華中科技大學

二〇〇二年招收硕士研究生入学考试试题

考试科目：英语作文

适用专业：外国语言学及应用语言学

（除画图题外，所有答案都必须写在答题纸上，写在试题上及草稿纸上无效，考完后试题随答题纸交回）

准考证号码：

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密封线内不要答题

Part One (50%)

Directions: *In this part you will read an article about 2300 words. You are required to write a summary of about 350 words based on the article.*

Delving into Water Issues

-- LBL Earth Scientists Solve Soil and Water Contamination Problems

Bounded by the Sierra Nevada mountains to the east and the Coast Ranges to the west, California's great Central Valley stretches 450 miles. Until about 100 years ago, the valley was a dry and dusty place in the summertime. In winter and spring, mountain runoff flooded vast areas of the valley, creating a marshy resting place for millions of migratory ducks, cranes, and geese. Also in the spring, as many as a million tule elks and antelopes and thousands of grizzly bears roamed the valley's golden grasslands.

Beginning in the late 1800s, farmers radically altered the landscape with the introduction of dams, irrigation, and, after World War I, massive groundwater pumping. The semi-arid valley was transformed into the most productive agricultural area in the world. Today, farming in the San Joaquin Valley--the southern part of the Central Valley--is a $17 billion a year business. Half the nation's fruit, nuts, and vegetables are grown there.

This spectacular productivity has had its price. Water from rivers and ancient aquifers has been redirected, pumped, and dammed for irrigation; in fact, today some 85 percent of California's "developed" water goes to irrigation. But irrigation unlocks salts and minerals from the soil. Then irrigation water full of these salts and minerals has to be drained to keep crops from getting waterlogged and salt from building up in the soil.

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Drainage has become a major problem for the San Joaquin Valley. Some say that unless current agricultural practices change, an elaborate system of drains will be needed to keep as much as a million acres from salting up on the west side of the valley. (Soils on the east side contain fewer salts and trace elements.) Already thousands of acres have been abandoned to the bitter white stuff. But even if such a system of drains were created, the problem remains: what can be done with the contaminated water?

Hydrogeologists Sally Benson and Peter Zawislanski, soil scientists Tetsu Tokunaga and Paul Johannis, chemist Andy Yee, and other researchers from LBL's Earth Sciences Division have worked for a number of years with federal and state water agencies to help find solutions to the difficult problems associated with agriculture. These projects include investigations of the environmental effects of drainage water, studies of improving irrigation water at its source, and evaluation of the larger water system and agricultural practices.

During the course of this work, says Benson, "We have gained an increased understanding of the biogeochemical processes that contribute to the fate and transport of inorganic chemicals"--expertise that could readily be put to use in the cleanup of sites affected by different sources of contamination. Beyond that, she notes, the Earth Sciences team has demonstrated the ability "to successfully integrate science and technology into the decision-making process involved in solving highly politicized, regulatory-driven problems."

The Earth Sciences team's work spans a decade. The environmental effects of contaminated drainage water became a matter of great public concern in the early 1980s, with the poisoning and deaths of wild birds at the Kesterson Reservoir and Wildlife Refuge in the western San Joaquin Valley. Analyses by U.S. Fish and Wildlife Service researchers of the trace-element composition in dead birds indicated that selenium was probably the principal concern. Since then, LBL scientists have been involved in soil and groundwater studies of the transport of selenium, which can have deadly effects when allowed to concentrate.

Kesterson was the terminal evaporation pond for agricultural drainage waters from the west side of the San Joaquin Valley. Recently developed agricultural fields about 85 miles to the south were the source area for this drainage.

"Prior to development, there was very little leaching of the soil," says Tokunaga. "This led to an accumulation of salts and trace elements in the soil and groundwater." When irrigation was introduced, it became necessary to drain the land to remove the salts that had now mobilized.

Salts and trace elements that had taken thousands of years to accumulate in an 86,000-acre source area leached out of approximately 8000 acres of that land and concentrated in Kesterson's 1200 acres in a matter of four or five years. The 8000 acre feet, or 10 million cubic meters of water, that Kesterson received each year contained about 300 micrograms per liter of selenium; the drinking water standard is 10 micrograms per liter.

The U.S. Bureau of Reclamation and California's Department of Water Resources had originally planned to discharge the salty water into a 120-mile central drainage canal, the San Luis Drain, diverting it northward and disposing of it in the San Joaquin- Sacramento River Delta. But, with the prospect of adding more contaminants to an already polluted San Francisco Bay, funding and political support for building the central drainage canal ran out in the early 1980s. Instead, the flow of drainage water was stopped at Kesterson's 12 ponds, which in the original plan were meant to be a series of temporary holding ponds.

In 1986, the U.S. Department of the Interior decided to close the San Luis Drain, so selenium and salt no longer arrived at Kesterson. Now the problem was how to manage this watery wildlife area.

Besides Tokunaga and Benson, who currently heads LBL's Kesterson work, some 20 other LBL researchers have worked on this problem. The big scientific question," says Benson, "was, could we keep selenium out of the food chain?"

Several options were considered by the agencies involved, including the U.S. Fish and Wildlife Service, the State Fish and Game Department, the State Water Resources Control Board, and the Bureau of Reclamation.

The first was called "wet-flex." The idea was to keep the area permanently flooded with local salty but selenium-free groundwater. There was initial concern that selenium would leach into the shallow groundwater beneath the ponds, but LBL geochemists explained that instead it would settle in the sediments at the bottom of the ponds. In the absence of oxygen and with the help of microbes, chemical reactions would transform the mobile selenate into selenite, selenides, and elemental selenium. These would readily be precipitated or adsorbed onto mineral particles and organic matter and, not being water soluble, would be less available for movement up the food chain or movement down into the groundwater.

The plan was rejected because wildlife would continue to be attracted to the area, and it was not known how low the concentration of selenium needed to be before it could be considered harmless.

An on-site disposal plan was also considered. This plan involved excavating the top 15 to 30 centimeters of sediment and placing it in a lined landfill on site. The excavation depth was based on work that indicated that an average of 75 percent of all selenium at Kesterson was contained within the top 15 centimeters.

Objections to the plan centered on questions of the landfill's future: Would the selenium leach out of it? How much would it cost to maintain, and, more importantly, what about the 25 percent of the selenium that would remain? When the ponds dried out, would the selenium reoxidize into a mobile form?

Additionally, every year there is a seasonal rise of rivers, surface waters, and water table within the San Joaquin Valley basin. The major cause is that hunting clubs flood the surrounding wetlands to attract ducks. When the water table rises, soil water is pushed toward the surface. Data on selenium concentrations showed a range of 10 to 1000 parts per billion (ppb) in soil water, higher than in the original pond waters, which had a range of 250 to 300 ppb. If the soil surface were artificially lowered by scraping it away, a larger area would be susceptible to the seasonal ponding of contaminated soil water at a time coinciding with the arrival of migratory birds.

The researchers set up a series of small-scale tests. "We were able to demonstrate that surface water that emerged from a test plot was at a concentration three times higher than any surface concentrations previously recorded at Kesterson Reservoir," says Tokunaga.

LBL scientists testified against the on-site disposal plan at State Water Resources Control Board hearings in 1988. They proposed instead what Benson calls "a very low-tech solution--to raise the level of the ground surface so pools couldn't form." The Bureau of Reclamation and Water Resources Control Board agreed and brought in a million cubic yards of clean soil from the surrounding area, enough to cover about half of Kesterson-- especially the low-lying areas--15 to 30 centimeters deep.

"The cost associated with the cleanup was a fraction of what it could have been if they'd done the excavating and had to monitor a hazardous-waste landfill," Benson says.

The soil cover dealt with the acute problem. What remained was the potential long-term hazard to wildlife.

LBL and University of California researchers pursued three lines of research. First was turning selenium into a methylated form (such as dimethylselenide) as a by-product of microbial metabolism. Experimental results indicated that this would not be a rapid means of removal.

Another approach was to grow or cultivate certain crops that would dissipate selenium but would not be harmful to wildlife. UC researchers found that it was difficult to grow anything but salt-tolerant plants because of the soil's high salinity and the need for irrigation.

The third approach was to observe what happens when no action is taken. The researchers found that the concentration of selenium in native plants was relatively low because so much sulfate--a component of drainage water that plants favor over selenium for uptake--was present.

The bulk of LBL's current activities, conducted by Benson, Tokunaga, and their coworkers, involves monitoring soil water and groundwater and periodically sampling seasonal pool waters to gain a clearer picture of long-term patterns.

Tokanaga says that there was some movement of selenium up and down the soil profile and a gradual increase in mobile selenate in soil water because California's six-year drought resulted in a more oxidizing soil environment.

Although some elevated levels of selenium have been found, biological monitoring by consulting company CH2M Hill has shown no ongoing problems for birds and small mammals. LBL-developed models of oxidation rates coupled with food-chain models show that the risk of significant increases of selenium in the food chain is small. In 1992, Benson and colleagues in the Bureau of Reclamation issued a report to the California Water Board stating that the actions taken have alleviated biological hazards at Kesterson.

Not only did the Earth Sciences team work out a solution to a localized problem, but, says Benson, "Wherever there is a veneer of highly concentrated contaminants, similar characterization methods and technology, guided by a similar remediation philosophy, could be employed."

LBL's work with the Bureau of Reclamation on the Kesterson clean-up led to another drainage water study, this one focusing on the TJ Drain leading from the Fallon Indian Reservation, 60 miles east of Reno, Nevada. The TJ Drain is one of several that deposits its waters in Stillwater Marsh, a national wildlife refuge. The deaths of thousands of pelicans and other birds and fish there in 1986 and 1987 were unpleasantly reminiscent of the Kesterson situation. "There was an immediate presumption that the deaths were related to agriculture," says Benson.

The Fish and Wildlife Service and US Geological Survey did extensive studies, looking for concentrations of selenium and mercury, but found no direct indication that trace elements had anything to do with the bird deaths.

The Fallon Indian Reservation lies in the Lahontan Valley, which thousands of years ago lay under water. In more recent years, it has been an arid area, watered primarily by runoff from the Carson and Truckee rivers. Runoff waters discharge into the Carson Sink, a closed basin system in which salts concentrate.

The Carson Sink flooded in the wet years 1983 and 1984, creating a large lake attractive to wildlife; fish and waterfowl populations burgeoned. As the lake dried up, its salinity increased. It also became overcrowded and there was, Tokunaga says, a "dramatic die-off of fish and birds in the area."

Right around the time of the deaths--possibly from avian cholera, botulism, and starvation--the TJ Drain from the Indian reservation's 1000 acres of newly irrigated alfalfa fields began operating. The two events "had nothing to do with each other," says Tokunaga. "About 10 miles separate the drain's discharge area from the drying waters in the Carson Sink."

But testing by the U.S. Fish and Wildlife Service demonstrated that waters from several drainage systems were toxic to fish. The TJ Drain had the highest concentrations of salts, boron, and arsenic, and a high flow rate--all of which made it the single drain of greatest concern. The agency wanted the TJ drain plugged, a move which, says Benson, had "profound implications for the Indian reservation, where alfalfa farming was the main source of income."

At the request of the Bureau of Reclamation, LBL began working at the Indian reservation in 1990 to investigate the water from the TJ Drain and recommend solutions. In the first year, the researchers--primarily Benson, Tokunaga, and Ray Solbau--studied three different fields. Their results suggested that the way the TJ Drain operated needed to be evaluated.

At the Fallon Indian Reservation, farmers irrigate their 5- or 10-acre parcels by flooding them with water (a practice not uncommon in the West). The excess water that floods to the end of a field is drained off into a ditch. Some of the remaining water, loaded with salts and minerals leached from the soil, seeps down into the groundwater and finds its way into a series of deep, open-ditch drains--about 4 meters deep--that lead into the TJ Drain.

"The water coming out of those deep ditches was old, natural, salty groundwater," says Benson.

The LBL researchers suggested placing shallower tile drains closer together. Two plastic drain pipes, perforated and packed in gravel so water could enter freely, were buried about 2 meters deep and 80 meters apart. The study showed a decline in dissolved solids--mostly salts--in one year's time. "The bad news was that arsenic and boron concentrations were still high," says Tokunaga.

The question remains, as it does throughout the arid West and everywhere irrigation creates contaminated drain water: What is to be done with the drainage?

Part Two (50%)

Directions: *In this part you are required to write an article of about 800 words on the following topic:*

My Views on Quality-oriented Education