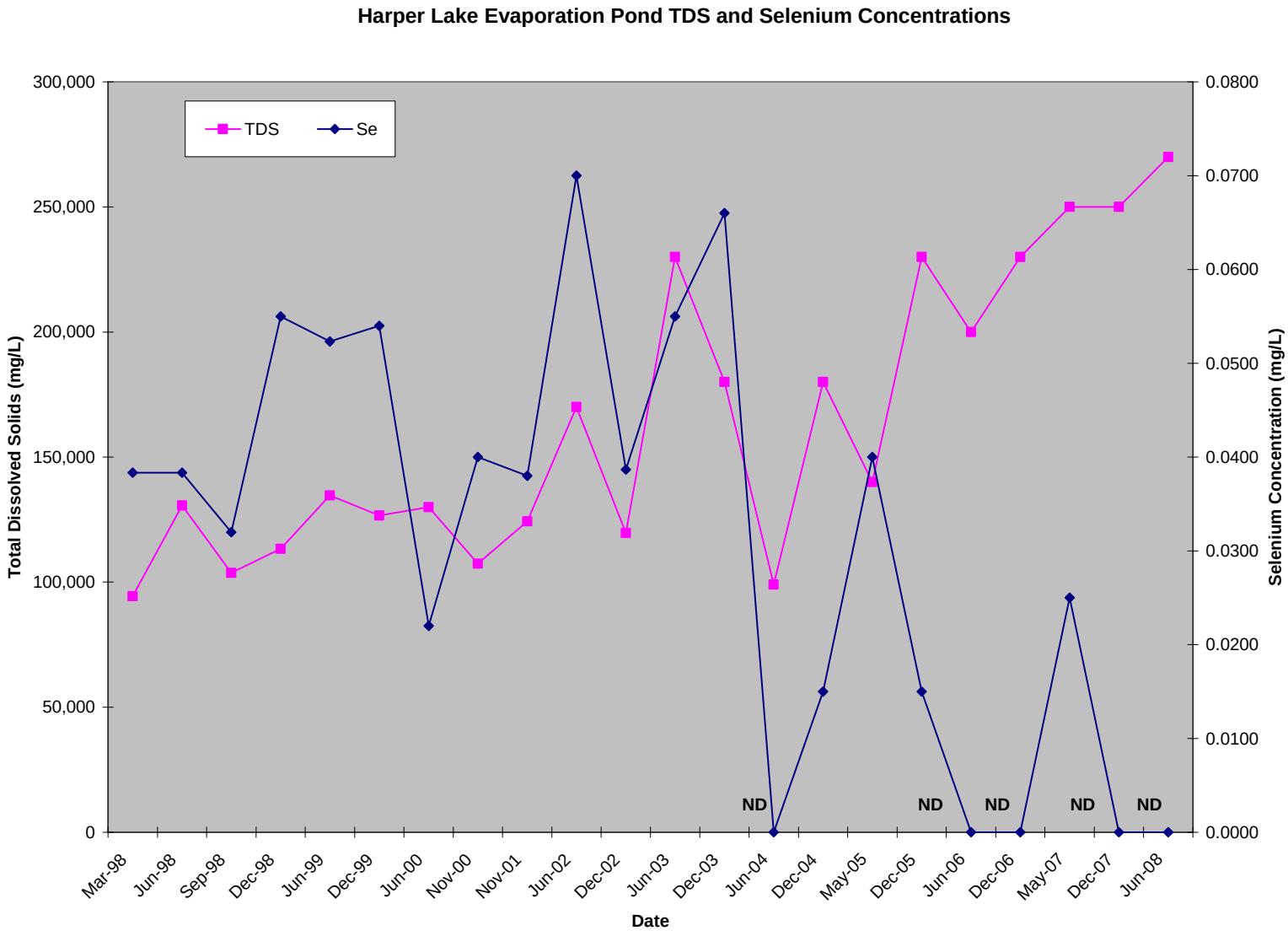
Figure BR14-1



ND = Not Detected

Selenium

The selenium concentration in the wastewater discharge to the BSEP evaporation ponds has been calculated to be 0.0028 mg/L. As evaporation occurs, the concentration of selenium increases due to the loss of water and corresponding concentration of metals. Samples of evaporation pond water at the Harper Lake SEGS site have been collected and analyzed semiannually for selenium since 1998. The detected selenium concentrations ranged from 0.0150 to 0.0700 mg/L, and the mean detected concentration was 0.0409 mg/L during the period of record (Table BR-14b). The concentrations detected during the first three quarterly sampling events were very similar, suggesting that dissolved selenium concentrations reached equilibrium concentrations relatively quickly. This indicates that selenium was being removed from solution by precipitation and/or sorption at equilibrium rates and that variations in selenium concentrations over time are likely related to changes in conditions that affect the precipitation and sorption equilibrium. Selenium solubility at neutral to alkaline pH tends to be dominated by sorption. No seasonal trend in selenium concentrations is apparent, and selenium and TDS concentrations overall do not appear to be consistently correlated (Figure BR14-1); however, increases in TDS concentrations since 2004 may be correlated with decreasing selenium concentrations during that time period. The data indicate that selenium under the Harper Lake SEGS pond operating conditions has remained consistently at or below 0.07 mg/L. BSEP evaporation ponds are assumed to have similar concentrations assuming equilibrium concentrations as discussed above.

Ecological Risk

Potential ecological risk to avian species from the BSEP evaporation ponds may result from selenium through bioaccumulation of the metal through the food chain (ingestion exposure route) or from sodium by salt encrustation and/or ingestion resulting in salt toxicosis. Based on review of water quality data and Biological Resources Mitigation Implementation Plan (BRMIP) quarterly compliance reports from 2002–2008 for the Harper Lake SEGS site, bird mortalities have not been a routine occurrence and have been minimized by adapting pond management (i.e., raising water levels). Bird risks and issues identified at Harper Lake SEGS were considered in developing PDFs for the BSEP to minimize the potential for evaporation ponds to become a new subsidy for birds. In addition, the BSEP includes a pond management program that uses lessons learned from the Harper Lake SEGS experiences to further minimize the risk of impact to birds. Because the BSEP evaporation ponds will be operated in a manner similar to the Harper Lake SEGS site, and will have reasonably similar water quality to the Harper Lake SEGS ponds that assumes equilibrium concentrations (and likely lower concentrations over a longer time until equilibrium is reached due to lower source water concentrations) it is anticipated that impacts to avian species will be avoided. However, if potential impacts do occur, a monitoring program that uses adaptive management techniques will identify and avoid, minimize, and mitigate those impacts.

Information on potential ecological risks from sodium (a major component of TDS) and selenium is presented below.

Total Dissolved Solids

Published ecological risk assessment studies have not focused on the biological toxicity associated with exposure to sodium or TDS, although it has been suggested that healthy birds or those that are acclimatized to hyper-saline conditions are able to adequately expel the excess salt via their salt glands (Woebser and Howard, 1987; USGS, 1999). A primary concern with increased avian hazards from exposure to hyper-saline conditions is associated with the formation and accumulation of salt crystals on the feathers of waterfowl, which impedes their ability to fly by weighing down the affected bird and potentially resulting in salt toxicosis (i.e., poisoning) (Woebser and Howard, 1987; Gordus et al., 2002). Evidence suggests that salinity levels are not the sole determining factor in the potential for salt encrustation on waterfowl. Studies have shown that the formation of salt crystals on hyper-saline ponds is often associated with water temperatures at or below 4 degrees Celsius (39 degrees Fahrenheit) (Woebser and Howard, 1987; Gordus et al., 2002). However, salt encrustation has also been observed in the deserts in August, when temperatures can be reasonable expected to be greater than 4 degrees Celsius.

Salt toxicosis via salt ingestion may also occur from overexposure to hyper-saline waters when alternative freshwater sources are unavailable or limited (i.e., during drought conditions) and birds become dependent on a hyper-saline water supply (Gordus et al., 2002). Based on the biological monitoring associated with the evaporation ponds at the Harper Lake SEGS, salt encrustation and salt toxicosis have been a rare occurrence there. BRMIP compliance reports identified an isolated event in August 2007 that was tied directly to high salinity levels in the evaporation pond, which fell to low water levels during that time. A second mortality incident was observed in October 2007; however, the cause was not determined. A recurrence has since been avoided with equalization of (i.e., increasing) the water levels in all evaporation ponds that are active at any given time.

The Harper Lake SEGS incident resulted in deaths to waterfowl by salt toxicosis and salt encrustation following very low water levels in one particular evaporation pond at SEGS VIII West during the 3rd quarter of 2007 (all bird mortalities resulting from salt toxicosis were found at the SEGS VIII West pond, with the exception of one bird found at the SEGS VIII East pond). In reviewing data from Regional Water Quality Control Board waste discharge reports for Harper Lake SEGS, the TDS concentration in composite samples collected from the evaporation ponds during this period was approximately 250,000 mg/L, based on the May and December 2007 semiannual sampling. It is therefore suspected that TDS concentrations in the SEGS VIII West pond would have been higher than 250,000 mg/L. The higher concentrations were thought to be caused by low water levels that resulted in a concentration of TDS to higher than normal levels (cover letter and Attachment 4 to the 2007 3rd Quarter

BRMIP Compliance Report). The addition of water to the pond has appeared to correct the situation and no further bird deaths associated with the evaporation pond salinity levels occurred subsequent to the fall 2007 events.

Salinity or TDS numeric action levels have not been established by regulatory agencies for wildlife exposure, and conditions resulting in salt encrustation and toxicosis in birds appear to vary with different site characteristics. Defining specific TDS concentrations that result in bird mortalities or other impacts associated with salinity is therefore not feasible. Consequently, management programs should utilize PDFs to minimize the potential introduction or availability of new water subsidies and incorporate monitoring programs to evaluate site conditions and impacts, if any. The monitoring programs should consider site characteristics, including water levels, temperatures, and TDS concentrations, in addition to bird activity, when establishing management changes and triggers.

<u>Selenium</u>

A review of relevant literature, including selenium research at two similar solar energy project sites, Harper Lake SEGS and the Blythe Energy Project (BEP), indicates that there are two primary routes of exposure for selenium toxicity in avian species at evaporation ponds: through drinking water, and through aquatic invertebrate food sources. However, the primary indicator of toxicity in wildlife is through aquatic invertebrate food sources (Nagpal and Howell, 2001; FPL Energy Operating Services, Inc., 2000; U.S. Department of the Interior [DOI], 1998). In addition, literature reviewed has identified that ecological risk responses associated with selenium exposure in avian species are most typically defined by negative effects on egg viability and avian reproduction as opposed to direct mortality via ingestion of food sources with high selenium concentrations (Nagpal and Howell, 2001; FPL Energy Operating Services, Inc., 2000; DOI, 1998). It is also possible that impacts may include mortality (Lemly, 1977; DOI, 1998).

Although there is an acknowledged concern regarding selenium exposure and ecological risk, there are no current regulatory action levels for selenium exposure to wildlife that define ecological risk limits in the United States. Although water quality guidelines for selenium have been considered, water is not the primary exposure route for avian species and may not be the best representation of risk. According to the DOI report (1998), when water is the only exposure route, “[w]aterborne selenium, *per se*, is not very toxic to fish and wildlife” (DOI, 1998). It is therefore important to consider primary exposure routes (i.e., ingestion of food sources) when evaluating selenium toxicity.

It is also important to consider salinity concentrations when evaluating the effects of selenium on avian species. Salinity affects invertebrate populations and, therefore, is also an important consideration as it influences food source availability for foraging bird species and may affect

selenium bioaccumulation in the food chain due to different accumulation rates in invertebrate food sources (FPL Energy Operating Services, Inc., 2000).

Due to such high variability associated with selenium concentrations and lack of observable adverse effects to waterfowl, a strict monitoring trigger based solely on water quality testing has been deemed inappropriate. Discussion of selenium toxicity therefore focuses on selenium in invertebrate food sources and this analysis focuses on studies conducted at similar solar energy facilities at Harper Lake SEGS and BEP that have involved monitoring and impact assessments.

Harper Lake SEGS Study

A study of avian feeding behavior and aquatic invertebrate populations was conducted from June 1998 to April 1999 to study the effects of selenium on shorebirds foraging at the evaporation ponds at Harper Lake SEGS (FPL Energy Operating Services, Inc., 2000). The study at Harper Lake SEGS evaluated potential adverse effects to avian species from selenium in food but did not evaluate the impacts of selenium on viability of avian eggs, since the birds were predominantly migratory and the local breeding and nesting activity for birds feeding at the ponds was not documented.

The most numerous groups of birds found using the Harper Lake SEGS evaporation ponds in the spring were the large shorebirds (e.g., American avocet and black-necked stilts) and in the summer were the small shorebirds (e.g., sandpipers and western snowy plovers). Fall and winter seasons displayed the lowest utilization of the ponds. Other species observed included waterfowl (e.g., grebes, northern shovelers, teals, mallards, gadwall, red heads, and phalaropes). Bird numbers at the ponds displayed two peaks; one in late winter/early spring and a second in late summer/early fall.

Birds that could be exposed to selenium in the evaporation ponds do not have a uniform tolerance to selenium. Ducks and coots appear to be most sensitive to selenium contamination, with black-necked stilts being moderately sensitive, and American avocets more tolerant (FPL Energy Operating Services, Inc., 2000). The study drew conclusions primarily upon data from the black-necked stilt due to the bird's intermediate sensitivity to selenium and its presence at the Harper Lake SEGS evaporation ponds. Similar projects have used the toxicity levels for the black-necked stilt as the standard for monitoring selenium levels.

Harper Lake SEGS evaporation ponds are similar to those that will be constructed at the BSEP Plant Site. Like Harper Lake SEGS, the BSEP is also located in a desert ecosystem and has the potential to attract similar shorebird and waterfowl migratory bird species. The Harper Lake SEGS, however, is located near an existing marsh that attracted bird species prior to construction of the evaporation ponds and is expected to attract greater numbers of

birds than BSEP throughout the life of the project due to the proximity to this resource. The ponds at both sites serve as an essential part of the solar power generation process and are assumed to have similar equilibrium concentrations of selenium because selenium represents a similar fraction of TDS at both sites. Three separate ponds were the focus of the avian study at Harper Lake SEGS: Pond IX North, Pond VIII West, and Pond VIII East.

The three ponds ranged in salinity levels from 61 grams per liter (g/L) TDS in Pond IX North to 210 g/L TDS in Pond VIII East. The study found that differences in the food web organization of the ponds could be attributed to the differences in the levels of salinity; therefore, salinity levels affected pond use by shorebirds. The most frequented pond from January to May was Pond VIII East with an average salinity level of 167.5 g/L TDS and from June to December was Pond VIII West with an average salinity level of 90.5 g/L TDS. The least utilized pond throughout the study was Pond IX North with the lowest salinity levels (average of 73.5 g/L TDS). This correlation between salinity levels and pond use is likely due to prey availability associated with the different salinities, rather than directly to salinity concentrations in the ponds. Under lower salinity levels, the water boatman (*Trichocorixa reticulata*) were abundant and eliminated the planktonic filter-feeding brine shrimp (*Artemia franciscana*) and brine fly (*Ephydra gracilis*) larvae. In the high salinity pond, the water boatman could not survive and the brine shrimp were abundant. The moderate salinity level pond provided a balance between predator and prey in the invertebrate populations.

Both the water boatman and brine shrimp had evidence of selenium in their systems when tested, ranging from 0 to 15 milligrams per kilogram (mg/kg) dry weight (Table BR-14c). Selenium in brine flies was generally not detected. Although both water boatman and brine shrimp had evidence of selenium in their systems and in some cases exceeded the minimum thresholds considered by the study to have adverse impacts (Table BR-14d), they were not the primary invertebrate food source for the shorebirds. The primary food source at the ponds was identified as the brine fly. Levels of selenium were undetectable in brine fly in all but one sample, where it was very low. In addition, the study revealed no evidence of sick shorebirds. Therefore, the study concluded that algae treatment at the ponds was not recommended unless future monitoring provided evidence that birds were being negatively impacted by selenium concentrations. Treatment for algae could cause a shift in invertebrate dominance that would affect the food chain order. The results in the study also indicated that selenium-contaminated bird food sources at SEGS VIII and IX ponds was not chronic, not present in the main food item (flies), and probably not of sufficient magnitude to be toxic to birds or damaging to reproductive processes.

Table BR-14c
Selenium Concentrations for Invertebrates from Harper Lake SEGS Evaporation Ponds

Invertebrate	Range mg/L	Mean mg/L	Detection Frequency*
Brine Flies (*Ephydra gracilis*)	0-2.4	0.2	1/12
Brine Shrimp (*Artemia franciscana*)	0-15	6.7	2/3
Water Boatman (*Trichocorixa reticulata*)	0-12	3.0	5/10

* Samples collected on 9/1997, 6/1998. 8/1998, 12/1998, and 3/1999 from each of the three ponds for each of the primary invertebrate species as available (total samples possible = 18)
Source: FPL Energy Operating Services, Inc., 2000

Table BR-14d
Minimum Selenium Levels (mg/kg dry weight) Invertebrate Food Producing Adverse Effects on Avian Reproduction

Site*	Minimum Selenium in Diet Producing Adverse Effects	Selenium Range in Invertebrate Food Organisms	Avian Species Affected
Tulare Basin	2.9	1-250	Black-necked stilts Ducks
Kesterson	Selenium in diet above minimum levels of adverse impact	20-110	Black-necked stilts Ducks American coots American avocets Eared grebes
Salton Sea	3.1	2-13	Black-necked stilts (low toxicity observed)

* Select Case Studies from Southern California Saline Evaporation Ponds
Source: FPL Energy Operating Services, Inc., 2000

Blythe Energy Project

In a letter dated March 14, 2005, the CEC expressed concern that the evaporation ponds at the BEP, in Blythe, California, had exhibited excessive levels of selenium and sodium. In response, the potential for adverse effects to avian species at BEP was analyzed and a program was implemented to deter bird use of the ponds (Karl, 2005). Like the Harper Lake SEGS study, this analysis also suggested that the risk to bird species from selenium and

sodium concentrations at the ponds was low. This conclusion was based on low bird usage of the ponds, primarily migratory versus resident populations, lack of observed bird mortalities, and the bird deterrent program.

Evaporation Pond Monitoring Program Recommendations

Based on the Harper Lake SEGS and BSEP analyses, it can be concluded that selenium and TDS concentrations in water and selenium concentrations in invertebrate food sources are important components in evaluating selenium and salt toxicity to birds. The BSEP will include a monitoring program that incorporates monitoring of bird populations at the evaporation ponds and monitoring water quality in the ponds for both selenium and TDS. The monitoring program will consider the following factors:

- Selenium and TDS concentrations in evaporation pond water
- Pond water levels, temperature, and salinity
- Bird species utilizing the ponds
- Nesting activities at the ponds

If significant adverse effects to birds are observed during the evaporation pond monitoring, and those effects are determined to be the result of selenium or salt toxicity (by autopsy of deceased birds), additional monitoring may be needed to further assess impacts to bird species, including:

- Selenium concentrations in invertebrate populations
- Selenium concentrations in avian eggs collected at the site, if any
- Collection of additional water quality samples, analyzed for selenium or TDS

A detailed evaporation pond monitoring plan will be prepared for the BSEP and submitted for agency review and approval prior to construction. The key components of the monitoring program for the BSEP are summarized below.

<u>Avian Monitoring</u>

Avian monitoring at the evaporation ponds will be conducted by the BSEP Designated Biologist twice monthly for the first two years of project operation. The BSEP Environmental Compliance Monitor (ECM) will continue monitoring after the first two years, under the direction of the BSEP Designated Biologist, at least twice a month for the life of the project. The monitors (biologist or ECM) will identify bird species and/or functional groups (e.g., waterfowl, waders, shorebirds, upland shorebirds) utilizing the ponds, record the behavior of the birds (e.g., feeding, swimming, wading, nesting), and note any mortalities or physical infirmities (e.g., birth defects or reduced growth) associated with any bird observed on or adjacent to the evaporation ponds. Any dead bird that can be safely retrieved from the evaporation ponds will be collected by the biologist or ECM and sent to a qualified laboratory

to determine if the mortality was directly related to selenium poisoning or salt toxicosis or encrustation. Documented mortality resulting from selenium poisoning or salt toxicosis or encrustation will result in corrective measures implemented in coordination with the agencies.

Water Quality Monitoring

Water quality in the evaporation ponds will be monitored quarterly for selenium and TDS with sampling conducted by the ECM or BSEP designated individual trained in water quality sampling and sample handling. Individual water samples will be taken from each pond. Should bird mortality occur, an additional water grab sample will be collected from the ponds for analysis at the time of discovery. Because water quality is difficult to tie directly to ecological risk by implementation of numeric standards, selenium and TDS concentrations will not trigger remedial action; however, the data will be collected to assess potential long-term correlations between water quality, as well as the pond water level, pond salinity, and temperature data discussed below, and bird behaviors and mortality, if any.

Pond Management

Each actively used evaporation pond will be outfitted with a level gauge for daily water level measurements, a hydrometer for daily salinity measurements, and a direct reading thermometer with the temperature data recorded at least diurnally. If the average overnight water temperature in the active evaporation ponds is at or below 4 degrees Celsius, the ECM will conduct a visual survey of the ponds immediately upon the following morning. If during inspection of the active ponds, the ECM observes evidence of recent substantive increases in salt crystallization anywhere within the pond (e.g., at or near the waterline), or if water levels in any of the ponds are observed to fall below a minimum depth of one foot (which could cause elevated levels of TDS), the ECM will route all of the wastewater into one or two ponds to increase the pond volume and lower the average salinity within the pond(s). At the same time, the remaining pond or ponds will be pumped dry. The pond to which the combined flow is discharged during this time will be rotated each year, periodically as needed, so that water levels do not rise too high and minimum freeboard requirements are met.

In the event that climatic conditions are such that evaporation must be increased to maintain pond levels below the freeboard limits, evaporative disposal nozzles (see for example http://www.bete.com/applications/disposal.html) will be used to increase wastewater evaporation rates.

In addition to managing the ponds to minimize bird usage, bird hazing measures will be implemented, as necessary, to deter birds from using the ponds. Potential hazing techniques include:

- Initiate use of an air canon in order to haze waterfowl and frighten them away from the evaporation ponds. The air canon will be stored on site, but only used under this circumstance, since birds may become acclimated to the disturbance caused by air canon hazing, if used on a regular basis. The air canon will be used until the evaporation process is completed in the pond, or until the crystallized salts returned to solution.
- Deploy "Bird-B-Gone Balloon" (a visual scare device) or other hazing devices into the pond, to discourage waterfowl from landing on the pond.

Reporting

At the conclusion of every operational year, the ECM will prepare a report for submittal to the CEC Compliance Project Manager, summarizing the results of the various tests and monitoring efforts, described as a part of the evaporation pond monitoring plan. The summary report will include copies of the water quality tests, a chronological listing of the overnight water temperatures, water levels and salinity measurements for the active evaporation ponds, and any results of necropsies performed on birds salvaged from in or around the ponds. Recommendations for changes to the monitoring program or pond management approach will be made, as warranted.

Summary

Based on an analysis of water quality and bird use at similar facilities, the BSEP facility is not expected to result in significant impacts to birds from selenium or salts in the evaporation ponds. The BSEP will implement a monitoring program to further assess and monitor potential impacts and if impacts are identified, changes to the program may occur under the auspices of adaptive management for the biological compliance program.

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