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A Time Bomb in the Earth

We're unleashing a killer in the heart of Yellowstone cutthroat country

By Ted Williams

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Selenium, a naturally occurring element, performs all manner of useful functions, not the least of which is teaching us that if a little is good, a lot isn't necessarily better. In varying quantities and applications it can make you healthy, wealthy and dead. It's great for vulcanizing rubber, tinting glass, bluing gun barrels, controlling dandruff and curing eczema. Farmers add it to livestock feed because if mammals don't ingest enough, they acquire debilitating calcium deposits, contract white-muscle disease, and abort fetuses.

But there's a threshold after which selenium morphs into a poison at least five times more toxic than arsenic and that, like DDT, bioaccumulates as it ascends the food chain. Exposure to high concentrations can eliminate populations by causing reproductive failure and embryonic deformities, short-circuiting nervous systems, and blowing out kidneys and livers. Such concentrations are unnatural. They occur when rock- and earth-bound selenium is unleashed into the environment by such human disturbances as oil refining, coal-fired electrical generation, agricultural irrigation, mountain top-removal coal extraction and strip-mining of sulfide minerals--especially phosphate, used mainly to make fertilizer and phosphoric acid.

Forty percent of the nation's phosphate reserve lies hundreds of feet below the earth's surface in Idaho, Wyoming, Montana and Utah, bound up in rock formations. When phosphate ore is extracted selenium is cast to the four winds and carried away in runoff. Plants and microbes quickly assimilate it and are consumed by larger and more complex organisms which, in turn, are consumed by still larger and more complex organisms. By the time the selenium reaches fish and mammals, concentrations can be deadly. Hundreds of sheep and dozens of horses have been killed, and we can only guess at the number of birds, fish and wild animals because no one is watching or counting in this isolated and forgotten land.

Selenium pollution threatens to extirpate the Yellowstone cutthroat trout (now found in just 10 percent of its natural range) from two of its few remaining strongholds--the Blackfoot and Salt river drainages in southeast Idaho. Four permitted phosphate strip mines are belching selenium into these systems. Yet the J.R. Simplot Co., one of three current operators (the others being Nu-West, Inc., and Monsanto), wants to expand its Smoky Canyon Mine into the Caribou-Targhee National Forest. And the Bush administration's scuttling of the roadless-area protection rule has allowed Simplot to hack roads into the Deer Creek watershed for test drilling (See "A Plague on All Your Forests," April 2006). In addition to the four permitted phosphate strip mines, southeast Idaho has 17 abandoned strip mines--all Superfund sites because they, too, are belching selenium.

Simplot vows to use the best technology available, but still admits that the creeks coming out of its mine expansion will be at or just below the current selenium standard of five parts per billion. And that's only if the cleanup of its existing mine (a Superfund site) turns out to be successful.

A section of Crow Creek (a tributary of the Salt River) flows through a ranch bought nine years ago by

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Pete and Judy Riede when they retired from General Motors to go fishing. "The average fish is 12 to 14 inches, and I've caught them significantly over 20," says Pete. "A section of Deer Creek (a tributary of the Crow that the mine will pollute) flows through the ranch, too; its trout are generally smaller, but there are beaver ponds that produce some tremendous fish."

So pristine was Deer Creek that, in August 2003, a Forest Service survey crew determined that it should be used as the standard of excellence--"a reference area for comparison to streams impacted by various land uses." The survey team went on to recommend "that activities not be allowed which would reduce the quality of fish and amphibian habitat in the drainage." Angler, author and communications director for Trout Unlimited's Public Lands Initiative, Chris Hunt, tells me this: "These fish are truly special; they move up out of the Blackfoot Reservoir-- 22- to 24-inch cutts that, come August, will charge up from under a cutbank and nail a grasshopper pattern. It's unbelievable in small-stream settings like this. As a fisherman, I can see the writing on the wall. These streams profiled in my guidebook [A Fly Fisher's Guide to Eastern Idaho's Small Water] are eventually doomed. I know that sounds drastic, but armed with the information I have now, I don't see a very bright future for the Yellowstone cutts and the non-native trout in the Caribou Highlands."

Nor do I, given the blasé attitudes of state and federal bureaucrats. On February 21, 2006, the Fish and Wildlife Service published the following statement in The Federal Register: "[US Forest Service selenium expert Dr. Dennis] Lemly (1999) described a particularly threatening scenario in the Blackfoot River drainage of Idaho where very high selenium concentrations were first discovered. A preliminary hazard assessment indicated that waterborne selenium concentrations in the Blackfoot River and 14 of its tributaries met or exceeded toxic thresholds for fish. The selenium problem centers on surface disposal of mine spoils. Compounding this problem is the presence of historic tailings dumps, many of which are large (greater than 353 million cubic feet) and contain a tremendous reservoir of selenium that has the potential to be mobilized and introduced into aquatic habitats (Lemly 1999). Continued expansion of phosphate mining is anticipated in these watersheds, and large mineral leases are awaiting development both on and off National Forest lands (Lemly 1999, Christensen 2005)."

That disheartening assessment accompanied a long string of similar disheartening assessments (all appended with "but," "however" or "nevertheless" clauses) as part of a denial of a petition to list the Yellowstone cutthroat trout as threatened. Identifying imperiled organisms and then protecting and recovering them as required by the Endangered Species Act is something our federal government just doesn't do anymore on its own volition. The administration of George H. W. Bush listed an average of 58 species per year. The Clinton administration listed an average of 65 per year-- this despite a one-year listing moratorium sponsored by Sen. Kay Bailey Hutchison (R-TX). The George W. Bush administration has listed an average of 8 for a total of 40. Thirty-eight of these listings were in response to court action, one in response to threatened court action, and one in response to a citizens' petition.

Because selenium bioaccumulates, a one-percent increase in the water column can translate to a 1,000-percent increase in fish flesh. At elevated but sublethal levels adult trout appear perfectly healthy, but their deformed fry perish in the swim-up stage or are quickly nailed by predators. Populations can wink out before biologists have a clue that there's a problem.

"It doesn't matter how little selenium may get into a stream; in some cases it's too damn much," declares Marv Hoyt, Idaho director of the Greater Yellowstone Coalition. "We've sampled these

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streams and found selenium in water below detectable limits, but levels in fish, insects and aquatic plants were 10 to 15 parts per million. Those concentrations cause reproductive failure in fish. Increasing selenium in streams by phosphate mining is just plain unacceptable. The Blackfoot and Crow cutthroat populations are really critical--two of the most important left in Idaho, and we're poisoning them."

From 1997 to 2001 the Idaho Department of Environmental Quality whitewashed the selenium hazard in what it called a "Human Health and Ecological Risk Assessment." According to this bogus document "regional human health and population-level ecological risks are unlikely to occur in the overall [phosphate mining area] based on observed conditions." But the department watered down the risks by distributing them over the entire mining area instead of impacted areas. When the Greater Yellowstone Coalition did its own analysis on seven streams in the Blackfoot and Salt River drainages it found that all fish sampled had elevated selenium levels dangerous not just to the fish but to humans who might eat them. In some cases the levels were four times the much laxer health standard now proposed by the Bush administration. The department had already posted a health advisory for consuming fish from East Mill Creek, where selenium levels are lower than in the seven streams sampled by the coalition.

Even more disturbing is the draft environmental impact statement (DEIS) for J.R. Simplot's Smoky Canyon Mine expansion into the Deer Creek watershed, released December 29, 2005, by the Bureau of Land Management and the Forest Service. The conclusion--full speed ahead--is based on misinterpretation of data, much of it obsolete and discredited anyway. The document isn't just grossly deficient; it is slovenly to the point of mocking the National Environmental Policy Act (NEPA). There is, for example, no mention that the entire length of Sage Creek, including the Pole Canyon drainage, has been added to the list of selenium-impaired streams. The authors evince scant comprehension of the bioaccumulation process, and they appear not to grasp the meaning of "mitigation," defining it as "actions to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice." As one reviewer--Dr. Patrick C. Trotter, a consulting fisheries scientist commissioned by the Greater Yellowstone Coalition--puts it: "I have had considerable experience working on teams that have prepared EIS documents for the NEPA process, and I recall quite a different set of guidances for applying the term 'mitigation' than appear to be used here. Careful design, careful construction, careful operation, and the application of best management practices were things that were expected would be done to prevent or avoid the occurrence of environmental impacts. Prevention and avoidance measures were not credited as mitigation. Mitigation meant measures taken to make right any environmental damage that could not be prevented or avoided despite best management practices or other best efforts."

For most of my career as a fish and wildlife journalist the Greater Yellowstone Coalition has provided me with information that has proved unimpeachable. Still, it's an environmental advocacy group, and for at least some readers its credibility is therefore suspect. So I went straight to the US Forest Service--which co-authored the DEIS and invited J.R. Simplot to cut roads and do test drilling, thereby making the Sage Creek Roadless Area the first casualty under the Bush administration's new roadless policy. The agency's resident selenium expert is Dr. Dennis Lemly, a senior scientist at the Southern Research Station in Blacksburg, Virginia, and one of my main sources in the early 1990's when he was with the US Fish and Wildlife Service and I was reporting on selenium poisoning of fish and wildlife at the Kesterson National Wildlife Refuge.

Kesterson is in California's Central Valley where selenium has always been present. The prolific

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wildflowers encountered by John Muir when he hiked down from the Coastal Range were taking selenium in precisely the proper dosage. But as agriculture swept into the area, unhealthy levels were pumped from the earth with groundwater. By the 1980's hundreds of thousands of eggs, hatchlings and adults of at least 20 species of aquatic birds were being fatally deformed or poisoned to death in gross violation of the Migratory Bird Treaty Act. The federal government's response was to whitewash the problem and punish the people who discovered it.

Dr. Lemly was calling selenium a "time bomb" back then; and he calls it one today. I asked him if, as a nation, we were doing better at defusing the selenium threat now than when he and I had talked 15 years ago. "Same issue, same problem, different place, different time," he said. "The damage used to be associated with irrigation drainage; now it's associated with mining. The bottom line is that when you start disturbing soils and geological formations containing selenium they're going to leach selenium."

Can phosphate be strip-mined in the Blackfoot and Salt river drainages without hurting Yellowstone cutthroat trout? Dr. Lemly thinks not. "These ecosystems cannot spare any more selenium input," he told me. "They're already at the threshold. We need to look at this in terms of the long-term health of the fish, but the secretaries [of Agriculture and Interior] are going to weigh jobs. So it's the age-old question of pitting environment against development. It's no different there than at Kesterson, but now it's the Mining Association doing the pushing instead of the farmers." According to Dr. Lemly, the NEPA process "is broken with respect for having a procedure in place to identify selenium threats." For the past five years he's been working out a five-step process that considers all sorts of biological, geological and hydrological conditions to figure a TMDL (Total Maximum Daily Load); and he is urging his agency to adopt it.

"Is there a safe TMDL for the Smoky Canyon Mine expansion?" I asked him.

"Probably not," he said. "But the agencies haven't gone through the process to determine that." In his review of the DEIS, he observes that, because it ignores and misinterprets data, it "seriously underestimates selenium threats." For example, he quotes the document's repeated claim that "Hardy (2003) showed that cutthroat trout grown for 44 weeks . . . showed no signs of toxicity." This statement, writes Dr. Lemly, "is absolutely not true," and he goes on to extensively quote Hardy's findings that link selenium with potentially fatal fry deformities. "From a fish-health perspective," Dr. Lemly continues, "it is irresponsible for the Agency Preferred Alternative [mine expansion] to be implemented. . . . This ecosystem is a tinder box, and allowing additional selenium discharges will likely start a cascade of irreversible events, culminating in severe toxic impacts to fish and aquatic life for many years to come. . . . The [secretaries] should not permit a process that could cause residual toxicity and place trust resources (and future land managers) in jeopardy for 100-plus years."

Despite the gross deficiencies of the DEIS, it contains three statements with which Dr. Lemly "strongly agrees": 1) "Impacts related to selenium bioaccumulation would be unavoidable." 2) "Indirect impacts to native fishes of the Study Area from further selenium accumulation, if they occurred, could be long-term and moderate to major." And, 3) "Specifically, long-term productivity effects related to cutthroat trout and other native fishes may be sacrificed through the bioaccumulation of selenium in Project Area streams (and eventually, the potential loss of reproductive function in resident fish)."

The Bush administration has reacted to America's selenium crisis by proposing relaxed standards. The current standard, which is causing so many problems with bioaccumulation, sets the limit for

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waterborne selenium at 5 parts per billion. The far laxer proposed standard--which EPA has offered in the wake of intense lobbying by mining, agribusiness and the electrical power industry--does away with a waterborne standard, replacing it with a fish-borne standard of 7.91 parts per million.

So that I might better understand the biological implications of the proposed standard I sought out the Department of Interior's resident selenium expert, Dr. Joseph Skorupa of the US Fish and Wildlife Service, who provided this assessment: "Nothing short of reckless." And he said: "The tissue standard would mean 50- to 90-percent mortality for cutthroat trout. And one commonality that everyone, including the corporate sector, agrees on is that, if EPA is going to switch to tissue-based standard, it needs to develop guidelines on how regulators can use that because it's not fish that come out of discharge pipes; it's water. You have to relate that tissue standard to what goes into the environment."

I'd first met Dr. Skorupa in 1993, shortly after he'd been disciplined for discovering and disseminating information about selenium--namely that it was wiping out Central-Valley wildlife, including endangered species. "Basically," he told me at the time, "I was locked into a windowless office, not allowed to take phone calls, not allowed to talk to anybody, not allowed to say 'hello' to the person in the next office." He was forbidden to pursue further selenium study, and when he procured an \$800,000 grant from the California Department of Water Resources he was ordered to give it back. Finally, he was forbidden to seek outside funding for selenium work, although he was free to pursue other grants.

Since then Dr. Skorupa has been high-profile enough that bureaucrats fear him. Still, he says this: "Any time the selenium issue gets near the energy sector I still get clamped down on really tightly." For example, shortly after selenium became a potential impediment to mountaintop-removal coal extraction he was invited to speak at a US Geological Survey symposium. The Interior Department heard about the title of his paper: "Fatal Flaws in EPA's Proposed Selenium Criteria" and informed USGS that the conference would be cancelled unless the title was changed. "I got this meek call from USGS begging me to let them change it," he reports. "I said fine, they could call it 'Bambi Meets SpongeBob,' but I wasn't going to change the content." Nor did he under the new title of "A Technical Review of EPA's Proposed Selenium Criteria."

Recently California irrigators served by the federal Central Valley Project have taken to citing the draft 7.91 parts per million tissue-based criterion as "scientific" support for relaxed environmental standards for their 25-year water contract renewals.

Rather than hacking new phosphate strip mines into the habitat of vanishing species, it strikes me that we should be cleaning up all 21 abandoned and permitted phosphate strip mines that are already poisoning Idaho's earth and water. By no means is the nation starving for phosphate. We have more than enough in places where it can be extracted without further compromising threatened and endangered species and creating new ones.

Under the current setup the public gets to pay for selenium cleanup twice--once with its fish and wildlife, and (provided the states and feds get around to doing something) once with its money. In the past, mining companies just walked away from their messes, and they aren't doing a whole lot better today. In no case is the damage by active or abandoned mines to fish, wildlife, water quality and public health being adequately remediated or even assessed.

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Recently, mining companies have been required to set aside cleanup and reclamation bonds of \$2,500 per affected acre, but this doesn't begin to cover the expense. Finally, "reclamation" in sensitive watersheds is a will-of-the-wisp goal that has never been achieved and may well be impossible. And, if it is impossible or if mining companies can't afford to do effective reclamation in sensitive watersheds (and elsewhere), the public cannot afford to allow them access to public resources on public lands.