Licensed TO KILL

How the **nuclear power industry** destroys endangered marine wildlife and ocean habitat to save money





By: Linda Gunter, SECC and Paul Gunter, NIRS • Scott Cullen, STAR and Nancy Burton, Esq.

"No price can be set for the things that have to be preserved." — Archie Carr

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How the **nuclear power industry** destroys endangered marine wildlife and ocean habitat to save money

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The commitment must be much deeper – to let no species knowingly die; to take all reasonable action to protect every species and race in perpetuity.

— Edward O. Wilson[1]

[1] The Diversity of Life, Edward O. Wilson,, page 342. W.W. Norton & Company, 1999.

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Acronyms

AEC	Atomic Energy Commission
BA	Biological Assessment
BO	Biological Opinion
BRS	Bibliographical Retrieval System
BSEP	Brunswick Steam Electric Plant
BTU	British Thermal Units
BWR	Boiling Water Reactor
CCC	California Coastal Commission
CEA	U.S. Council for Energy Awareness
CEQ	Council on Environmental Quality
CMA	Clearwater Marine Aquarium
COA	Clean Ocean Action
CP&L	Carolina Power and Light
CREC	Crystal River Energy Complex
CWA	Clean Water Act
DCPP	Diablo Canyon Power Plant
DEP	Connecticut Department of Environmental Protection
DEPE	New Jersey Department of Environmental Protection and Energy
DER	Daily Event Report
DFG	California Department of Fish and Game
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
ESA	Endangered Species Act
FDEP	Florida Department of Environmental Protection
FOIA	Freedom of Information Act
FP	Fibropapilloma/Fibropapillomatosis
FPC	Florida Power Company
FPL	Florida Power and Light
FTC	Federal Trade Commission
GPUN	General Public Utility Nuclear
HSUS	Humane Society of the United States
ITS	Incidental Take Statement
ITP	Incidental Take Permit
KWH	kilowatt hour
MCBI	Marine Conservation Biology Institute
MMPA	Marine Mammal Protection Act
MMSC	Marine Mammal Stranding Center

MRC	Marine Review Committee
NAD	National Advertising Division, Council of Better Business Bureaus
NAS	National Academy of Sciences
NAWMP	North American Waterfowl Management Plan
NCSTC	North Carolina Sea Turtle Coordinator
NEA	New England Aquarium
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPR	National Public Radio
NRC	Nuclear Regulatory Commission
NRDC	Natural Resources Defense Council
NU	Northeast Utilities
OCNGS	Oyster Creek Nuclear Generating Station
PA	Privacy Act
PDR	Public Document Room
PG&E	Pacific Gas and Electric
PSE&G	Public Service Electric and Gas Company
PSIG	pounds per square inch
PUC	Public Utilities Commission
PWR	pressurized water reactor
RIS	Representative Important Species
RWQCB	Regional Water Quality Control Board
SNGS	Salem Nuclear Generating Station
SONGS	San Onofre Nuclear Generating Station
STRP	Sea Turtle Restoration Project
STSSN	Sea Turtle Stranding and Salvage Network
TDAR	Thermal Discharge Assessment Report
UIDS	Underwater Intrusion Detection System
USFWS	U.S. Fish and Wildlife Service
WQCB	California Water Quality Control Board
WTO	World Trade Organization

Executive Summary

Marine life in all forms, from endangered manatees and sea turtles to essential microscopic organisms, is being harmed and killed by once-through cooling systems, used to remove waste heat at nuclear power stations. A typical once-through cooling system draws into each reactor unit more than a billion gallons of water a day, 500,000 gallons a minute. After cycling through the power generating station, the heated water is discharged at temperatures up to 25 degrees F hotter than the water into which it flows. A total of 59 out of the 103 U.S. reactor units rely on this system, either exclusively or in conjunction with closed cycle canals or cooling towers.

This report examines the toll the once-through cooling intake and discharge system takes on marine biodiversity around nuclear plants, including sea turtles and other endangered marine animals. The report takes into account the already severe problems affecting the health of U.S. oceans and waterways and the impacts of nuclear power plant operation within the context of this crisis. The authors review the cumulative impact of marine ecosystem destruction by coastal nuclear reactors as well as the local effect on marine life in the vicinity of the plant. Particular attention is given to the effectiveness of regulatory oversight and the adherence to and implementation of the federal Clean Water Act (CWA), the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA).

Power Plant Systems and Alternatives

Nuclear power electrical generating stations use the tremendous heat resulting from the controlled splitting of the atom to boil water to generate steam for powering electrical turbogenerators. Atomic reactors produce much more heat in the fission process than is needed to generate electricity. For each unit of electrical energy generated, two units of heat energy are released into the environment. To operate a nuclear power station efficiently, this waste heat must be removed.

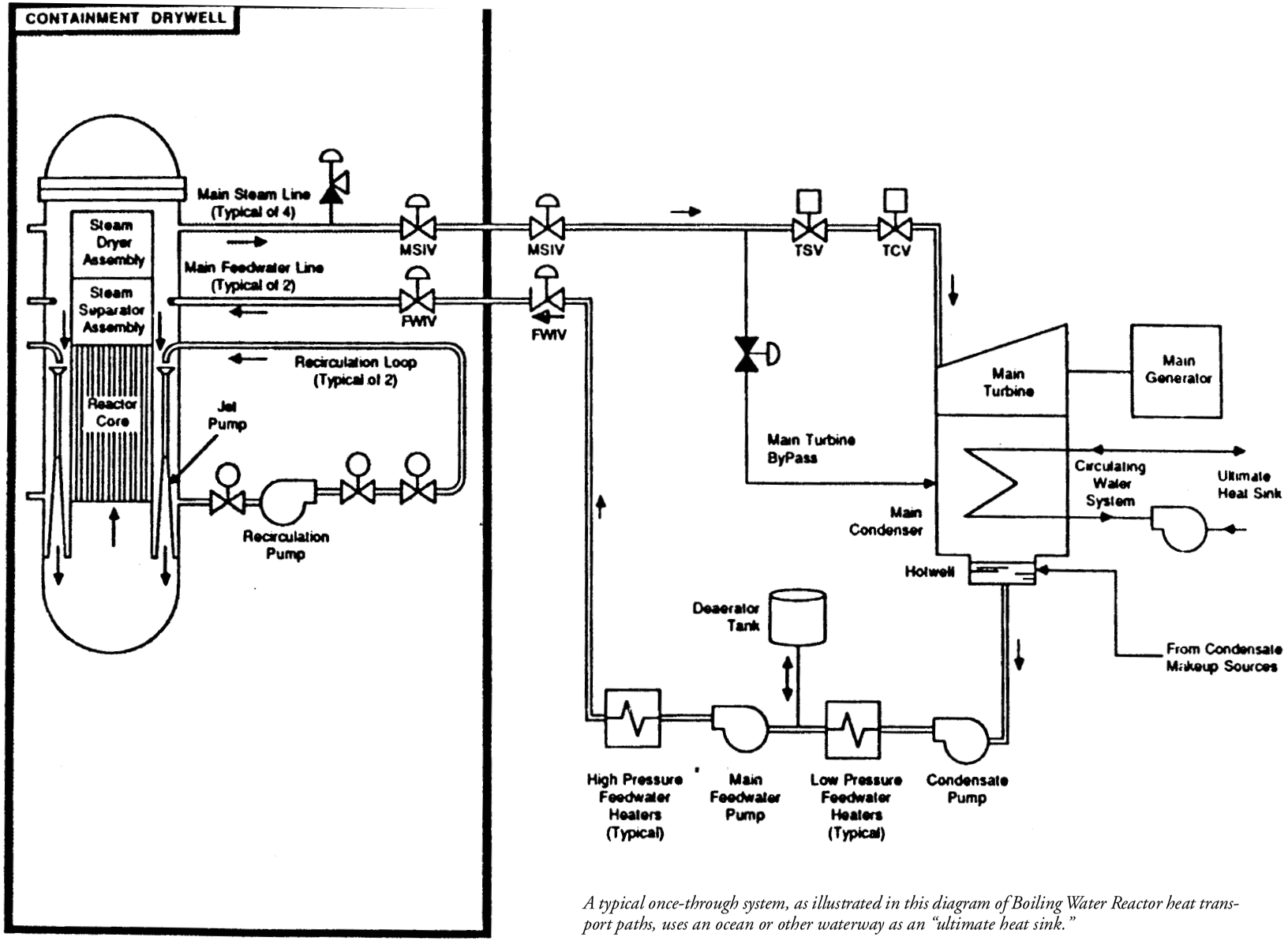
The damage to endangered species, marine life and habitat, by once-through coolant reactors such as those at St. Lucie, pictured, is catastrophic and in some cases potentially irreversible.

Electric utilities use a variety of methods to remove waste heat from their nuclear reactors, but most companies rely on the once-through cooling system. The system transfers the heat load to the intake water and discharges the heated water back into the environment, using the same body of water as a *heat sink* to absorb and dissipate the excess heat generated by the system. In contrast, operators using cooling towers draw in a lowered water intake of about 20,000 gallons a minute, reducing the potential for damage to marine life sucked into the nuclear plant. Cooling towers also eliminate the need to discharge large volumes of heated water into the water source and the resulting damage to the marine environment in the discharge area.

Overall Harmful Effects of the Once-Through System

The environmental impact of diverting more than a billion gallons of water per unit per day from a water source such as an ocean or estuary, heating it up, then discharging it at temperatures up to 25 degrees F higher than the surrounding water has been shown to cause significant damage. Not only are marine animals “entrained” or “impinged” by the intake system, but billions of smaller marine organisms, essential to the food web, are also sucked into the reactor operating system and largely destroyed in

Normal BWR Heat Transport Paths During Power Operation



A typical once-through system, as illustrated in this diagram of Boiling Water Reactor heat transport paths, uses an ocean or other waterway as an "ultimate heat sink."

this process. *Entrainment* involves the drawing in of marine life through an intake tunnel, pipe, or canal at a velocity the marine animals cannot resist. Once drawn in, they are subject to *impingement,* becoming trapped against "prevention devices" such as screens, racks, bars, and barrier nets. Larger animals may then drown or suffocate after becoming impinged.

Smaller fish and other organisms may be entrained through the entire reactor system and are often scalded by the heated water before being discharged into the waterway. Others, pulverized by the reactor condenser system, emerge as sediment that clouds the water around the discharge area, often blocking light from the ocean floor. The resulting shadow effect kills plant and animal life around reactor discharge systems by curtailing the light and oxygen they need to survive.

Regulatory Oversight and Mitigation

The lack of oversight by federal agencies authorized to protect the marine environment from unfettered industrial development and pollution has alarmed industry watchdog and animal protection organizations. Ecological concerns include the destruction of marine species and their surrounding habitat, particularly the killing and capturing of endangered species through the routine operation of atomic reactors.

Under the present system, the nuclear industry's needs almost always prevail over the interests of marine life.

Under the present system, the nuclear industry's needs almost always prevail over the interests of marine life. The use of technology that is least harmful and polluting to the environment is a prerequisite of the CWA. However, installation of cooling towers, unquestionably an improvement over once-through cooling systems, has been selectively enforced at atomic reactor sites and resisted by utilities hoping to avoid the expense. The U.S. Environmental Protection Agency (EPA), responsible for enforcing compliance with intake and discharge permits at reactors under the terms of the CWA, has largely failed to establish national performance standards. This failure has resulted in at least one lawsuit to date, forcing EPA to revise its national performance standards for both new and existing power plants. This process is ongoing.

The U.S. Nuclear Regulatory Commission (NRC) is entrusted with the enforcement of licensee regulations under the Endangered Species Act but frequently acts instead as an advocate for the nuclear industry. The NRC often persuades the National Marine Fisheries Service (NMFS), the agency that governs the protection of most marine animals, to back away from more stringent actions that would minimize destruction of these animals and their habitat. To save the industry money, requirements that would protect marine life and habitat are weakened, watered down, or done away with entirely at nuclear reactors.

Instead of applying sanctions when a nuclear plant kills more than its allowed quota of an endangered species, as laid out in the *incidental take statement* issued by NMFS, NRC acts on behalf of the plant owner to secure a larger quota. If a plant exceeds its allowed take limit, it must renegotiate a new limit. This is known as *reinitiation of consultation* under ESA Section 7. The utility must first prepare a *biological assessment* of the problem. After discussion with NMFS and NRC, and an NMFS draft response, NMFS issues its final *biological opinion,* setting out the new take limits and establishing the new incidental take statement. NRC is invariably an advocate for the utility during this process. For example, at reactors where sea turtles are captured, NRC consistently encourages NMFS to withdraw from its biological opinion most of the requirements that are important to the long-term survival of the species such as habitat studies, tissue sampling, video studies, and comprehensive animal necropsies. NRC also supports industry attempts to raise the limit on the number of animals that can be killed or captured during reactor operation.

Falsification and False Promises

State water and wildlife authorities also fall prey to nuclear industry pressure tactics. Regulators are kept in the dark and legally intimidated by the nuclear industry in its efforts to avoid or dramatically reduce penalties and mitigation requirements for the harmful effects of the once-through cooling system. This occurs even after proof that an offending utility has deliberately withheld or misrepresented vital but unfavorable data.

For example, the California utility, Pacific Gas & Electric (PG&E), for many years, provided state water authorities with skewed data on its Diablo Canyon nuclear power station. The data showed that the plant's intake of billions of gallons of water a day did very little harm to surrounding marine life. PG&E's conclusions were based on the unscientific formula that the amount of sea life drawn into the system at the intake port could be accurately measured by the amount of small fish and other organisms at the outflow of the cooling system.

In the spring of 2000, Diablo Canyon's operators were discovered to have withheld information from environmental regulators for two decades revealing the true effect of the reactor's hot water discharges into the coastal waters off Diablo Cove and miles beyond. The concealed data included infrared images indicating more extensive thermal plume impact zones than previously admitted and time-series photographs showing the progressive deterioration of biologically important marine habitat in coastal waters around the reactor. The damage was catastrophic to the indigenous marine life community, including the near obliteration of the already threatened black and red abalone populations. The concealed findings also revealed up to a 90 percent destruction of many varieties of sea life as they passed through Diablo Canyon's cooling system. These findings had never been reported to state or federal agencies.

State water authorities viewed the escalating damage as sufficiently severe to press for a cease and desist order against the utility's previously accepted levels of waste heat discharges. A state cease and desist order would have effectively halted, or reduced the thermal discharges, or reduced their temperature, and imposed severe fines on the utility for continued heat pollution that threatened marine habitat and its indigenous species.

However, the order was undermined by the utility. Despite publicly documented evidence, and even evidence of its own, PG&E argued that no mitigation action was needed. Using a threat to outspend environmental regulators in legal actions appealing the cease and desist order, PG&E forced the authorities to back down. Instead, the state regulators have proposed to accept a settlement that ignores the reactor's ongoing thermal damage and includes a cash pay-off of just $4.5 million for vaguely worded marine species protection measures while simultaneously reducing the scope of monitoring the harmful effects of the Diablo Canyon cooling system. This regulatory retreat in effect allows the utility to continue its business-as-usual practices while sacrificing an entire indigenous marine life community as the cost of marketing electricity.

Edison quickly reneged on its promise and began its campaign to avoid any protective obligations.

Nuclear utilities make promises during licensing they have no intention of fulfilling once their reactors begin operation. Units 2 and 3 at the San Onofre Nuclear Generating Station (SONGS) near San Diego, CA, were permitted to come on line, based on the owner's submission to a comprehensive environmental impact study. The utility, Southern California Edison (Edison), agreed at the time to compensate fully for any environmental damage subsequently found by the study.

When findings suggested that the operation of San Onofre had caused substantial damage to the marine environment, however, Edison quickly reneged on its promise and began its campaign to avoid any protective obligations. Since the study's publication in 1989, Edison has done little but dispute and disregard the recommended actions. Despite the California Coastal Commission's July 1991 instruction to complete a 150-acre wetlands restoration and build a 300-acre artificial reef near the plant, Edison has, to date, spent a mere $2.7 million in the construction of a 22.5 acre reef. This is a paltry sum when compared to the utility's 1999 earnings of $484 million from a $1.5 billion net cash flow, as reported to the Securities and Exchange Commission.

Species-Specific Harmful Effects: Sea Turtles

Four species of endangered and one threatened species of sea turtle present in U.S. coastal waters are harmed and killed by nuclear power station operations. Loggerhead, green, and Kemp's ridley sea turtles are the most common victims at nuclear reactors. Leatherback and hawksbill sea turtles have also been taken on rare occasions. Worldwide, the Kemp's ridley is the most severely endangered sea turtle species, although the Pacific leatherback is currently at the most immediate risk of extinction.

Sea turtles are entrained into the large-diameter coolant intake pipes used by coastal reactors. A 1990 National Academy of Sciences (NAS) study, "Decline of Sea Turtles, Causes and Prevention," examined the impacts on worldwide sea turtle populations and recommended protective measures to prevent their extinction. The academy, in its investigation of power plant impacts, found that death and injury can occur in transit through a reactor's once-through intake pipe such as the one employed at the St. Lucie plant in Florida. However, since 1985, no utility has attributed sea turtle injury or mortality at a nuclear reactor site to transit through an intake pipe, although sea turtles continue to be entrained through the St. Lucie pipe in large numbers.

Sea turtles are also impinged by the force of the intake water and become lodged on velocity cap structures at the intake entrance or farther downstream on barrier nets, underwater deterrent systems, and, ultimately, against the power station's metal grate trash racks. Mortality reports ascribe death to drowning, but some experts clarify this as suffocation as necropsies usually show no water present in the lungs of dead sea turtles at nuclear plants.

Utility operators often refuse to admit responsibility for the death and injury of sea turtles, blaming prior injuries, including boat collisions and shark attacks.

Utility operators often refuse to admit responsibility for the death and injury of sea turtles, blaming prior injuries, including boat collisions and shark attacks. By making this distinction between sea turtles directly killed or injured by reactor operations and those allegedly suffering prior injuries, utilities can effectively increase their kill and capture limits. For example, if a reactor is given a lethal "take" limit of 10 sea turtles a year and makes its own judgment about which animals were killed due to plant operation, "noncausal" lethal takes can be omitted from the limits to increase the amount of authorized kills at the reactor.

To avoid costly protective actions, nuclear utilities dismiss their deadly role as minuscule. However, every sea turtle killed at a nuclear reactor has an essential part to play in the species' survival. Sea turtles harmed by nuclear reactors range from juveniles and subadults to adults all of whom have already survived the enormous attrition from predators suffered by hatchlings. Scientists and sea turtle experts agree that removing these viable members of the population could have serious consequences. Egg-bearing females are particularly vulnerable, especially when habitual nesting beaches are occupied by a nuclear reactor such as occurs in Florida at the St. Lucie station. Furthermore, evidence shows that sea turtles are lured into dangerous proximity of reactors by the artificially warmed

waters, the resulting abundance of favored prey, and the resemblance of the intake structures to reefs, a desirable feeding and resting place. This puts sea turtles in danger of entrainment through intake structures and of being trapped by colder waters should they linger too long in the artificial environment created by the reactor discharge system.

Species-Specific Harmful Effects: Fish, Fish Larvae, and the Marine Habitat

Fish, fish larvae, and fish eggs are harmed and destroyed upon entering the flow of reactor cooling water where they are sucked into and impinged on the water intake screens. These ecologically essential life forms are then stressed by the mechanical, chemical, and thermal impacts of the operation of the once-through cooling system. Smaller fish, fish larvae, spawn, and a tremendous volume of other marine organisms are daily drawn deeper inside the reactor coolant system where up to 95 percent are scalded and discharged back into the water body as lifeless sediment. These high destruction rates can overtake recovery rates, resulting in extensive depletion of the affected species. In this way, entire marine communities can lose their capacity to sustain themselves.

Smaller fish, fish larvae, spawn, and a tremendous volume of other marine organisms are daily drawn deeper inside the reactor coolant system where up to 95 percent are scalded and discharged back into the water body as lifeless sediment.

In addition, should a reactor abruptly shut down, water temperatures around the plant will drop causing cold-stunning, an event fatal to fish acclimated to the warmer water. Occasionally, reactor operators deliberately raise the temperature of the water inside the coolant system to kill mollusks encrusting the pipes. Fish that cannot escape are scalded and discharged into the local marine environment. This increases the clouding of the water around the discharge structure already caused by the volume of hot water gushing from the reactor, further impeding the growth of essential marine plants such as kelp.

The hot discharge water damages and destroys fish and other marine life and dramatically alters the immediate marine environment. Warmer waters have been found to cause a fatal disease, known as "withering syndrome," in black and red abalone, which have been virtually eliminated around Diablo Canyon in California with little chance of recovery, even if the water temperatures return to normal. The warmer temperatures drive away indigenous species of fish and attract others whose populations flourish, further stressing the displaced species and threatening their survival. Kelp, unable to photosynthesize efficiently due to the shadowing effect of discharge sediment, also is weakened by higher water temperatures. In the immediate discharge areas, the ocean floor is scoured clean of sediment by the force of the thermal discharge, resulting in bare rock and creating a virtual marine desert. Areas farther from the discharge become coated in heavy, life-stifling sediment. Unusually altered water temperatures have been shown to interfere with the normal behavior patterns of some species of fish, including striped bass, consequently disrupting the completion of necessary life-cycle activities.

The utility operating the reactor typically conducts the reporting and analysis of fish kills. This method of self-reporting inevitably results in gross underestimates of fish kills at nuclear reactors. In one example of cold-stunning when the Oyster Creek station in New Jersey shut down, the utility officially reported several hundred fish mortalities, but sightings by local fishermen recorded at least 4,000 dead striped bass. In fact, the utility had counted only fish found within the reactor's property perimeter and not those beyond plant boundaries. The full magnitude of the damage to fish populations from nuclear power operations is likely far greater than suggested by unreliable estimates from utilities.

Species-Specific Harmful Effects: Marine Mammals and Other Marine Wildlife

The nuclear industry values economic profits over reducing harm to wildlife and the humane treatment of marine animals. Nonendangered species such as seals and sea lions are drowned at nuclear plants, often with the tacit approval of NMFS, the agency that grants permits for take limits it judges will not impair the species' survival. However, the agency's decision-making process does not factor in the slow, inhumane drowning of marine mammals through a reactor intake tunnel. It is left to environmental watchdog groups to draw attention to the plight of these animals. This is what happened at the Seabrook reactor in New Hampshire where the drowning of seals ceased after activists pressured the utility into installing preventive bars at the intake tunnel.

An endangered manatee mother swims with her calf. In Florida, manatees have been sucked through reactor intake pipes. One was found dead at Turkey Point but the necropsy was incon-

Endangered manatees and American crocodiles have been captured and killed at atomic reactors. Manatees have also fallen prey to habituation to the artificially warmed waters, a problem that has resulted in cold-stunning of the animals when the plants reduce power or shut down. In Florida, manatees were sucked through the St. Lucie intake pipe, both before and after repairs to the opening through which they entered. The experience of a human diver who survived entrainment through the St. Lucie pipe in 1989 tells us that the victim must endure turbulence, darkness, and severe tearing by large, sharp barnacles encrusted on the pipe's interior.

Although the Turkey Point nuclear station in Florida has positioned itself as a "sanctuary" for American crocodiles, the animals have also died there, at least one apparently from impingement against the suction of the cooling canal skimmer pumps. The crocodiles, attracted by the artificially warmed discharge water, cluster around the plant, vulnerable to injury from plant operations. Turkey Point has also reported a manatee mortality.

Various breeds of diving ducks have drowned at nuclear plants, sucked through the intake structures into the circulating water systems.

Various breeds of diving ducks have drowned at nuclear plants, sucked through the intake structures into the circulating water systems. Almost no attention has been paid to these incidents, even though at least one resulted in the death of 103 greater or lesser scaup, a bird whose numbers have declined at an alarming rate in recent years. The elimination of 103 members of a single population of scaup, if repeated, could have serious consequences. Scaup are attracted by zebra mussels that reportedly flourish on water intake structures, but no preventive methods are known to avoid fatalities among these feeding birds.

Even when reluctantly complying with protective requirements, some plants do further damage to the environment. Operators of the Salem reactors in New Jersey were obligated to restore wetlands in the area. But in doing so, they broke a dike and cut a channel to create a flat marshland that has proven deadly to the already diminishing horseshoe crab population. The dredging effort that broke the dike was particularly destructive, as the utility chose not to halt the operation during the crabs' breeding season. Repeated herbicidal sprayings have also harmed the estuarine environment the utility is charged with protecting.

Articles such as this in Nuclear Industry magazine, make misleading claims about the benefits to wildlife of nuclear power operation without revealing its true destruction.

False Advertising

The nuclear industry has spent tens of millions of dollars over the years, attempting to portray itself as environmentally friendly and beneficial to wildlife. Some of its advertising and promotional efforts have featured the same animals killed or captured at nuclear reactors such as seals, sea turtles, and American crocodiles. Industry advertising and promotional materials have claimed that "sea creatures and nuclear plants get along well," that nuclear power "helps protect the environment," and even that nuclear reactors cause "no harm" to sea turtles. Utilities use their web sites to trumpet token gestures toward conservation such as sea turtle nest counts, without telling readers about their own part in destroying these same species as they attempt to nest on land now occupied by atomic reactors.

When nuclear power advertisements were challenged in 1998 by consumer, environmental, business, and public policy groups, the industry at first defied recommendations from the National Advertising Division of the Council of Better Business Bureaus (NAD) to cease its deceptive practices and amend its advertising messages. However, the NAD referred the case to the Federal Trade Commission, which urged the industry to "take to heart the evaluation of its advertising that has been rendered by its peers" and agreed that the industry had "failed to substantiate its general environmental benefit claim." Only then did the industry buckle to pressure and its advertisements no longer feature sea turtle hatchlings or basking sea lions. Again, without the intervention of watchdog organizations, the nuclear power industry will continue to mislead the public about its effect on endangered and other marine wildlife.

Conclusions and Recommendations

Nuclear power plants use the once-through cooling system to save money. When presented with the opportunity to install cooling towers at the time of construction, many reactor owners declined, citing financial burdens. By this choice, the utilities passed the cost on as environmental damage. Today, with nuclear power in steep economic decline, the industry once again argues that it cannot afford to retrofit with cooling towers to curb harmful impacts on the marine environment.

The nuclear industry is allowed to self-monitor and self-regulate to an unacceptable degree.

The nuclear industry is allowed to self-monitor and self-regulate to an unacceptable degree. Subject to lenient and often accommodating regulatory oversight, reactor operators will deliberately leave out essential information about damage to the marine ecosystem when reporting to state and federal authorities. In the case of PG&E and its Diablo Canyon site, the utility remained silent about the true extent of destruction to marine life and habitat around the reactor. In other instances, mitigation promises made at the time of licensing were quickly broken. The industry flaunts the threat of litigation to force authorities into accepting minimal penalties for repair to the environment damaged or fundamentally altered by the operation of atomic reactors.

Regulatory authorities must rely on the honesty of nuclear utilities to report accurately the captures and deaths of marine wildlife at nuclear reactors. Such reporting is erratic, inconsistent, and some-

times absent altogether. Utilities often fail to report at all to NRC, preferring to provide information about the deaths of marine animals to NMFS or state departments of environmental protection. This circumvents the tenets of the Endangered Species Act and the Marine Mammal Protection Act and effectively shields the industry from public scrutiny. This is compounded by NRC's own inconsistencies. At times, NRC posts information about wildlife kills and captures at reactors on its Daily Events Reports (DER) that appear on its website. At others, it records this information only in the archives of its Public Document Room. The public must therefore inquire 'on spec' to ascertain whether or not captures have taken place and not assume that the DER postings provide a full accounting. These inconsistencies, from the utilities to the federal authorities, make it extremely difficult for the public to know the true extent of the destruction of marine life at atomic reactors.

The nuclear industry flaunts sea turtle nest protection efforts at the same time its reactors capture egg-bearing females attempting to nest.

The NRC, the federal authority charged with enforcing compliance with take limits, mitigation actions, and other requirements, acts more as a lapdog than a watchdog. In fact, NRC often persuades permitting agencies such as NMFS to buckle to the industry's professed economic needs by convincing the agency "not to fall on their sword" over requirements such as sea turtle entrainment studies. Under NRC's watch, the marine environment, not the nuclear industry, has paid the price for electricity generated by once-through nuclear power reactors. NRC is even willing to come up with preplanned scenarios to help NMFS "save face" when confronted with utility resistance to needed mitigation measures. Although NMFS occasionally presents nuclear utilities with convincing arguments for protective measures, it rarely stands by its original opinions once NRC-supported industry opposition has been considered.

The nuclear industry makes only token gestures toward protective actions and balks at any serious repair of the environmental destruction it has caused. Instead, the industry portrays atomic reactors as environmentally friendly wildlife sanctuaries, a myth as deceptive as the industry's earlier promise of electricity "too cheap too meter." It flaunts sea turtle nest protection efforts at the same time its reactors capture egg-bearing females attempting to nest. It is left mainly to environmental watchdogs and animal protection organizations to advocate for protective measures and publicly to expose the industry's destruction of marine wildlife.

Endangered species such as sea turtles, manatees, American crocodiles, and least terns, along with a wide variety of fish, other marine mammals, sea birds, and smaller, essential marine organisms, are species whose numbers are further diminished by the operation of nuclear power. The survival and safety of these animals is of negligible interest to an industry that prizes profit above all and shifts blame to other causes when confronted with the rising deaths and injuries of these creatures at its reactors.

Noted scientists and oceanic experts agree that the health of the world's oceans is in jeopardy. Yet, the nuclear industry is willing to destroy significant areas of marine habitat through daily operation of its once-through coolant reactors. When presented with the opportunity to repair some of the damage, the industry instead fights back with threats of costly and protracted legal challenges. Though willing to spend millions of dollars and countless years fighting lawsuits, the industry is not willing to finance protection of the endangered species it kills or restoration of the marine environment it destroys. The nuclear industry displays a callous disregard for the importance of the oceans as a life source and marker for environmental and human health.

The agencies empowered both to regulate the industry and to protect the public, wildlife, and environment from industry wrongdoing are lax at best, even negligent and collusive. Though entrusted to enforce laws largely designed for the well-being of humans, wildlife and habitat, agencies

such as NRC and NMFS are in fact more inclined to favor industry needs at the expense of human and environmental health.

Given the nuclear industry's refusal to install less damaging technology or to implement even the smallest of protective measures at its once-through reactors, an essential option exists that can prevent further and potentially catastrophic damage to the oceans and the life that dwells there. The *precautionary principle* —whereby activities that harm the environment are halted before the damage is irreversible, and the burden of proof is placed upon the polluter, not the public—is not only a timely, but an essential, approach. Consequently, we recommend that the use of once-through cooling technology be halted before more animals are harmed and further, irreversible damage is done to essential marine ecosystems. Only in this way can the marine environment be protected from one of its most aggressive predators. Additionally, nuclear utilities should adhere to the same standards of law as other industries and such laws that do apply must be implemented consistently.

Clarification of Report Criteria

This report is an examination of the effects on marine life and habitat of the condenser cooling systems used to operate U.S. coastal nuclear power reactors. The report does not presume to portray the full extent of marine destruction caused by nuclear utilities. Nor does it attempt to examine the many significant radiological and toxicological issues affecting water and environmental quality directly associated with the ongoing operation of nuclear power stations. These effects are omitted from this report to provide a focus on the nonradiological issues, not because these impacts are insignificant. Nor does this report cover the effects of nuclear power operation on terrestrial wildlife and endangered nonmarine species.

Reactors examined are a selection of primary users of the once-through cooling system. The findings here represent examples of reactors chosen because of their known or suspected effects on marine life. The report is not meant to provide the definitive analysis of once-through systems at every U.S. nuclear plant. This does not mean that reactors not specifically named in this report do not cause similar effects. Indeed, all reactors using the once-through cooling system routinely destroy millions of aquatic organisms, large and microscopic. The species affected, the quantity and type of destruction, and other specifics may differ, but the harmful consequences are no less critical. Much of the material in this report comes from Freedom of Information Act requests and has never before been released to the public.

The authors present this as a preliminary analysis of findings to date. This report does not constitute a complete study, as events continue to unfold and circumstances to change at nuclear plants around the country. However, it is apparent that the lack of investigation, analysis, and enforcement by NRC and other responsible federal and state agencies has left a void in the patchwork of regulated protection of marine species and their habitat. Fair and equitable regulation of the harmful impacts of the coolant intake and discharge system must now be implemented.

Introduction

An Ocean of Neglect

"This will be the century of the environment. In these next few years, we...will hold the fate of civilization in our hands...and in our minds. Unlike the Cold War, it is not a wrong decision, or an aggressive act, that will spell our doom. It is our inaction that will spell our doom." —Archie ("Chuck") Carr III[1]

"Out of sight, out of mind" is the phrase most applicable when examining the health of oceans along the U.S. coasts. While parts of the U.S. landmass have benefited from designation as federally protected areas, little such status has been granted to the seas. Not until May 2000 did U.S. President Bill Clinton issue an executive order to expand the protection of U.S coastal "marine protected areas" where fishing, offshore drilling, and other "consumptive uses" of marine resources would come under closer scrutiny.[2] Signed into law in August 2000, the order establishes a 16-member commission to study ocean issues and recommend long-term strategies. Though heralded by conservation organizations as a progressive step, the law appears unlikely to produce any quick, tangible results. In late 1999, Tundi Agardy, a marine expert at Conservation International wrote: "The United States has done virtually nothing to conserve this great natural resource or to actively stem the decline of the oceans' health."[3] Although the United States has the highest marine ecosystem diversity of any nation in the world, it has no comprehensive system to protect this unequaled national treasure.[4] Consequently, experts have no doubt that the sea's biological diversity and ecological integrity are in trouble.[5] In fact, government policies toward this most crucial of ecosystems represent an ocean of neglect.

According to experts, the United States has done little to conserve the great natural resources of our oceans. Environmental groups have pressed for ocean "no-take" zones where wildlife can live in tranquillity, free from the threats of big industry and human activity.

This inattention may be costly. The signs are that something is very wrong in the world's oceans, and contamination and alteration of that environment by industries like nuclear power, if left unchecked, may be changing the marine ecosystem beyond redemption. Yet the world's oceans, though critical to life on Earth, are barely understood, and no international body monitors coastal pollution.[6]

Damage to marine ecosystems by commercial industries like nuclear power, more interested in profit than environmental protection, goes largely unobserved and unpunished. Lawmakers tend to focus on hot-button issues most likely to garner public attention and votes. Researchers Robert J. Wilder, Mia J. Tegner, and Paul K. Dayton asked: "Why have lawmakers paid so little attention to the degradation of the sea? It is a case of out of sight, out of mind . . . and most policymakers assume there is little need for concern."[7]

"Why have lawmakers paid so little attention to the degradation of the sea? It is a case of out of sight, out of mind."

The damage to marine life caused by the nuclear power industry, which operates 59 reactors on U.S. waterways and oceans using the once-through cooling system, has been sparsely reported and largely overlooked. A typical 1,000-megawatt reactor using the once-through cooling system requires as much as 500,000 gallons of cooling

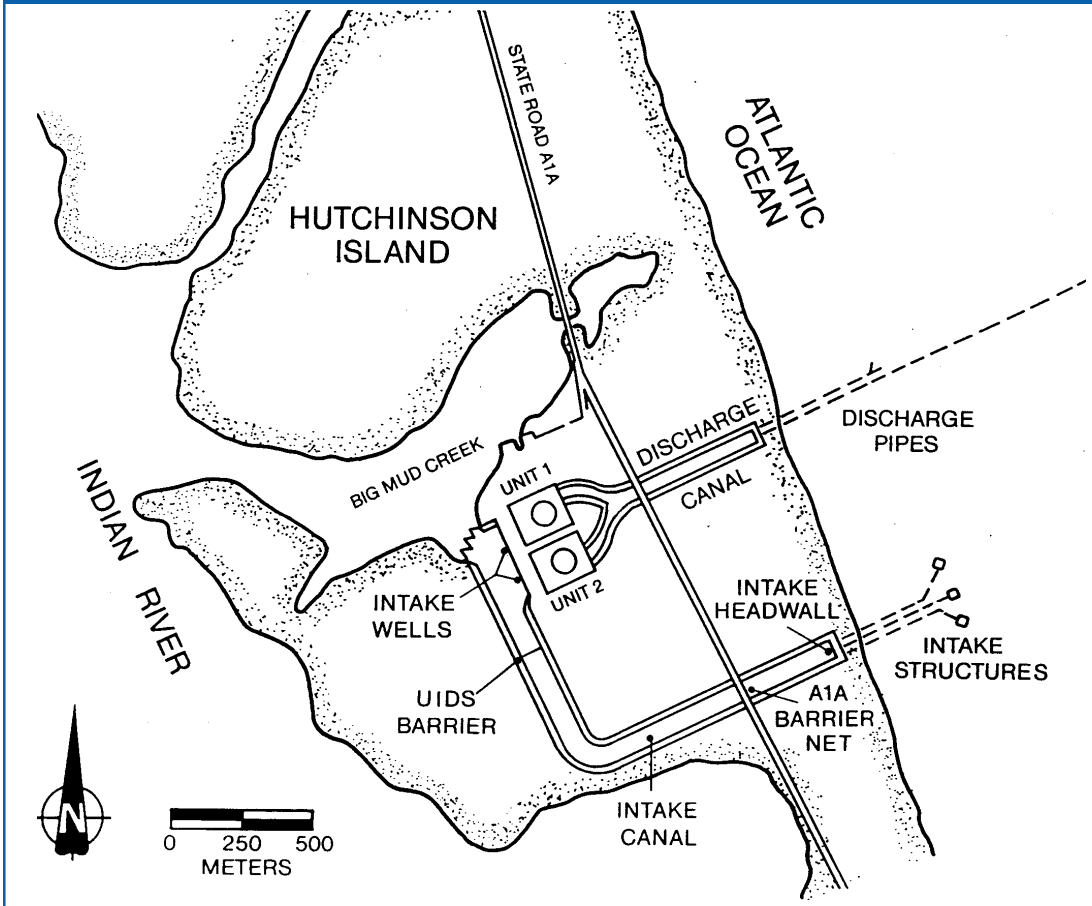
water a minute, drawn in from our lakes, rivers, and oceans. After cooling the reactor system, the now artificially warmed water is discharged back into the body of water from which it was drawn. This technology was selected as the cheaper alternative to cooling towers that use as little as 20,000 gallons a minute, which the economically beleaguered industry views as too cost-prohibitive to install. Instead, the price is being paid by marine life and the ecosystems on which they depend.

The nuclear industry deliberately obfuscates the problem and misleads the public and decision-makers through its deceptive propaganda.

Nuclear power is an inherently dangerous and increasingly uneconomical technology. The risk of catastrophic accident, the unsolved problem of long-lasting radioactive waste, and the economic decline of the industry all have received global attention. But the threat from the routine operation of these facilities to the marine environment and its wildlife is virtually unknown by the public and overlooked by regulators and policymakers. Furthermore, the nuclear industry deliberately obfuscates the problem and misleads the public and decision-makers through its deceptive propaganda, positioning itself as an environmentally friendly technology that is beneficial to wildlife.

In reality, the coolant system's intake structure, which draws water into the plant, has been found to kill wildlife inhumanely and significantly alter or destroy the marine environment. Marine species are sucked

Figure 2: St. Lucie Plant cooling water intake and discharge system



The St. Lucie plant cooling water intake and discharge system. Reactors using this system can draw in as much as one million gallons of cooling water a minute or 3 billion gallons a day before discharging it into the same body of water. At some reactors the discharge water is heated up to 25 degrees F above ambient temperatures.

(entrained) into the plant's cooling canals through an intake canal or tunnel. Larger species, such as sea turtles and seals, have drowned or suffocated during entrainment. Others become impinged against trash rakes or net. Fish larvae, spawn, and fingerlings (young fish), are destroyed by their passage through the plant systems and, when discharged at the end of the cooling process, are described by the industry as "debris."

Endangered sea turtles, creatures that have lived in our oceans for 200 million years, are rapidly dwindling in numbers. Among the common victims at U.S. nuclear power plants are the Kemp's ridley sea turtle (the most severely endangered sea turtle species in the world), the loggerhead sea turtle, and the green sea turtle. Additionally, the endangered West Indian manatee and American crocodile, seals and sea lions, several species of large fish, and a variety of sea birds, some endangered or at risk, have also been found captured or dead in the circulating water systems at atomic reactors.

The degradation of the marine environment as a result of this technology could have serious, and potentially irreversible, repercussions if operation of once-through nuclear reactors is allowed to continue unchecked.

The coolant system discharge structure used by these same reactors presents additional hazards by expelling water warmed to a higher temperature than the water into which it flows. Recent research findings suggest that even small elevations in temperature over long periods can alter the abundance of many species of marine life.[8] Consequently, indigenous species around reactor discharge systems are displaced and replaced by others unnatural to that environment. The warmer waters also attract sea turtles, fish, crabs, sea birds, and other organisms. Periodically, reactors are shut down, the flow of warm water stops, and the temperature of the waterway into which it flows abruptly drops. This can result in cold-stunning of the species occupying the waters. Warmer waters may also present other hazards. Studies have shown decreased reproduction and increased mortality in seabirds coinciding with warmer water.[9]

The degradation of the marine environment as a result of this technology could have serious, and potentially irreversible, repercussions if operation of once-through nuclear reactors is allowed to continue unchecked. Marine ecosystems are home to many kinds of living things that occur nowhere else. Marine species provide a livelihood for millions of people and food, medicines, raw materials, and recreation for billions worldwide; they are intrinsically important.[10] The nuclear industry argues that its negative effects, if any, are localized and temporary, and therefore have no long-term or widespread impact on species. This view is vehemently contradicted by the California Department of Fish and Game:

> The science of ecology has now generally recognized that the destruction or disturbance of vital life cycles or of the balance of a species of wildlife, even though initiated in one part of the world, may have a profound effect upon the health and welfare of people in distant parts; like pollution it does not cease to be of vital concern merely because the problem is created at a distant point.[11]

Clearly, the depletion of these resources by nuclear power and other factors will ultimately harm not only the creatures themselves but the ability of humans to prosper and survive.

An additional hazard results from the cleaning methods used by once-through reactors. When the water intake and discharge pipes become restricted with marine organisms such as mollusks, impeding the plant's efficiency, they are cleansed to eliminate what the industry calls "biofouling." A chemical concentration—usually chlorine or other biocides—is flushed through the system to kill or flush out these impediments. This operation can have grave consequences for the survival of wildlife essential in the food web. For example, chlorines have been found to disrupt the endocrine system of marine animals, affecting reproductive capacity.

Alternatively, reactors may be cleansed by flushing with superheated water or sponge balls. Hot water flushes can kill hundreds of tons of fish and larvae through scalding. Some plants have recorded sponge ball loss onto beaches and into the ocean where there is concern they could be ingested by sea turtles and other marine creatures.[12] Sponge balls are generally rubber balls slightly larger than the condenser inner tubes through which they are injected under pressure as a cleaning mechanism. The differential pressure between the inlet and discharge of the condenser forces the balls through the condenser tubes. Flexible cleaning plugs are used in the same way.

The critical importance of crustaceans and other small marine organisms destroyed in this process is overlooked in favor of plant efficiency. But their destruction may have far-reaching effects on sea creatures higher up the food chain. "We can do great harm to the system without actually endangering a species, by fundamentally altering the habitat or the system itself," wrote Wilder, Tegner, and Dayton.[13]

"We can do great harm to the system without actually endangering a species, by fundamentally altering the habitat or the system itself."

However, most of these activities continue unobserved and are self-reported by the industry. Utilities operating reactors capture and kill marine wildlife while the regulatory bodies meant to regulate them provide a virtual "license to kill" by permitting official annual kill numbers deemed unlikely to threaten the survival of a species.[14] Agencies like the Nuclear Regulatory Commission (NRC) and the National Marine Fisheries Service (NMFS) decline to end the destruction or effectively punish infractions and instead raise take limits (quotas of animals the utilities are permitted to capture or kill) to save utilities the financial burden of protective alternatives. This environment of greater regulatory latitude in favor of near-term profit is short-sighted and irresponsible, as Archie Carr, the renowned Florida naturalist, observed:

> The true test will come when . . . it becomes necessary to fight the indifference of most of the world and the active opposition of much of it, to surmount man's ingrained determination to put the far future out of his mind in matters of current profit.[15]

Increased human activities in waterways around reactors, particularly boating and fishing encouraged by plant owners, significantly worsen the plight of wildlife, particularly endangered species, rendering the nuclear industry's continual requests for higher takings even more inappropriate. However, unlike the nuclear industry, the shrimping industry and others engaged in "takings" do not claim to be helping to "protect the environment" or to be living "in harmony" with wildlife. Such external factors are ignored by the nuclear industry, which prefers to view its impact in a vacuum, unrelated to the cumulative effects of damage to marine species and environment. For example, nuclear power operators routinely petition NMFS and NRC for increased numbers in permitted sea turtle captures and kills, further jeopardizing the tenuous survival prospects for a species threatened with extinction.

Instead of accommodating the nuclear industry's financial wishes, regulatory agencies should take heed of the obvious indicators of environmental peril provided by nature itself. In the case of sea turtles, their plight has recently worsened due to an unexplained viral disease, called fibropapillomatosis (FP), now approaching epidemic proportions, particularly among green sea turtles. Scientific opinion is consistent in observing that the disease occurs near areas of heavy human use and in warmer, often contaminated near-shore waters, frequently causing severe immunosuppression in the infected animals. A currently less widespread virus, similar to the bovine fibropapilloma virus, has been observed in manatees, occasional victims of entrainment at nuclear plants. Dolphins in Florida's Indian River, near the St. Lucie nuclear reactors, have manifested

mysterious skin lesions resembling papillomas. These warning signs of potentially devastating epidemics, with a likely human cause, make it even more imperative that nuclear utilities do their part, together with other industries, to halt the activities that harm marine life, especially endangered, species.

Although harming and killing of seals, manatees, and sea turtles is an obvious attention-getter, the destruction of smaller organisms by nuclear power operation will likely have the most severe and long-lasting effect on the marine environment. Wrote Wilder, Tegner, and Dayton:

> Biodiversity at sea is greatest among smaller organisms such as diatoms and crustacea, which are crucial to preserving ecosystem function. Numerous types of plants such as mangrove trees and kelps have equally essential roles but are often overlooked entirely. We look away from the small, slimy and ugly, as well as from the plants, in making marine policy. The new goal must be to consider the ecological significance of all animals and plants.[16]

At present, the destruction of smaller marine organisms and habitat by nuclear power operations is a vastly overlooked and under-regulated area. However, even among endangered species, regulatory oversight may be incomplete, allowing unknown numbers of endangered and threatened animals to be killed at nuclear reactors. According to a study of U.S. nuclear reactor sites, commissioned by NRC in 1997, "the potential exists at every site that undocumented incidental take could occur, primarily because NRC staff and the licensees may not be aware that a threatened or endangered species may be present near a facility."[17]

"We look away from the small, slimy and ugly, as well as from the plants, in making marine policy. The new goal must be to consider the ecological significance of all animals and plants."

Organizations like the Marine Conservation Biology Institute (MCBI) and The Cousteau Society have called for the establishment of marine protected areas—no-take zones where marine species can thrive unthreatened by industrial, commercial, and recreational activities. The signers of a February 2000 'Call for Presidential Action' circulated by MCBI suggested "a benchmark goal of a minimum of 2 percent of U.S. marine waters protected in no-take marine protected areas within 5 years, spread geographically and across biomes."[18] The Sea Turtle Restoration Project advocates similar swimways and no-take zones for sea turtles. These experts and others recognize that swift action must be taken to stop the destruction of marine life before many precious species become extinct.

The prevention of such extinctions has become of paramount importance to scientists such as James W. Kirchner and Anne Weil who believe that "there are intrinsic limits to how quickly global biodiversity can recover after extinction events, regardless of their magnitude. They also imply that today's anthropogenic extinctions will diminish biodiversity for millions of years to come."[19] Kirchner and Weil found that "once ecosystems lose key species, they are not likely to recover their full function and biotic variety in less than about 10 million years."[20]

Implementation of the widely advocated *precautionary principle* offers a compelling solution. A 1993 gathering of leading scholars and other environmental experts in Wisconsin examined the failures of existing regulations to provide adequate protection for human health and the environment, and issued a statement in support of the precautionary principle that recommended:

> When an activity raises the threat of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically [emphasis added]. In this

context, the proponent of the activity, rather than the public, should bear the burden of proof.[21]

Wilder, Tegner, and Dayton also endorse the precautionary principle. They wrote:

> The precautionary principle stands in sharp contrast to the traditional marine policy framework: take as much as can be taken and pollute as much as can be polluted until a problem arises. Rather than wait for the environment to cry for help, the precautionary principle places the burden on fishermen, oil drillers, industry, farmers whose fields run to rivers or shores, and whomever else would exploit the sea, intentionally or not, to avoid harming this precious resource in the first place.[22]

Notes

[1] Archie ("Chuck") Carr, III, "A Century of Sea Turtles," Keynote Address, 20th Annual Symposium on Sea Turtle Biology and Conservation, March 1, 2000, Orlando, FL.

[2] Charles Babington, "Clinton Imposes Reef, Coastline Protections," *Washington Post on-line,* May 27, 2000.

[3] Tundi Agardy, "Creating Havens for Marine Life," *Issues in Science and Technology* (Fall 1999): p.1.

[4] "Safeguarding America's Seas, Establishing a National System of Marine Protected Areas, A Call For Presidential Action," petition circulated by the Marine Conservation Biology Institute, Redmond, WA, February 14, 2000, p. 2.

[5] Ibid., p. 3.

[6] Marine Environmental Research Institute, "Marine Mammal Die-offs," Blue Hill, ME, www.meriresearch.org/monitor.html.

[7] Robert J. Wilder, researcher, Marine Science Institute and lecturer in Environmental Studies Program, University of California; Mia J. Tegner, marine biologist, and Paul K. Dayton, professor of oceanography, both of Scripps Institute of Oceanography, University of California, San Diego, "Saving Marine Biodiversity," *Issues in Science and Technology* (Spring 1999): p.7.

[8] R.D. Sangarin, J.P. Barry, S.E. Gilman, and C.H. Baxter, "Climate Related Change in an Intertidal Community over Short and Long Time Scale,"*Ecological Monographs* 69 (1999): 465–90.

[9] Amy Mathews-Amos and Ewann A. Berntson,"Key Findings of the New WWF/MCBI Report, Turning Up the Heat: How Global Warming Threatens Life in the Sea," MCBI, Redmond, WA, 1999, p. 1.

[10] "Safeguarding America's Seas," p. 3.

[11] California Department of Fish and Game, Legal Department, "In the Matter of WDR Order 90-09 Diablo Canyon Nuclear Power Plant," Memorandum to Regional Water Quality Control Board, February 29, 2000, p. 8.

[12] Florida Power Company, "Biological Assessment for Crystal River," FOIA #2000-0182, Appendix A5, submitted to NRC October 1, 1998, p. 23.

[13] "Saving Marine Biodiversity," p. 2.

[14] For a discussion of the laws and regulations governing these issues, see chapter 6, this report.

[15] Archie Carr, "A Naturalist in Florida, A Celebration of Eden. Essay," *A Dubious Future* (New Haven, CT.: Yale University Press, 1994) p. 233.

[16] "Saving Marine Biodiversity," p. 2.

[17] M.R. Sackschewsky, *Threatened and Endangered Species Evaluation for 75 Licensed Commercial Nuclear Power Generating Plants,* Executive Summary, Pacific Northwest National Laboratory (operated by Battelle for the U.S. Department of Energy), Richland, WA, March 1997, p. iv.

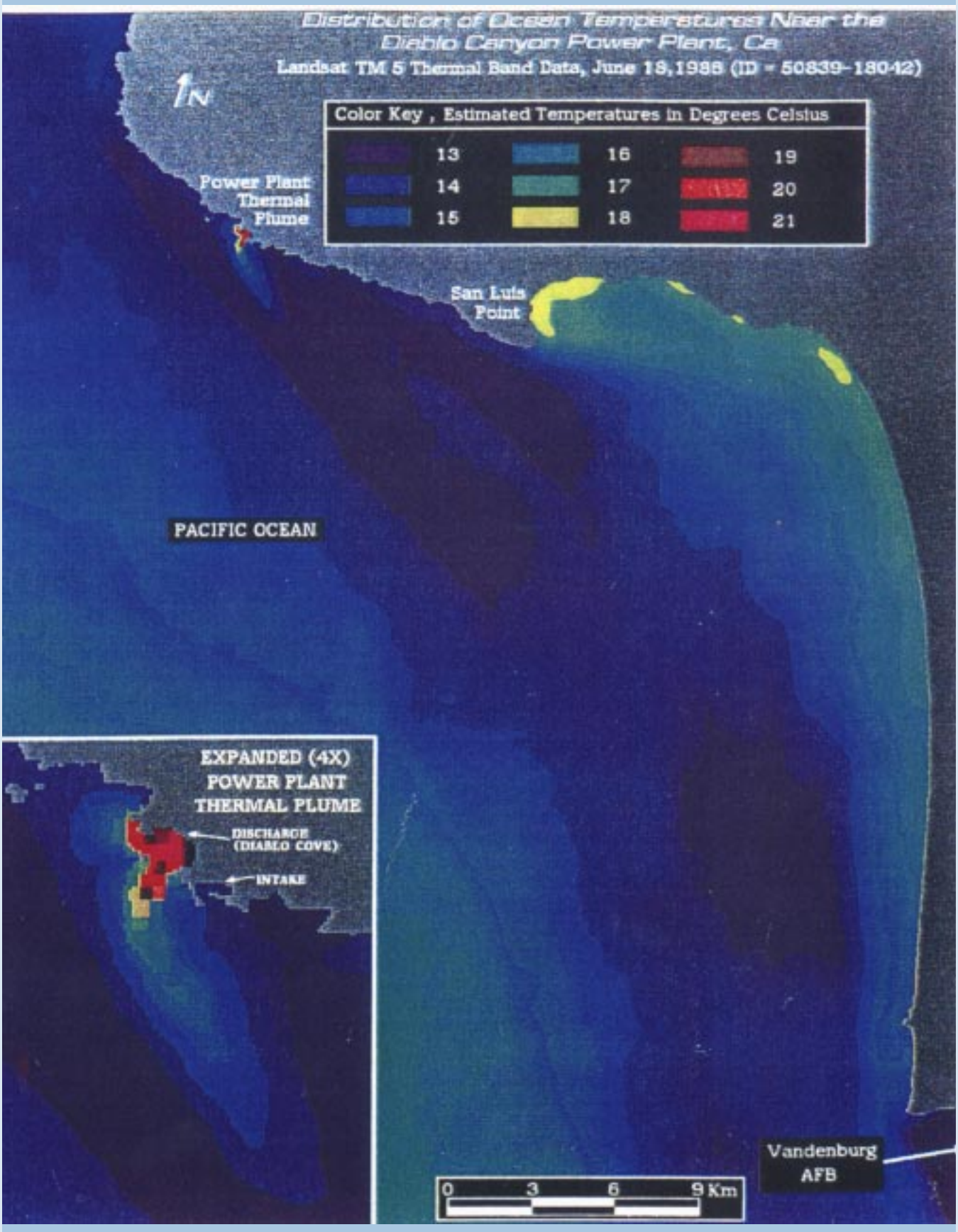
[18] Safeguarding America's Seas, p. 1.

[19] James W. Kirchner, Department of Geology and Geophysics, University of California, Berkeley, CA, and Anne Weil, Department of Biological Anthropology and Anatomy, Duke University, Durham, NC, "Delayed Biological Recovery from Extinctions Throughout the Fossil Record," *Nature* (March 4, 2000), www. nature.com

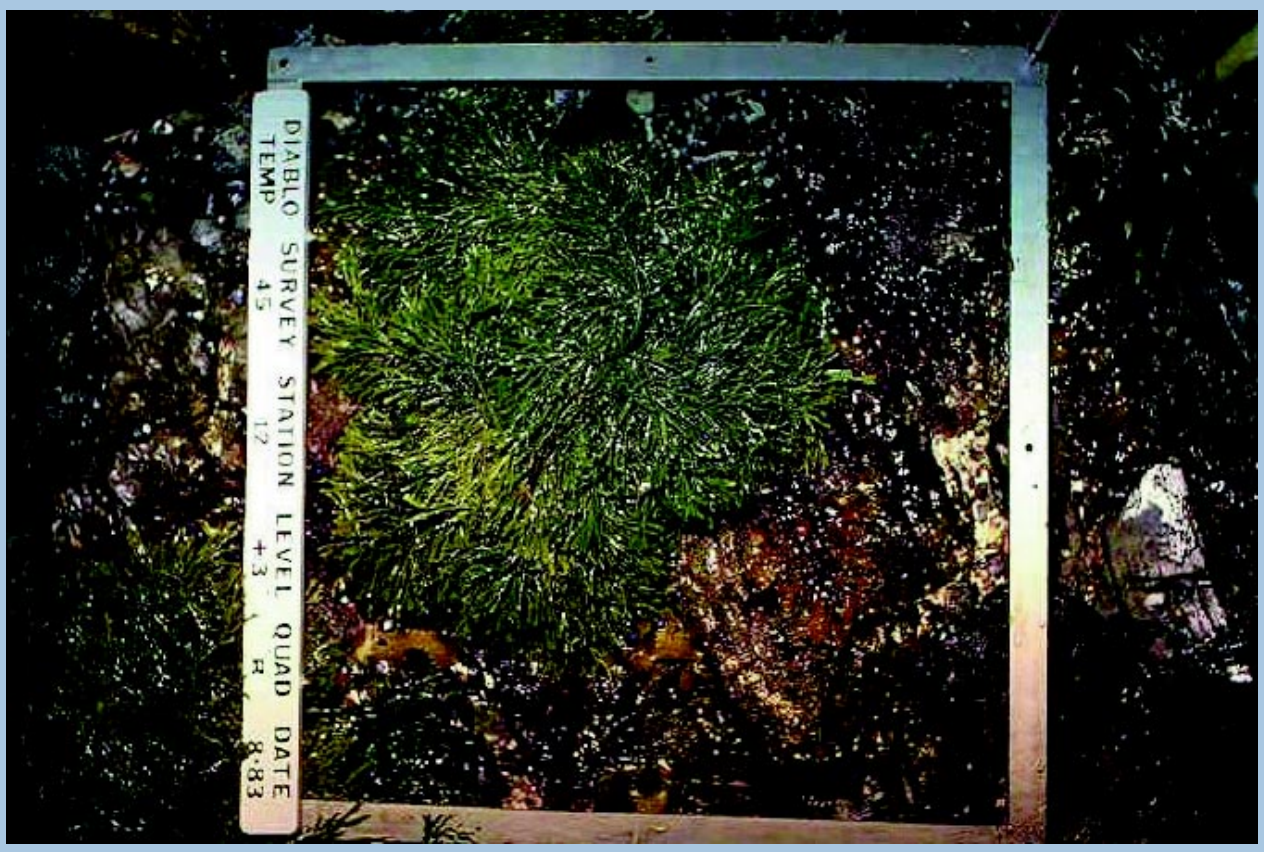
[20] William K. Stevens, "The 'Hot Spot' Approach to Saving Species," *New York Times*, March 14, 2000.

[21] "Wingspread Statement on the Precautionary Principle," Statement from the work session: Environmentally Induced Alterations in Development: A Focus on Wildlife, December 10–12, 1993, Racine, WI.

[22] "Saving Marine Biodiversity," p. 4.



California's Diablo Canyon Nuclear Power Station takes in 2.5 billion gallons of coastal water a day and discharges the same volume heated up by 23 degrees F. Infrared photographs (shown) reveal that thermal damage in Diablo Cove and beyond is far more extensive than originally predicted by PG&E.



BEFORE: A 1983 photograph from an environmental impact study documenting a pristine and thriving marine ecosystem in Diablo Cove prior to the full power operation of the Diablo Canyon Nuclear Power Station in 1986.

AFTER: The same quadrant photographed in 1991 after 5 years of thermal discharge from Diablo Canyon Nuclear Power Station showing bare rock, the complete reduction of a marine community throughout Diablo Cove.

This loggerhead turtle was found badly injured after entrainment through Florida Power & Light's St. Lucie intake tunnel in 1997. After being sent to a rehabilitation facility, the animal died. A 1985 FPL report as well as a 1990 National Academy of Sciences study cite transit through the St. Lucie pipe as harmful to sea turtles but the utility usually places blame on causes unconnected to reactor operation.

Sea turtles are routinely killed at U.S. nuclear reactors. Meanwhile, the industry makes hollow boasts about nest and hatchling protection at the same time it asks for permission to kill more sea turtles each year. This green sea turtle was found dead in the St. Lucie intake canal in 1997 and is typical of mortalities at the St. Lucie reactors and elsewhere.

At St. Lucie, where as many as 933 sea turtles have been captured or killed in one year, the utility tries to present a very different face to an unsuspecting public, even refering to its land as a "Sea Turtle Sanctuary."

Some Arguments For Nuclear Energy Are Smaller Than Others.

Around the nuclear electric plant on Florida's Hutchinson Island, endangered wildlife have a safe haven. The baby sea turtles hatching on nearby beaches are more evidence of the truth about nuclear energy: it peacefully coexists with the environment.

America's 110 operating nuclear plants don't pollute the air, because they don't burn anything to generate electricity. Nor do they eat up valuable natural resources such as oil and natural gas.

Still, more plants are needed—to help satisfy the nation's growing need for electricity without sacrificing the quality of our environment. For a free booklet on nuclear energy, write to the U.S. Council for Energy Awareness, P.O. Box 66080, Dept. HP01, Washington, D.C. 20035.

Nuclear Energy Means Cleaner Air.

As this 1992 advertisement shows, the nuclear industry is shameless in its distortion of the truth. The industry touts St. Lucie as a "safe haven" for sea turtles where the animals can "peacefully coexist" with a technology that captures hundreds of sea turtles a year, a majority of them mothers attempting to nest.

1

Sea Turtles in Crisis

How hundreds of endangered sea turtles are routinely killed and captured annually at U.S. reactors.

"The agents of destr uction ar e no w in motion. We can see that in our tur tles, in the appearance of mysterious cancers, or fibr opapillomas, on their bodies, deriv ed fr om what was the benign sea; the v ery cr ucible of life. The tur tles pr o vide us with windo ws into the health of the oceans, and w e already kno w the vie w through those windo ws is mur ky with biospheric danger ." —Archie ("Chuck ") Carr, III[1]

In the United States, sea turtles are protected under the Endangered Species Act. Six of the seven species of sea turtle are listed worldwide as endangered or threatened, and five of the species—*Caretta caretta* (loggerhead), *Lepidochelys kempi* (Kemp's ridley), *Chelonia mydas* (green), *Dermochelys coriacea* (leatherback) and *Eretmochelys imbricata* (hawksbill)—have been captured or killed at U.S. reactors.

The Assault on Sea Turtles

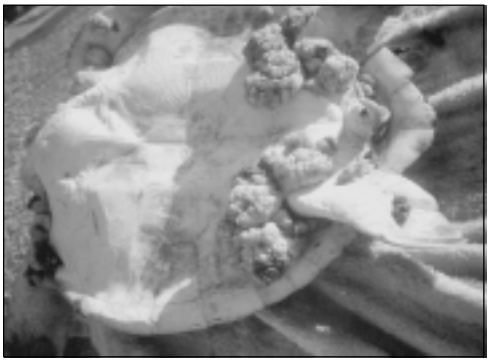
Sea turtles have been in existence for millions of years: the first fossil records date back 150 million years. However, due to human activities, sea turtle numbers are now in severe decline in most parts of the world. The millions of sea turtles that once roamed the earth's oceans are now reduced in number. Within the past five centuries, trade in sea turtle meat, eggs, shell, oil, and leather has driven these species toward extinction.[2]

Endanger ed and thr eatened sea tur tles ar e the most common victims among larger animals at atomic r eactors. This loggerhead sea tur tle was found dead in the S t. Lucie plant intake system in F lorida.

Sea turtles are the most severely affected among endangered or threatened marine species by the operation of atomic reactors. Every year at U.S. coastal nuclear power plants using the once-through cooling system, sea turtles are harmed or killed, sometimes in large numbers, through entrainment or impingement. Sea turtle captures and deaths have been documented at the Diablo Canyon and San Onofre nuclear reactors on the California coast and at the Salem, Oyster Creek, Brunswick, St. Lucie, and Crystal River reactors on the East coast. Other plants not examined here may also be taking sea turtles.

Sea turtles are being assailed from all directions. The shrimping and long-line fishing industries, sea turtle fisheries around the world, collisions with boats, ingestion of plastics and debris, and the destruction of foraging habitat and nesting beaches due to construction, beach renourishment and armoring, and excessive lighting, all contribute to the decimation of sea turtle populations.

A more recent killer is a virus first described in captured sea turtles in the 1930s, observed in mariculture-reared green sea turtles in the late 1970s, and recorded in rapidly increasing prevalence in the wild starting in 1982.[3] Identified as fibropapillomatosis, it is believed to be a form of herpes virus of as yet unidentified etiological origin. The fibropapilloma (FP) virus has been observed in sea turtles worldwide. Although scientists have arrived at no firm conclusions about what has triggered the epidemic, the strongest hypotheses favor contamination of the seas by human-caused toxic pollutants as well as potentially warmer waters due to global climate change that allow the virus to flourish. According to noted sea turtle researcher Dr. George Balazs, "turtles under stress from pollution could be more vulnerable to a virus that would otherwise be relatively harmless."[4]



A sea turtle suffering from fibropapilloma virus. Scientists believe warmer, contaminated water contributes to the epidemic.

Sea turtles with the FP virus are found more frequently in near-shore habitats than in oceanic environments and in cloudy and dirty rather than clear and clean waters. This inevitably coincides with the presence of shoreline industry, including atomic reactors. On the Atlantic seaboard, sea turtles are generally observed in these shallower near-shore waters. "Green turtles free of FP migrate to the neritic zone along the Florida coast and remain free of tumors while residing there," observes Dr. Lew Ehrhart, who studies green sea turtles at the University of Central Florida. "Many of these turtles may become infected when they enter the lagoon system."[5]

If FP is indeed a herpes virus, then stress is considered a likely trigger, potentially a result of the many man-made alterations to and contamination of the marine environment. Sea turtles with advanced FP may be chronically stressed and immunosuppressed.[6] Elevated water temperatures, identified by researchers as a potential contributing factor to the spread of the FP virus, are present around the discharge structures of nuclear power plants. These warmer waters' potential for exacerbating the FP problem should be examined. Stress could also be a contributing factor. Research of sea turtles in captivity by Dr. Paul Klein and others at the University of Florida has found that immunosuppression is not required for the manifestation of the disease.[7]

Sea Turtle Deaths at Nuclear Power Plants

At atomic reactors, sea turtles generally die through drowning or, more accurately, suffocation when becoming trapped against underwater intrusion detection systems and trash racks, or in barrier nets designed to capture sea turtles reaching the intake canals or cooling ponds. Although debate still rages about whether animals feel emotions, it is hard to argue that this experience is painless for sea turtles. "For a sea turtle to drown would be the equivalent of being put in a room and having all the oxygen sucked out for a human," says Todd Steiner, executive director of the Sea Turtle Restoration Project, a California-based nonprofit organization dedicated to the protection of sea turtles and marine biodiversity.[8]

...sea turtle deaths at St. Lucie "resulted from injuries sustained in transit through the intake pipe, from drowning in the capture nets, and perhaps from causes before entrainment."

An unknown number of sea turtles may die later from injuries sustained during capture, either at rehabilitation facilities or after release back into the wild. In analyzing data from Florida Power & Light's (FPL) St. Lucie plant on Florida's East coast, the 1990 National Academy of Sciences (NAS) sea turtle study concluded that sea turtle deaths at St. Lucie "resulted from injuries sustained intransit through the intake pipe, from drowning in the capture nets, and *perhaps* [emphasis added] from causes before entrainment."[9]

A 1985 FPL study on sea turtle entrainment at the St. Lucie plant noted:

> The potential for injury during passage through the intake pipe was also a concern. Approximately 7 percent (75 out of 1135) of the sea turtles removed from the intake canal had recent lacerations, abrasions or other injuries that may have resulted from passage through the pipes. Wounds were considered minor in approximately 51 of the entrapped animals and major (deep cuts, broken flippers, etc) in 24 of the animals.[10]

There are contradictory data assessing whether sea turtles voluntarily swim into or are sucked through the opening to the St. Lucie intake pipe. A March 2000 St. Lucie Sea Turtle Entrainment Study, conducted for FPL by Ecological Associates, states: "When turtles use the [intake] structures as shelters, they may be rapidly drawn into the intake pipes."[11] The same report states: "The animals must actively enter the structures before they encounter water velocities sufficiently strong to affect their entrainment."[12] However, the study concludes that "once within the intake pipes, velocities prevent most turtles from escaping."[13]

Typically, nuclear utilities are eager to deflect blame for sea turtle deaths at their facilities, and, in reporting sea turtle takes, attempt to categorize most as "noncausal" to plant operation.

Curiously, except for FPL's 1985 study, no other utility documents could be found that cite transit through the St. Lucie intake pipe as a cause of sea turtle injury or death. In the company's Daily Event Reports (DER), required by the Nuclear Regulatory Commission (NRC) under the plant's licensing agreement, sea turtle mortalities are generally attributed to the NAS "perhaps" factor such as boat propeller injuries, shark attacks, or emaciation from the FP virus.

Florida Power & Light's St. Lucie plant may have made more aggressive attempts than others to mitigate sea turtle deaths, largely because it captures more sea turtles than other U.S. plants—an average of 252 a year between 1978 and 1998. In 1978, St. Lucie installed a sea turtle barrier net under the state route A1A bridge across its intake canal in an effort to prevent sea turtles from traveling farther into the plant's intake system. However, smaller sea turtles continued to pass through the eight-inch mesh and drown in the intake wells and tangle nets during rescue. In an effort to correct the problem, FPL looked into potential sea turtle deterrents such as strobe lights, bubble curtains, electrical fields, and pneumatic guns. However, the company concluded that none of these deterrents would function with guaranteed efficacy.[14]

In January 1996, the utility installed a second barrier net, but with a five-inch mesh, beyond the A1A net, after a consultation with National Marine Fisheries Service (NMFS). An underwater intrusion detector system was installed in January 1987. However, the five-inch and A1A nets have to be lowered whenever an algae load or influx of jellyfish render them ineffective, since blockage of the nets reduces the intake flow into the plant's cooling system, resulting in plant inefficiency. When the nets are lowered, sea turtles pass over them and drown in the intake wells and the underwater intrusion detector system. The addition of the five-inch net did little to reduce capture numbers, which decreased only slightly, from 933 in 1995 to 906 in 1996, after its installation.

Typically, nuclear utilities are eager to deflect blame for sea turtle deaths at their facilities, and, in reporting sea turtle takes, attempt to categorize most as "noncausal" to plant operation. A typical description of a dead loggerhead finding at the plant reads: "Due to its condition, its death does not appear to have been caused by conditions in the plant intake canal."[15] Verification of cause of death, for this animal and many others, is left largely to the judgment of plant personnel.

Total Number of Captures and (number of dead) turtles removed from the intake canal, St. Lucie Plant, 1976-1997

	SPECIES					
YEAR	Loggerhead	Green	Leatherback	Hawsbill	Kemp's Ridley	TOTAL
1976	33(4)					33(4)
1977	80(5)	5(2)	1			86(7)
1978	138(19)	6(1)	3	1		148(20)
1979	172(13)	3(1)				175(14)
1980	116(5)	10(3)				126(8)
1981	62(5)	32(2)	2		1	97(7)
1982	101(16)	8	1			110(16)
1983	119(4)	23(4)				142(8)
1984	148(3)	69(2)		1	2	220(5)
1985	157(4)	14		1		172(4)
1986	195(27)	22(1)	1	1	1	220(28)
1987	175(11)	35)		2	6(2)	218(13)
1988	134(6)	42(2)			5(2)	181(10)
1989	111(4)	17(1)	1	2	2	133(5)
1990	112(1)	20(2)				132(3)
1991	107(1)	12		1	1	121(1)
1992	123(2)	61(2)	1	2		187(4)
1993	147	179(1)	5	2	4	337(1)
1994	164	193(4)	2		2	361(4)
1995	254(1)	673(15)	1		5	933(16)
1996	349(3)	549(4)		5	3	906(7)
1997	188	191(5)	2	1		382(5
Total	3185(134)	2164(52)	20	19	32(4)	5420(190)
Annual Mean	150.1	103.0	1.0	0.9	1.5	256.5

**Excludes 1976 (partial year of plant operation).*

Carolina Power and Light's (CP&L) Brunswick nuclear power station on the Cape Fear River estuary in North Carolina reported a dead loggerhead with "rear flipper missing. Possible propeller marks on top of shell. Shell not broken."[16] Another report, by FPL, states "One sick sea turtle and one dead sea turtle were removed from the plant intake canal . . . Initial investigation indicates that neither incident was causally related to plant operation."[17] At other times, nuclear utilities decline to identify the cause of death. "A relatively small green turtle was found against the A1A barrier net," read an FPL report. "Cause of death could not be determined."[18] This kind of subjective decision making leaves open to speculation how many sea turtles are in fact hurt by intake into reactor systems, since utilities consistently prefer to deflect the blame elsewhere.

An Eyewitness Account

The likelihood of severe injury to sea turtles resulting from transit through the St. Lucie intake pipe is supported not only by FPL's 1985 data and the NAS study, but also by the first-hand experience of Bill Lamm, a Vero Beach scuba diver who was entrained at St. Lucie in a harrowing and life-threatening experience in June 1989. While spear fishing underwater near the intake structure, located approximately 1,600 feet out into the Atlantic Ocean, Lamm was abruptly sucked into the intake pipe on a ride so terrifying that he considered suicide before emerging inside plant boundaries in the intake canal. "I thought if I just took the regulator out of my mouth I could die fast," Lamm told reporters after the event.[19] Lamm described being propelled in extreme turbulence and complete darkness. "When you first go in you're just bouncing around, you're bouncing all over the place, you're hitting all the walls just tumbling around."[20] After being bumped and bashed against the barnacle-encrusted pipe, Lamm's wet suit was shredded and his steel scuba tanks deeply gored. "[I]t just looked like somebody took a knife and just started slicing all over the place," he said.[21]

Vero Beach scuba diver, Bill Lamm, was sucked through the St. Lucie intake pipe in 1989. Lamm described the experience as harrowing and his scuba suit and tanks were gored en route by barnacles inside the pipe.

Lamm's life was saved by his breathing apparatus and his ability to overcome an initial sense of panic. "They were surprised I survived," Lamm said of the FPL officials he sought out after his ordeal. "Number one, the amount of water going through that pipe is just horrendous. It's a lot of water."[22] Lamm knows he is one of the fortunate ones. "I feel really sorry for the animals that have to go through that," he said. "I'm told quite a few . . . do go through there. I know all of them don't make it. It'd be impossible for all of them to make it . . . I wouldn't want to do it again. Once is enough."[23]

After the incident, Lamm was stunned to learn that FPL intended to sue him for trespass, a charge the utility quickly dropped. Lamm eventually reached an out-of-court settlement for an undisclosed sum after filing suit against the utility, alleging company negligence caused the accident.[24] An investigation by NRC two months later discovered a hole in the concrete slab covering the entrance to the intake pipe, which was likely responsible for Lamm's entrainment. At the time of the incident, FPL denied the intake structure was damaged. Repairs to the intake structure were not completed until almost three years later, in February 1992, after two endangered manatees had also been sucked through the pipe in March and September 1991. Although the animals reportedly survived, the efficacy of these repairs is questionable. Since 1992, at least three more manatees have been sucked into the St. Lucie intake canal through the pipe, again with nonlethal results but suggesting the repairs have been inadequate to protect marine mammals and, potentially, other humans from entrainment.

> *. . . Lamm was abruptly sucked into the intake pipe on a ride so terrifying that he considered suicide before emerging inside plant boundaries in the intake canal.*

Inconsistent and Unreliable Reporting

The annual capture and mortality rate of sea turtles at U.S. reactors is difficult to estimate, due to inconsistencies in reporting by the utilities and the lack of oversight by NRC and NMFS. Nuclear utilities are required by the incidental take statement (ITS), issued by NMFS and overseen by NRC, to report all lethal and nonlethal captures of sea turtles. (For an explanation, see chapter 6, this report.) Limits on the numbers of sea turtles that can be "taken" at reactors are set by NMFS, and plants are required to remain within these limitations. Regulatory oversight is scant at best, and incidental take statements have apparently not been issued for most nuclear plants where endangered species are affected.[25] It is unclear whether this lack of these statements stems from the utilities' failure to inform regulatory authorities of captures of endangered species or from NMFS and NRC oversight in issuing permits.

CP&L was found to be operating without an incidental take statement for sea turtles at its Brunswick atomic complex until an NMFS official drew attention to this oversight . . .

Regulatory authorities have to rely on power plant personnel's complying with licensing requirements and truthfully reporting the number of takes.[26] In the case of Florida Power Company's (FPC) Crystal River Energy Complex on Florida's West Coast, FPC correspondence shows that, in 1998, utility personnel decided not to report takings to NRC at all unless they were lethal. An off-site notification sent to NRC read: "The licensee plans to routinely notify the FDEP [Florida Department of Environmental Protection] for future capture of live turtles; however, the licensee does not plan to report to the NRC each individual notification of the FDEP. Notification will be made to the NRC when FDEP is notified of a deceased turtle."[27] This is a violation of their license, which requires licensees to report all "takes" to NRC who in turn must pass the information on to NMFS.

CP&L was found to be operating without an incidental take statement for sea turtles at its Brunswick atomic complex until an NMFS official drew attention to this oversight, reported in an NRC internal e-mail that read:

> [She] mentioned that Brunswick is taking turtles and there is no incidental take statement. She found out through the state of SC. She said we better check into it and maybe begin a consultation. Given the heat the shrimp fishery has been taking, all other sources of mortality better be covered by ITS.[28]

CP&L, like other utilities, makes subjective judgments about responsibility for sea turtle deaths at its facility. CP&L reported 49 sea turtle captures and 3 mortalities at Brunswick in 1996 at a September 14, 1999, meeting to discuss the biological opinion issued by NMFS for the plant.[29] However, Brunswick's individual reports to the Sea Turtle Stranding and Salvage Network for 1996 show a total of 13 mortalities for that year, 10 more than the 3 indicated in the September 1999 view graphs and 3 more than the annual lethal take limit. The lower number fails to reflect mortalities Brunswick considers "noncausal" to the plant. If a turtle "most likely washed into the intake canal already dead," it may be arbitrarily discounted in Brunswick's official graphs showing capture and mortality numbers.[30] Brunswick and other plants also do not count as mortalities any sea turtles that were injured when captured but died after being sent to rehabilitation.

In California, reporting appears even less regulated. NRC may not be contacted at all, or utility reports of takes are not posted publicly by NRC on its web site as Daily Event Reports. According to an official from the NMFS Southwest office, takes of sea turtles at Edison's San Onofre reactors are reported directly to him by the chief scientist at the plant and not by NRC. "We haven't had much contact with the NRC on this issue," said Joe Cordaro, NMFS Southwest biologist.[31] An entrainment record provided

by NMFS Southwest showed nine sea turtles captured at the plant between 1983 and 1991, two of them mortalities and all involving green sea turtles. Data were not available for 1984, 1987, or 1989, therefore the numbers are incomplete.[32]

Even taking these inconsistencies into account, the numbers of sea turtles killed or captured annually can be estimated at close to 1,000 in some years at the plants studied. For example, at St. Lucie, annual capture rates ranged from 86 in 1977 to 933 in 1996; they averaged 634 a year during a four-year period between 1993 and 1996.

The numbers of sea turtles killed or captured annually can be estimated at close to 1,000 in some years at the plants studied.

The Marine Mammal Stranding Center (MMSC) in Brigantine, NJ is the only independent facility in the state responsible for tracking, counting, and rehabilitating marine mammals and sea turtles. However, its director, Bob Schoelkopf is no longer informed by PSE&G when its Salem reactors capture sea turtles. Schoelkopf had been collecting and rehabilitating injured sea turtles from Salem at the utility's request as well as performing necropsies. But when Schoelkopf reported the need for the utility to reestablish new take limits with NMFS after sea turtle takes exceeded legally permissible levels, the plant owners severed ties with Schoelkopf and the MMSC.[33]

The Lure and Dangers of Nuclear Reactors for Sea Turtles

The NAS study attributed high sea turtle capture rates at St. Lucie to the fact that:

> [T]he continental shelf is narrow in that area, and that seems to cause the normally high density of turtles passing along the coast to be concentrated near the shore, where the coolant-water intake tube is. Second, that part of the coast appears to be on the main coastal migratory route for turtles in the region.[34]

In addition, high captures can be accounted for in part because the plant was built on a loggerhead nesting beach. The March 2000 Entrainment Study found that females comprised more than 85 percent of the adult loggerhead captures at St. Lucie between 1977 and 1998.[35] Of the adult loggerheads, 562 were females, and 75 were males.[36] The study concluded that: "the fact that seasonal trends in adult captures coincided with seasonal trends in nesting suggests that many of the females captured at the St. Lucie plant intake may have migrated to the area for the purpose of nesting."[37]

Evidence also suggests that sea turtles are attracted to waters around atomic reactors because the artificially elevated water temperature caused by the discharge system changes the marine environment and may attract greater numbers of prey such as crabs. The FPL Entrainment Study reported that: "Changes in the abundance of loggerhead and green turtle food items in the vicinity of the intakes might also affect the abundance of these two species in the area of the intake structure."[38] Sea turtles travel into dangerous proximity of the intake system at the Crystal River reactor and linger there because of the lure of food items that collect there. An FPC report states that: "Possible contributing factors (to increased numbers of sea turtles in the intake basin) include . . . changes in prey abundance."[39] FPC's biological assessment of sea turtle captures at the Crystal River Unit 3 nuclear reactor observed: "FPC has postulated that marine growth on the intake bar racks might be one of the reasons sea turtles remain in the intake canal. The turtles may regard some of the marine organisms on the bar racks as food items."[40]

In addition, the intake structures create an artificial reef that is enticing as a feeding and resting ground for sea turtles. In fact, sea turtles may mistake intake structures for reefs, increasing their chances of

entrainment. The FPL study found that "the large opening between the velocity caps and the base of the intake structures may very much resemble a reef ledge and appear to offer an ideal resting site to turtles."[41]

The study also found that the warmer water expelled through the discharge system may lure sea turtles closer to reactors, increasing their chances of entrainment. "The second discharge pipe in combination with the second power plant would also be expected to increase the thermal plume in the general area of the intake structures," the study stated. "This might act as an attractant to sea turtles during cooler periods thus increasing their probability of entrainment."[42]

In the event of a sudden reactor shutdown, the water temperature around the discharge system abruptly drops. This can place sea turtles at risk of cold-stunning, an event that also causes large fish kills around atomic reactors. Cold-stunning, similar to hypothermia, is brought on by sudden exposure to cold water temperatures. It is usually fatal to sea turtles, if they cannot reach warm waters within 24 hours after exposure. Sea turtles remaining close to the reactor after being lured there by the discharge plume, may also risk cold-stunning if the sea water temperature drops rapidly, especially in enclosed shallow bays such as around the Oyster Creek reactor on Barnegat Bay, NJ. There, sea turtles are not only threatened by impingement at the cooling intake system but are also at risk of cold-stunning around the discharge system, according to an NMFS biological opinion for the facility. "Turtles may be attracted to the thermal effluent from the discharge canal that warms Oyster Creek, and could be cold-stunned when leaving the creek and returning to the colder water in Barnegat Bay in the late fall," the opinion stated.[43]

"Turtles may be attracted to the thermal effluent from the discharge canal that warms Oyster Creek, and could be cold-stunned when leaving the creek and returning to the colder water in Barnegat Bay."

Although the evidence demonstrates that sea turtles are attracted to both the intake and discharge structures around nuclear plants, the NMFS opinion on whether all dead sea turtles found at nuclear power plants should be considered causal to the plant's operation varies from case to case. In reviewing Salem, for example, NMFS stated: "The possibility that the Salem Generating Station is attracting turtles to the area is sufficient to include turtles that have been dead for some time before impingement in these assessments of take."[44] Regarding the Oyster Creek Nuclear Generating Station, NMFS concluded:

> The possibility that the OCNGS is attracting or diverting turtles into the plant is sufficient enough that turtles that may have died before impingement should be included in the assessment of take, unless the cause of death is readily visible (such as a traumatic propeller injury) or is revealed through necropsy.[45]

However, when reviewing sea turtle takings at the Crystal River plant, which combines cooling canals with a once-through system, NMFS found "that dead turtles floating in the canal are not causally related to plant operation" and that:

> [S]everely decomposed turtles found on the bar racks are not causally related to plant operations . . . Therefore dead sea turtles not considered causally related to plant operations and verified by the FDEP [Florida Department of Environmental Protection] are not considered taken by CREC [Crystal River Energy Complex].[46]

Such noncausal judgments are made entirely subjectively by plant personnel without the necessity of proof.

Causes and Impacts of Sea Turtle Deaths at Nuclear Reactors

Despite arguing for a distinction between "causal" and "noncausal" sea turtle deaths in order to legally take a greater number of animals, nuclear utilities admit that the precise cause of death can be difficult to determine. After a sudden influx of Kemp's ridleys at Crystal River's Unit 3 reactor in 1998, FPC wrote vaguely to NRC: "The exact causes of death of the sea turtles at Crystal River appear varied and are usually difficult to determine." FPC would concede only that 4 of the 11 deaths may have been drownings against the CR-3 intake structure and therefore causal to plant operation.[47]

Public relations efforts by nuclear utilities eagerly boast about nest protection efforts such as CP&L's beach nest warning signs or FPL's nest counts, without mentioning the destruction of adult animals at the reactors. There are no reports of hatchlings entrained at nuclear reactors, but their tiny size means they would likely remain unobserved as they passed through the reactor cooling system with other smaller fish and organisms that are rarely discharged alive at the end of the process. The known sea turtle victims are juveniles, subadults, and adults, all critical members of the population. Their deaths contribute to a cumulative impact.

The taking of juveniles and subadults appears to affect populations significantly, as removing larger sea turtles approaching breeding age has an adverse impact on overall population stocks.[48] Although hatchling production is important, mortality of adult sea turtles has a far greater impact on the survival of the species than mortalities among hatchlings. In simulation studies using a stage-based population model for loggerhead sea turtles, researchers found:

> [T]he key to improving the outlook for these populations lies in reducing the mortality in the later stages, particularly large juveniles . . . By increasing survival of large juveniles (who have already survived some of the worst years) a much larger number of turtles are likely to reach maturity, thereby greatly magnifying the input of the increased reproductive value of the adults stages.[49]

The researchers felt that current conservation efforts may be focusing too much on hatchling protection, "the part of the turtle's life history least likely to produce noticeable, long-term results."[50] Dr. Richard Reina, who primarily studies Pacific leatherback sea turtles in Costa Rica, agrees.[51] "It's extremely important to protect the adult and subadult turtles because they are the ones who determine the success or the failure of the population," he said.[52]

Nuclear Power's Impacts on Sea Turtle Food Supplies

The survival of sea turtles may be affected indirectly by the operation of nuclear power as well as by direct entrainment. The destruction of sea turtle food supplies such as crabs, jellyfish, and mollusks by the effects of the once-through cooling system can deprive the creatures of once abundant food supplies. The killing of seagrass beds deprives green sea turtles of an essential food source. Since countless billion marine organisms are entrained each day and most of them do not survive the entrainment process, nuclear power operation may be diminishing the sea turtle's essential nutrient sources.[53]

Horseshoe crabs, a food source for the loggerhead sea turtle, have been decimated by the Salem plant's failed attempt at environmental restoration, its Estuary Enhancement Program.[54] (See chapter 3, this report.) Though not the only factor in the decline of horseshoe crabs, the reactors are part of the cumulative effect. Mollusks are destroyed after accumulating in and around a plant's intake and discharge structures. The plant may flush the system with sodium hyperchlorite or biocides to destroy these organisms, disrupting the food chain and the supply of prey for sea turtles. The effect of these biocide releases, though diluted, on sea turtles and their prey is largely unknown, but research suggests

these substances may disrupt the endocrine systems of marine mammals and reptiles, seriously impairing reproductive success.

An Inhumane Method of Capture

FPL and a few researchers focused on sea turtle rehabilitation efforts have argued that the capture of sick or injured sea turtles at nuclear power plants contributes in a positive way to the study of sea turtle population numbers. FPL alleges its "Canal Capture and Release Program . . . has provided an invaluable source of population information for loggerhead and green turtle populations."[55] At the Marinelife Center of Juno Beach, FL, a rehabilitation facility that receives sea turtles from St. Lucie, Larry Wood, marine curator, points out that "turtles in need of medical care are found by the staff at the intake that would not have been otherwise found. Many sick or injured turtles were rehabbed and re-released as a result of the intake canal and the expertise of the staff."[56] This argument is supported by Richie Moretti, director of the Turtle Hospital, a sea turtle rehabilitation facility in Marathon, FL, who says he receives about 75 percent of his injured or sick sea turtles from St. Lucie. "If they kill five a year and we save eight of their turtles, then they're three turtles ahead," said Moretti. "It would be nice if they didn't kill any but it also saves a lot of turtles lives because if they had not been caught they would have died."[57]

However, the fact that female loggerheads are entrained in large numbers at St. Lucie while attempting to nest on rookeries, some of which are now occupied by reactor buildings, makes a mockery of FPL's hollow publicity about its nesting surveys and capture and release efforts. Furthermore, since scientists have yet to establish the cause of, and a cure for, the FP virus, it is unknown whether captured sea turtles suffering from the disease and rereleased after treatment, survive for a significant time period in the wild. "A few animals may be releasable, and many tumors may grow back," says Dr. Elliott Jacobsen, a veterinarian at the University of Florida who works on sea turtles with the FP virus.[58] It would seem that a less traumatic alternative could, and must, be found for sea turtle capture and study.

. . . female loggerheads are entrained in large numbers at St. Lucie while attempting to nest on rookeries, some of which are now occupied by reactor buildings . . .

Intake injuries have been recorded at several different reactors. In 1998, the Clearwater Marine Aquarium "responded to an unusual number of Kemp's that were getting caught by the grating at the mouth of the intake canal [at Crystal River],"according to Glenn Harman, the Aquarium's biologist.[59] In a three-month period, 11 Kemp's ridleys died in the plant's intake canal and intake basin.[60] Harman reported that "Nine turtles during 1998 and five during 1999 were kept at the aquarium for further treatment of injuries suffered. These injuries included shell and plastron damage, which in these cases was severe in nature."[61] Harman did not attribute any specific cause to the injuries.

Rakes used to clean intake trash racks can also injure sea turtles caught on the racks. In its 1995 biological opinion for Oyster Creek, NMFS wrote:

> Debris is cleaned from the intake screens by a trash rake, which is moved on a track from one bay to the next. The rake, a horizontal array of large, curved tines, is lowered down into the bay to remove debris from the intake gratings. When the rake reaches the desired depth, the tines are deployed, curving downward to penetrate through the grate before the rake is raised. This process could cause serious injury to a turtle.[62]

This cause of injury is rarely identified in nuclear utility stranding or capture reports where such rakes are present.

Schoelkopf's organization suggested a solution for a similar problem at Salem by pitching the trash racks at a 45 degree angle to avoid injuries to sea turtles from the rakes. "They said it would cost millions of dollars and no way they'd change it," Schoelkopf said.[63] Once Schoelkopf was excluded from the collection of injured and dead sea turtles at Salem, there was no way to independently verify the cause of sea turtle injuries or mortalities at the reactors. A July 27, 1998, report from Salem reads: "Dead sea turtle was removed from circulating water sys intake trash racks. Based on turtle being badly decomposed, licensee disposed of turtle in trash dumpster."[64] "If there is a gash, how can we tell if it's from the racks, or if it occurred post mortem, if we are not allowed to look at the turtle?" asked Schoelkopf, who believes that the trash rakes as well as boat propellers or shark bites can cause sea turtle death or injury.[65]

Depending on the extent of their injuries, many of the sea turtles captured at nuclear plants require rehabilitation for several months or longer before being rereleased. Even animals that have no external injuries may be at risk as physiological changes related to capture may affect the sea turtle's ability to survive after release. A sea turtle rescued after entrainment on a barrier net or other part of the reactor intake structure may appear healthy but could have suffered potentially fatal changes in blood chemistry. In forcibly submerged sea turtles, oxygen stores are rapidly consumed, anaerobic glycolysis is activated, and acid-based balance is disturbed, sometimes to lethal levels.[66] In studying forcibly submerged green sea turtles, researchers observed that "no increase in blood lactate was seen until the first 30 to 60 minutes of forced submergence, when blood lactate reached 90 to 100 mg ml^{-1}. Recovery to predive levels required 15 h or more."[67] High lactate can be fatal to sea turtles by increasing the acid content of the blood to lethal levels. The immediate release of these animals is inappropriate. Monitoring of these animals is therefore needed 24 to 48 hours prior to release.

Insufficient supervision after capture at a power plant can also jeopardize the sea turtle's future. "Many animals are released from the power plant without observation, this could be detrimental," said Harman in reference to Crystal River.[68]

According to Schoelkopf, sea turtles are kept in shallow containers after capture at Salem, eliminating the ability to assess whether the animals can swim, dive, and catch food on their own, all essential skills to ensure the animal's survival once released back into the wild.[69] Schoelkopf also believes that at least several days in captivity are necessary to ensure the animal is ready for release and that a 24-hour holdover is not long enough to establish this with any certainty.[70] A priority for release is that sea turtles can catch food on their own.[71] Thus, all sea turtles captured at a reactor and released, even after a short period of rehabilitation, may not survive in the wild and could be considered potential mortalities.

Unlike St. Lucie, which retains two sea turtle biologists on staff and uses the expertise of a number of respected marine rehabilitation centers around the state, other plants appear to be less than adequately equipped to handle captured sea turtles. On April 27, 1994, Pacific Gas and Electric's (PG&E) Diablo Canyon plant in California captured a green sea turtle in its intake cove. A PG&E letter, dated May 16, 1994, described the event:

> The turtle was found floating on the surface between the curtain wall and the barracks in forebay 2-3. Biologists were notified and unsuccessfully attempted to direct the turtle under the curtain wall. The turtle was then directed into a net and placed in the back of a pickup truck. The animal was taken to the boat dock and released in the Intake Cove. It swam rapidly for about 100 feet before becoming slightly entangled in kelp. Biologists recaptured the turtle and took it to a location about 1/2 mile south of the Intake Cove. Upon release, the turtle swam strongly for about 100 yards, took sev-

> eral breaths, and dived beneath the surface. Biologists observed the turtle to be in a nonstressed condition.[72]

How the unidentified biologists were able to determine the turtle was "nonstressed" during such a short handling period and whether it survived this ordeal is unclear.

Brunswick operators work with the North Carolina Sea Turtle Coordinator (NCSTC), but on occasion handle sea turtle captures or kills at the reactors without such supervision. In addition, plant personnel sometimes retain captured sea turtles for too short a period to assess with certainty the animals' viability. According to Carolina Power and Light's 1998 biological assessment,

"With sea turtles, every individual animal counts," says Marathon's Moretti. "We always consider that every animal may be the animal that makes the difference whether your grandchildren will see sea turtles or not."

> [T]he estimated "holding" time from capture (removal from the canal) to release at Yaupon Beach on Oak Island is generally less than an hour—unless the turtle is injured, in which case the NCSTC is contacted for advice and possible attention by a veterinarian, or turned over to the NCSTC for attention. Under unusual circumstances, a turtle may be held overnight at the BSEP [Brunswick Steam Electric Plant] biology lab before release.[73]

For some who work to rehabilitate sea turtles, the prospect of their release and subsequent entrainment at a nuclear plant is alarming. Dr. Beth Turnbull, a veterinary pathologist at the New England Aquarium, was on the team responsible for attempting to save the lives of almost 150 animals, the largest number of cold-stunned sea turtles on record in New England, in December 1999. All rescued sea turtles were tagged, and 22 were flown to rehabilitation facilities in Florida to ease the burden on the aquarium. Turnbull commented:

> The feeling is, why are we working so hard to save every individual, giving them blood transfusions . . . and these guys are shipped down to Florida to then be taken by nuclear power? . . . It's very frustrating and it shouldn't happen . . . It would break my heart if I knew one of them was taken, and since we have tagged them all, it would be possible to know. [74]

Because sea turtles spend much of their time in the open ocean, tracking their fate after release is difficult. While some sea turtles are tagged at nuclear plants, this practice is inconsistent at the different facilities. Tagging helps in some instances to provide additional data on specific populations and also serves as an indicator of recapture.

Recapture itself may present problems, particularly if the sea turtle has developed site fidelity to the plant's intake structure, as has been observed at St. Lucie, thus increasing its chances of recapture and enhancing the likelihood of injury or death. The FPL March 2000 Entrainment Study noted:

> It is safe to say that at least 5 percent of the juvenile loggerhead turtles captured in the canal showed site fidelity to the intake structure. Some juvenile loggerheads returned to the canal only once while others returned repeatedly (23 times in one case)."[75]

The study found that site fidelity could be equated with capture rates. "Green turtles exhibited a higher incidence of site fidelity than loggerheads . . . green turtle capture rates were higher than those

for loggerheads."[76] However, the obvious trauma of such repeated ordeals appears lost on Michael Bressette, FPL biologist, who quipped to the press: "I'm convinced (some of them) just like the ride through the pipe."[77]

An Uncertain Future

Atomic reactors are an important contributing factor to sea turtle mortality, which, added to mortality in fisheries and habitat destruction, has a powerful cumulative effect. If these species are to be preserved, this mortality must cease. "With sea turtles, every individual animal counts ," says Marathon's Moretti. "We always consider that every animal may be the animal that makes the difference whether your grandchildren will see sea turtles or not."[78]

Reina agrees. "There are times of having been closely associated with a particular turtle and I have the opportunity to watch her return to the ocean," he said.[79]

> To me, it's always quite a sad experience because I watch her leave and I see her disappear into the ocean and I wonder if that turtle's ever going to come back again. And I wonder, too, the population in general that we work with, what is their future? Am I going to see those turtles in 5 years or 10 years? But also because of what turtles might be telling us about what's happening in the marine environment. What else is going to disappear that I don't even know about? What is it that we're losing and what is it that we're missing?[80]

Moretti concurs. "That turtle that swims off into the future may be the future," he said. "Each individual turtle."[81]

Summary

Sea turtles, an endangered group of species whose numbers worldwide continue to decline, are seriously threatened by the operation of U.S. atomic reactors using the once-through cooling system. Sea turtles are injured or killed while entrained through intake pipes, impinged on trash racks and at the intake wells, or caught on barrier and tangle nets. Sea turtles die at nuclear power plants by drowning, suffocation, or as a result of injuries sustained during transit and capture.

In the case of St. Lucie, nesting by female loggerheads is impeded because the plant is located on a nesting beach. Most of the loggerhead sea turtles captured and killed in the intake system are adult females, attempting to reach area nesting beaches. Although the 1990 NAS study cites injury during transit through the intake pipe as a primary cause of sea turtle mortality at St. Lucie, this attribution was not made in any FPL documentation after 1985.

The artificially warmed waters created by nuclear plant discharge systems attract sea turtles and their prey, luring them into dangerous proximity of intake structures. Sea turtles can become the victims of cold-stunning should a plant abruptly shut down or when venturing back out into the open sea where water temperatures may have cooled.

Although sea turtle deaths at nuclear power plants may be numerically lower than those attributed to other factors such as drowning in shrimp nets, this is part of a larger cumulative effect that has a devastating effect on the survival of sea turtles. The taking of important subadults as well as breeders can have a greater impact on populations than the taking of other age groups.

Reporting of sea turtle takings is erratic among the different utilities studied and by federal agencies. Although utilities are obligated to report all takings to NRC, some appear to deal directly with NMFS or state agencies, a violation of the Endangered Species Act. When NRC does receive reports, it may post these as Daily Event Reports on its web site or simply retain them in its Public Document Room, a less accessible source to the public. Plants taking sea turtles without an incidental take statement are operating outside regulatory control. Some reactor operators make judgments on their own about whether or not a sea turtle death is "causal" to the plant's operation. Sea turtles dead on discovery may be arbitrarily classified as "noncausal" mortalities by plant personnel and are therefore not tabulated in official total kill numbers.

On-site veterinary attention at the different sites is inconsistent. Some utilities may lack on-site expertise or may seek an outside opinion when handling sea turtles. The decision by plant operation staff to contact a sea turtle veterinarian or coordinator is frequently a judgment call, and some dead sea turtles are buried or disposed of on site without necropsy. Attention by qualified veterinarians should be mandatory for all injured sea turtles rescued at reactors. Universal guidelines applicable to all reactors sites should be developed to reduce stress and mortality in rescued animals.

Sea turtle tagging is inconsistent at the different plants and must be performed by someone with appropriate training and expertise.

Atomic utilities often are reluctant to mitigate the problems they create and, even when they attempt to do so, the solutions can be inadequate. Sea turtles continue to die or be injured at reactors, despite the installation of barrier nets and other intended excluder devices. More research to exclude them is needed.

The rehabilitation process after capture at a nuclear plant may be detrimental to the sea turtle if it is not properly undertaken. Changes in blood chemistry that can occur during capture may prove fatal to sea turtles released too soon. Prolonged rehabilitation may accustom the sea turtle to captive life. However, there is no evidence to suggest that those working at respected rehabilitation facilities release sea turtles prematurely or before the animals demonstrate the essential ability to swim, dive, and catch their own food. This may not be true, however, of sea turtles captured at nuclear plants and released at the site after a few hours or even several days with potentially inadequate supervision.

A significant number of sea turtles requiring treatment likely received their injuries during the physical trauma of capture at nuclear reactors. Yet most utilities discount these animals as victims of reactor operation and put the blame on other causes without need for substantiation. The alleged benefits to sea turtles or to scientific study that intake canal capture and release programs provide is entirely negated by the fundamental absence of satisfactory oversight when these animals are harmed or killed at atomic reactors. Each sea turtle death at a nuclear reactor contributes to the cumulative effect on the species. The nuclear reactor intake system is hastening the sea turtle's advance toward extinction.

Notes

[1] Archie ("Chuck") Carr, III, "A Century of Sea Turtles," keynote address, 20th Annual Symposium on Sea Turtle Biology and Conservation, March 1, 2000, Orlando, FL.

[2] Jeff Ripple, *Sea Turtles* (Stillwater, MN: Voyager Press, 1996), p. 10.

[3] "Fibropapillomatosis of Marine Turtles, History," www.vetmed.ufl.edu.

[4] George Balazs, "Fibropapillomas in the Hawaiian Green Sea Turtle," www.turtles.org/tumor.htm.

[5] Llewellyn Ehrhart, University of Central Florida, Orlando, FL, "Review of FP Research," paper presented at Fibropapillomatosis Workshop, 18th Annual Symposium on Biology and Conservation of Sea Turtles, Mazatllan, Mexico, March 3–7, 1998.

[6] Alonso Aguirre, "Review of FP Research," 18th Annual Symposium, Biology and Conservation of Sea Turtles.

[7] Paul Klein, "Summary of Presentations," 18th Annual Symposium, Biology and Conservation of Sea Turtles.

[8] Todd Steiner, video interview by report authors and Humane Society of the United States, 20th Annual Sea Turtle Symposium, Orlando, FL, March 4, 2000.

[9] National Academy of Sciences, Committee on Sea Turtle Conservation, Board on Environmental Studies and Toxicology, Board on Biology, Commission on Life Sciences, National Research Council, *Decline of Sea Turtles, Causes and Prevention*, (Washington: National Academy Press, 1990), p. 112.

[10] J.R. Wilcox, *Sea Turtle Intake Entrapment Studies,* April 9, 1985, FPL, p. 16. NRC Public Document Room (PDR), Adock 05000389.

[11] Ecological Associates, Inc., "St. Lucie Plant Sea Turtle Entrainment Study," Jensen Beach, FL, March 2000, p. 20. NRC PDR, L-2000-78, Appendix C-001.

[12] "Entrainment Study," Executive Summary, p. ii.

[13] "Entrainment Study," Executive Summary, p. iii.

[14] FPL, attachment to "Entrainment Study," re: St. Lucie Units 1 and 2, Docket Nos. 50-335 and 50-389, March 22, 2000, p. 2.

[15] FPL, "Daily Event Report," October 13, 1998. FOIA # 2000-0058, Appendix A15.

[16] Sea Turtle Stranding and Salvage Network, "Stranding Report, Brunswick Steam Electric Plant," July 14, 1998. FOIA# 2000-0058, Appendix B-1.

[17]FPL, "Daily Event Report," November 24, 1999. FOIA# 2000-0058, Appendix A-3.

[18] FPL, "Daily Event Report," September 20, 1999. FOIA# 2000-0058, Appendix A-5.

[19] "Vero Diver Prepared 'To Die Fast': Whisked Toward Nuclear Plant, He Considered Suicide," *Palm Beach Post* , June 8, 1989; www.finaledition.pbpost.com.

[20] Bill Lamm, video interview by authors and Humane Society of the United States, Vero Beach, FL, March 5, 2000.

[21] Ibid

[22] Ibid.

[23] Ibid.

[24] "Diver Pulled into FPL Pipe Settles Suit," *Palm Beach Post,* September 8, 1989.

[25] M.R. Sackschewsky, *Threatened and Endangered Species Evaluation for 75 Licensed Commercial Nuclear Power Generating Plants,* Pacific Northwest National Laboratory (operated by Battelle for the U.S. Department of Energy), Richland, WA, March 1997, p. 13.

[26] Joseph G. Cordaro, wildlife biologist, NMFS Southwest Office, interview by Linda Gunter, January 2000.

[27] FPC, "Event Report," April 2, 1998. FOIA# 2000-0182, Appendix A-15, p. 2.

[28] Michael Masnik, NRC, "Memorandum to Claudia Craig, NRC, and Leonard Weins, NRC, regarding a conversation with Colleen Coogan of NMFS," May 21, 1997. FOIA# 2000-0058, Appendix # C-6.

[29] NRC Meeting Agenda, Brunswick Biological Opinion, September 14, 1999. FOIA# 2000-0058, p. 13.

[30] CP&L Sea Turtle Stranding and Salvage Network, "Stranding Report," June 4, 1996. FOIA# 2000-0058, Appendix C-1.

[31] Joe Cordaro, telephone conversation with Linda Gunter.

[32] California Marine Mammal Stranding Network Database, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Region, January 25, 2000.

[33] Bob Schoelkopf, director, Marine Mammal Stranding Center, Brigantine, NJ, interview by Paul and Linda Gunter, February 11, 2000.

[34] *Decline of Sea Turtles,* pp. 112–13.

[35] "Entrainment Study," p. 26.

[36] Ibid.

[37] Ibid.

[38] "Entrainment Study," p. 36.

[39] Florida Power Corporation, "Report on Significant Environmental Event," submitted to NRC, May 1, 1998. FOIA# 2000-0182, Appendix C-16.

[40] FPC, "Biological Assessment for Crystal River Unit 3," submitted to NRC October 1, 1998. FOIA# 2000-0182, Appendix A-5, p. 17.

[41] "Entrainment Study," p. 20.

[42] "Entrainment Study," p. 30.

[43] NMFS, "Biological Opinion regarding continued operation of the Oyster Creek Nuclear Generating Station under Endangered Species Act, Section 7 Consultation," 9-21-95. FOIA# 2000-0098, Appendix B-4, p. 6.

[44] NMFS, "Biological Opinion for Salem," January 2, 1991, p. 6. PDR 50-272/311/354.

[45] NMFS, "Biological Opinion for Oyster Creek," Appendix B-4, p. 8.

[46] NMFS, "Biological Opinion for Crystal River, V. Effects of the Action," submitted to FPC by NRC July 15, 1999, Appendix A-3, p. 15. FOIA# 2000-0182.

[47] FPC, "Report to NRC," May 1, 1998, Appendix C-16, p. 1. FOIA# 2000-0182.

[48] Allen R. Jacks, "The Use of Nonreleasable Turtles in Public Education," 20th Annual Symposium on Sea Turtle Biology and Conservation, Orlando, FL, March 1, 2000. Notes taken by Linda Gunter.

[49] Deborah T. Crouse, Larry B. Crowder, and Hal Caswell, "A Stage-Based Population Model for Loggerhead Sea Turtles and Implications for Conservation," *Ecology* 68(5) 1987: 1412–23.

[50] Ibid.

[51] Dr. Richard Reina, research associate, Drexel University, and member of Principal Investigators team on leatherback extinction; Dr. Frank V. Paladino; and Dr. James R. Spotila, video interview by authors and Humane Society of the United States, 20th Annual Sea Turtle Symposium, Orlando, FL, March 4, 2000.

[52] Ibid.

[53] "Clean Ocean Action, Ocean Challenge," www.cleanoceanaction.org.

[54] Ibid.

[55] FPL, "Green Turtle Lethal Take Discussion," attachment to NRC re: Entrainment Study, Ecological Associates Study, March 2000. NCR PDR.

[56] Larry Wood, e-mail to Linda Gunter, March 24, 2000.

[57] Richie Moretti, telephone conversation with Linda Gunter, January 2000.

[58] David Royse, "Mysterious Tumors Threaten Endangered Sea Turtles," Associated Press, October 24, 1997.

[59] Glenn Harman, e-mail to Linda Gunter, January 6, 2000.

[60] Florida Power Company report to NRC, May 1, 1998, p. 1.

[61] Harman, e-mail, January 6, 2000.

[62] NMFS, "Biological Opinion, Oyster Creek," Appendix B-4, p. 7.

[63] Schoelkopf, interview.

[64] National Pollution Discharge Elimination System, "Noncompliance Notification," submitted to NRC July 23, 1998. PDR, Microfilm address: A4518-079-A4518-083.

[65] Schoelkopf, interview.

[66]Molly E. Lutcavage and Peter L. Lutz, "Diving Physiology," Lutcavage and Lutz, eds., *The Biology of Sea Turtles* 1 (Boca Raton, FL: CRC Press, 1977), pp 277–96.

[67] Ibid.

[68] Glenn Harman, e-mail to Linda Gunter, January 13, 2000.

[69] Schoelkopf, interview.

[70] Ibid.

[71] Harman e-mail, January 6, 2000.

[72] PG&E, Letter DCL-94-105 to NRC, May 16, 1994. FOIA# 2000-0129, Appendix A-9, p. 1.

[73]CP&L, "Biological Assessment of Impacts to Sea Turtles at the Brunswick Steam Electric Plant," submitted by NRC to NMFS, March 9, 1998, p. 12. NRC PDR Adock 05000324.

[74] Beth Turnbull, telephone interview by Linda Gunter, December 13, 1999.

[75] "Entrainment Study," p. 24.

[76] "Entrainment Study," p. 30.

[77] Deborah Circelli, "FPL Effort Saves Turtles From Soup," *Palm Beach Post,* May 15, 2000.

[78] Richie Moretti, video interview by authors and Humane Society of the United States, 20th Annual Sea Turtle Symposium, Orlando, FL, March 4, 2000.

[79] Reina interview, March 4, 2000.

[80] Ibid.

[81] Moretti interview, March 4, 2000.

2

Gone Fission: Environmental Friend or Marine Predator?

Once-through cooling reactors kill billions of fish larvae and spawn and ruin the habitat essential for their survival.

"How inappropriate to call this planet Earth, when clearly it is Ocean." —Arthur C. Clarke[1]

Once-through cooling systems cause numerous environmental impacts. In their sheer numbers, fish, in all stages of their lifecycles, are the most severely affected. In the process of sucking in and circulating the tremendous volume of water needed for once-through cooling, reactors draw in large numbers of adult fish, larvae, and eggs as well. *Impingement* is the killing of aquatic organisms sucked into and caught on the water intake screens. *Entrainment* is the killing of fish, fish larvae, and eggs due to the thermal, chemical, and mechanical stresses on organisms entrained in the once-through cooling system. The discharge of the heated coolant water also causes damage. Thermal pollution has been found to destroy entire local marine environs and the fish that live there. Warmer water fish that move into the discharge plumes can be cold-stunned when the reactor suddenly shuts down, killing the acclimatized fish through hypothermic shock.

Thermal pollution has been found to destroy entire local marine environs and the fish that live there.

Each reactor can have a different impact on fish populations, depending on such factors as the types of species, breeding and feeding habits, and proximity to the reactor.[2] The extent of harm each reactor inflicts on marine habitat depends on the number of reactors at the plant, their size, the water body, and the location of the intake and outflow structures. As will be demonstrated by examining the operations at the Diablo Canyon (DCPP), Millstone, and Salem nuclear power plants, atomic reactors destroy marine habitats and indigenous fish populations far more extensively than predicted when the reactors began operating decades ago.

A Double Standard for the Fishing and Nuclear Power Industries

Most U.S. reactors began operating in the 1970s. The nation had begun to recognize the problems associated with overfishing and was enacting legislation to prevent overfishing and allow stocks to recover. The Magnuson Fishery Conservation and Management Act of 1976 ushered in a new era of federal fishery management. The Magnuson Act of 1994, as subsequently amended and reauthorized, recognized that certain stocks of fish had declined to the point where their survival was threatened, and other stocks of fish had been so substantially reduced in number that they could become similarly threatened.[3] These problems were viewed as a consequence of increased fishing pressure and the inadequacy of fishery resource conservation and management practices, resulting in a diminished capacity to support existing fishing levels.[4]

The Magnuson Act established eight regional fisheries management councils that were charged with developing Fishery Management Plans for fisheries under their jurisdiction. For example, in New England, each state has its own set of fisheries regulations restricting gear, fishing areas, season, and licenses. Federal fisheries permit holders fishing in state waters must comply with federal fisheries regulations, unless state regulations are more restrictive or unless specifically exempted.[5] Furthermore, fisheries management experts close areas of fishing grounds or prohibit fishing during certain seasons to reduce fishing activity and protect a specific spawning nursery area or a spawning season.[6]

In general, the commercial fishing industry is highly regulated as to the manner of catch, quantity, and frequency. Conversely, the nuclear power industry is required to take very few precautions to avoid impacts on fish stocks and the larvae of numerous near-shore species. Indeed, two very different regulatory regimes control the environmental impacts of commercial fisheries and the nuclear power industry. In theory, nuclear power plants are required to use water intake systems that "reflect the best technology available for minimizing adverse environmental impacts," according to the Clean Water Act (CWA). Yet, in the absence of all-inclusive federal regulations, not a single state has put limits on the number of fish that power plants are allowed to kill.

Indeed, two very different regulatory regimes control the environmental impacts of commercial fisheries and the nuclear power industry.

As the following case studies illustrate, the operation of once-through nuclear reactors has resulted in much larger impacts on fish stocks than anticipated. Fish species and the marine habitat remain inadequately protected by a flawed regulatory system. Efforts to enforce the CWA Section 316(b) requirement, mandating the use of the best technology available to minimize adverse environmental impacts of intake structures, have failed. This is due largely to the fact that utilities not only have embarked upon experimental projects with questionable and suspect environmental benefits but are also attempting to get this option generally accepted instead of installing technology that reduces damage to the marine environment. The regulatory system empowers utility owners with the responsibility for environmental monitoring, and agency review is based upon data submitted and potentially manipulated by the utility. The bias that can result when the "fox watches the hen house" creates the potential for misrepresentation of the facts. In fact, utilities have been eager to take advantage of these loopholes.

Showdown at Diablo Cove — A Utility Gets into Hot Water

A Cease and Desist Order Stirs Controversy

A recent, high-profile confrontation over the destruction and alteration of the marine environment by thermal discharge pollution is exemplified by events at Pacific Gas and Electric's (PG&E's) Diablo Canyon Power Plant near San Luis Obispo, CA. The two-unit nuclear power station, first fully operational in 1986, draws in and directly discharges 2.5 billion gallons of heated water a day into the rocky intertidal zone of Diablo Cove on the Pacific Ocean.

The controversy stems from allegations by the California Water Quality Control Board (WQCB), the California Department of Fish and Game (DFG), and a host of environmental groups who allege that PG&E has been violating its National Pollution Discharge Elimination System (NPDES) permits to the detriment of ocean aquatic life. In February and March 2000, the fish and game department and water board drafted a cease and desist order for Diablo's discharges into the ocean cove.

A memo from the fish and game department stated:

> Overall, the effects of the discharge include loss and degradation of habitat, decreases in several species' diversity and density, and loss of entire species. It has been shown that the effects continue to expand beyond Diablo Cove and are greater than predicted. The discharge does not provide for the protection of propagation of species and does not provide habitat suitable for indigenous species.[7]

The proposed cease and desist order cites that 97 percent of the cove's surface kelp forest (Bull Kelp) has literally been clear cut from its former habitat, with more kelp forests potentially affected beyond the cove.[8] As a result, the intertidal communities of Diablo Cove are now devoid of historically abundant quantities of perennial algae cover. Surfgrass, once the predominant plant thriving in continuous bands throughout the cove, survives only in isolated locations.

The Decline of the Abalone

Water temperatures in north Diablo Cove now prevent the successful developmental growth of black abalone and red abalone, both indigenous coastal water mollusk species. PG&E had first predicted that black abalone would not be at risk from the reactors. From 1988 to 1991, following reactor startup, the red and black abalone population in Diablo Cove declined by almost 90 percent as the result of withering syndrome, a chronic progressive disease exacerbated by elevated sea water temperatures. NMFS lists the black abalone as a "candidate species" under the Endangered Species Act.[9] Further population declines in the black abalone could lead to listing as a threatened or endangered species. In 1997, the California Legislature imposed a moratorium, making it unlawful to take abalone for commercial purposes from San Francisco south.[10] Furthermore, the statute defines *take* as including killing or attempting to kill.[11] The California courts have determined that the definition of take in the Fish and Game Code included killing and that nothing suggested that the proscribed killing must result from hunting or fishing.[12] The commercial nuclear power industry, however, has so far escaped penalty for its virtual elimination of abalone populations in its waters.

Water temperatures in north Diablo Cove now prevent the successful developmental growth of black abalone and red abalone, both indigenous coastal water mollusk species.

The Department of Fish and Game stated that, as a result of the routine operation of Diablo Canyon, mortality does occur in species found in Diablo Cove and that substantial decreases in formerly indigenous species continue to take place.[13] The department concluded: "This is because the temperatures that are found in the affected areas are in excess of the upper temperature limits for survival, growth, and reproduction of several indigenous species."[14]

The agency concluded:

> The question presented is whether the degradation of the marine environment near DCPP [Diablo Canyon Power Plant] is acceptable to the Department of Fish and Game. Based on review of law and policies administered by the Department, and other laws requiring enhancement and protection of the marine ecosystem, the answer is no."[15]

The DFG maintained, based upon ""the effects of elevated water temperature and the severe decrease in adult population densities below the recommended Department levels, that it is questionable whether or not abalone populations will recover naturally in Diablo Cove should temperatures return to normal."[16]

The state agency went on to add, "The black abalone was listed as a candidate species by the National Marine Fisheries Service on June 23, 1999 (Federal Register, Vol.. 64, No.120) throughout the entire range (Oregon, California, Baja California)."[17]

Evidence of Discharge Destruction Suppressed by PG&E

Like all reactors' water discharges, Diablo Canyon's are regulated by both state agencies and a federal National Pollution Discharge Elimination System permit, certified by the Environmental Protection Agency and governed by the Clean Water Act. In 1982, prior to Diablo Canyon's operation, the state established effluent limitations for heat discharge into Diablo Cove. PG&E's permit stipulated that: (1) there shall be no degradation of indigenous species; (2) there shall be no degradation in marine communities, to include plants, invertebrate and vertebrate animals and; (3) the elevated temperatures of the receiving water shall not have any adverse effect on beneficiary uses, including shellfish harvesting and the marine habitat.[18]

The permit relied on a Thermal Discharge Assessment Report, prepared by PG&E. The report predicted very limited harm to a small percentage of the Diablo Cove habitat and its species. Also in 1982, PG&E submitted a report entitled "Assessment of Alternatives to the Existing Cooling Water System" that, after exploring options for reducing discharge water temperatures, concluded that all of the alternatives, including the installation of cooling towers and ponds, were economically prohibitive.[19]

Michael Thomas, WQCB project manager for the Diablo Canyon Studies, said: "It's essentially bare rock—what I call bare rock."

In approving the 1982 discharge permit, the WQCB considered the utility's high cost for a technological fix of its discharge problem and determined what were "reasonable" levels of environmental degradation in accepting a daily effluent discharge objective of 20 degrees F above ambient temperatures in the Diablo Cove and a periodical 100 degrees F above ambient discharge to kill mussel and barnacle infestations in the cooling system piping.[20] The WQCB recognized that, once the reactors were operational, their effects would be further studied and that additional regulation might be required if the effects were different from those predicted. The WQCB stipulated that, should the thermal effect limits prove inadequate, the regional regulator would have the authority to modify or revoke the permit in order to protect the beneficial uses of Diablo Cove.[21]

Defined as an "existing discharge" under state regulations, the NPDES permit issued in 1990 provided Diablo Canyon with a waiver to allow a maximum discharge temperature of 22 degrees F above the natural temperature of Diablo Cove. This is 2 degrees F higher than the stated water quality discharge objective. However, the 1990 discharge permit again stipulated that: "Waste discharge shall not individually or collectively cause temperature of the receiving water to adversely affect beneficial uses."[22]

As part of the permit, the utility was required to environmentally monitor Diablo Cove to analyze the hot water discharge effects on the cove. In December 1997, PG&E submitted a study that determined that there were large, statistically significant, and ecologically important changes in habitat-forming species of surf grass, kelps, seaweeds, and algae with impacts on the rest of the cove community caused by the reactors. Collapse of these plant species affected many more species in the interrelated community of marine species that graze among the plants such as limpets, snails, abalone, sea urchins, fish species that feed on the algae, and invertebrates.

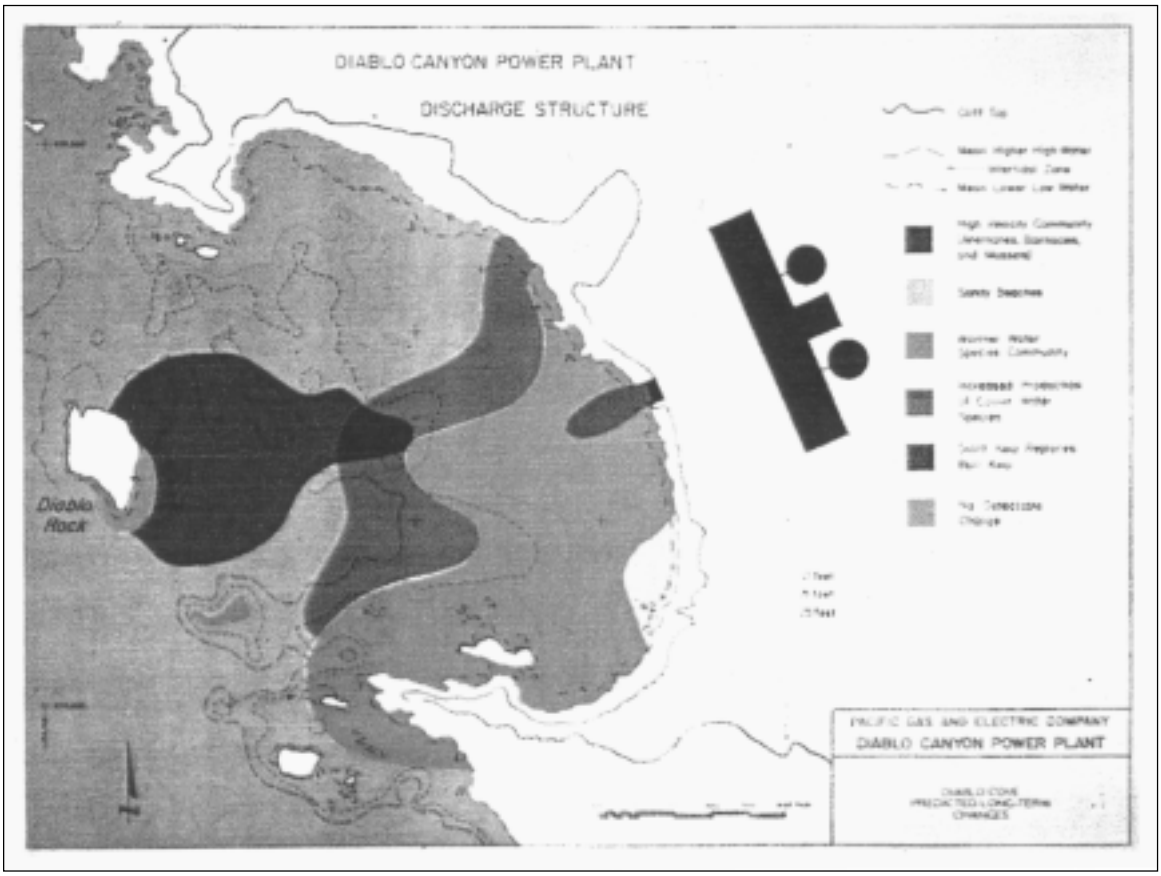
The study findings not only indicated that the utility prediction of impact on a variety of species was entirely wrong but also that PG&E failed to predict accurately how far and wide the hot water discharge

would extend. The original thermal plume pollution predictions were literally off by more than a mile, significantly affecting an additional area 4.2 miles to the north of the reactors. Where utility predictions had placed a 0.3 mile area of Diablo Cove at uncertain risk from thermal pollution, the actual impacts from the reactors amount to 1.4 miles of nearly complete loss of all habitat in the intertidal zone. Summing up Diablo Canyon's effect on this once vital, densely covered marine habitat, Michael Thomas, WQCB project manager for the Diablo Canyon Studies, said: "It's essentially bare rock—what I call bare rock."[23]

Legal Wrangling Ends in Water Board Capitulation to Utility Demands

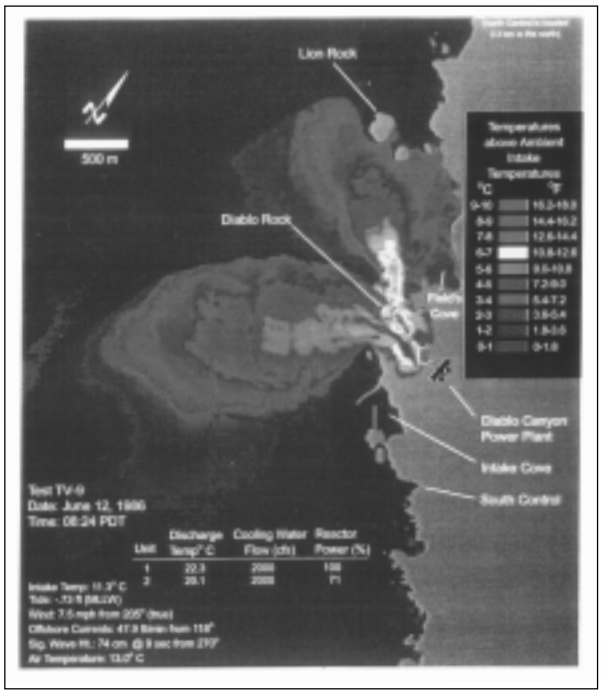
Completing the utility's environmental monitoring program report was not entirely a cooperative and forthcoming process. For 10 years, PG&E did not submit 1986 infrared images that showed a much more widespread distribution pattern of Diablo Canyon thermal plumes into the cove. PG&E also withheld an extensive set of 20-year time-series photographs of ocean monitoring stations, showing a steady degradation of habitat. The submittal of temperature-monitoring data, collected by PG&E from 1997 to 1998, confirming elevated temperatures, was delayed until May 2000, even though the company had submitted annual monitoring reports for 1998 and 1999.[24]

In 1994, PG&E attempted to reduce the state's monitoring program by about 90 percent, essentially its elimination. PG&E's effort to close down the Diablo Cove marine life monitoring program was



PG&E's predictions of benefits, rather than damage to Diablo Cove as a result of the heated discharge waters, proved to be way off target. Furthermore, the utility knew of the damage, but withheld evidentiary photos for more than ten years. In a 1982 PG&E report, the utility asserted that there would be potential indirect benefits of the discharge on the Cove's marine habitat. "By causing an increase both in the turnover and, possibly, the source of the ocean water, an increase in nutrient supply may promote a more luxurious growth and production of the cove's marine plant community and marine biomass," read PG&E's report. In March 2000, testimony by the Regional Water Quality Control Board the agency stated: "In reality, bare rock has increased in Diablo Cove, and the intertidal algal community has been almost completely lost.

vehemently and successfully opposed by state agencies and several environmental groups. Additionally, allegations came to the attention of the California Office of the Attorney General that the utility had omitted information from a 1988 report, analyzing the effects of taking in 2.5 billion gallons of water a day from the cove and the entrainment of marine life in the reactor cooling system. PG&E eventually settled with California for $14.04 million and was required to reanalyze the effects through an independent review. This fine was 7 times higher than any fine ever levied by the federal Nuclear Regulatory Commission for any violation.[25]



An aerial infrared photo showing dispersion of the thermal plume on June 12, 1986. In its March 2000 testimony, during cease and desist hearings, the Regional Water Quality Control Board observed on exhibiting this photograph: "It should be noted that the infrared images in Figures 6 and 7 [shown] are dated 1986, but were not submitted to the Regional Board until 1996, about ten years after they were taken. PG&E's 1988 annual thermal effects report did include other plume maps which did not show the plume contacting the nearshore areas."

PG&E denies state allegations that it has violated its NPDES permit. In response to charges of environmental damage as a result of its discharges, the utility has argued that the WQCB should reconsider the economics of Diablo Canyon station operation when enforcing the NPDES permit and thus should relax enforcement of its regulations.[26] The state has countered that if it were to reconsider the economics of the power plant, it should not be limited to just the costs to the utility. The regional board responded that:

> [S]uch analysis would have to explore issues including the cost of disposing of the DCPP radioactive waste, the market price for electricity being produced versus the cost of production by DCPP, and whether the electricity produced by DCPP is necessary to meet electrical demands of the community.[27]

The board's deliberations on the DCPP cease and desist order took a sharp turn in favor of the utility on June 2, 2000. Without issuing a decision on the staff-supported order, the board and PG&E reached a broad tentative settlement agreement whereby the utility would pay $4.5 million for marine restoration projects and preservation of coastal land owned by the company. Despite the unreconciled disagreement between the parties over the significance and extent of the cooling system's harmful impacts on the marine environment, the board sought to resolve the pollution issues to avoid a lengthy and expensive legal battle in utility appeals.[28] (For more details on this case, see chapter 4, this report.)

"You still gotta realize that you're taking in a square mile of water, to the depth of 14 feet, per day, and passing it through that power plant, killing every bit of plankton and some of the adult fishes contained in the cove every day."

Diablo Discharges Only One Piece of the Disaster

The issue of the thermal discharges is but one piece of the environmental problem caused by the wasteful once-through cooling system. The environmental consequences from the intake of large volumes of water into the system must also be taken into account. With the intake of large volumes of water into the nuclear power station cooling systems, the entrainment of wildlife and marine life has a significant, and at least equally disastrous, impact on the environment.

As California marine biologist and chemist Dr. Rimmon Fay pointed out at the Diablo Canyon hearings:

> "You still gotta realize that you're taking in a square mile of water, to the depth of 14 feet, per day, and passing it through that power plant, killing every bit of plankton and some of the adult fishes contained in the cove every day."[29]

Millstone Nuclear Power Station and Long Island Sound: Fishing Without a License

In the first 11 months of 2000, 43 arrests were made off the coast of Connecticut for fishing violations in Long Island Sound.[30] Those arrested were charged with an array of offenses, including catching undersize lobsters, exceeding quotas, fishing without a license, and failing to keep accurate log entries. Penalties for such violations may range from a $25 fine or 30-day imprisonment or both; each illegal taking of a fish or crustacean is considered a separate offense.[31] Commercial fishermen face potential license suspension for illegal takings and other violations.[32]

Although commercial, sport, and recreational fishing are closely regulated, Millstone's fish kills are unregulated. There are no limits on Millstone's kills, by season, size, age, or number.

The State of Connecticut Department of Environmental Protection (DEP) employs a staff of 13 full-time conservation officers to patrol the Long Island Sound; six officers and two supervisors are assigned to the area east of New Haven. These "harbor police," who are also certified police officers, are charged with enforcing state and federal laws governing all aspects of fishing in Long Island Sound, including commercial, sport, and recreational uses.[33] The regulations set limits for legal capture of fish and crustaceans as to season, size, age, number, and even gender. For example, Section 26-157c-1 of the Regulations of Connecticut State Agencies, entitled "Taking lobsters—general," provides as follows:

> (a) Lobsters may be taken only by lobster pots, traps, trawls or similar devices or by skin diving, including the use of self-contained underwater breathing apparatus, or by hand. The use of spears or hooks of any kind to take lobsters and the possession of lobsters taken by any method which pierces the shell are prohibited.
> (b) No person shall buy, sell, give away, offer for sale or possess (1) any female lobster, regardless where taken, with ova or spawn attached or from which the ova or spawn have been removed or (2) any female lobster, regardless where taken, bearing a v-shaped notch at least one-quarter inch in depth and tapering to a point in the flipper next to the right of the center flipper as viewed from the rear of the lobster, or (3) any lobster, regardless where taken, with a body shell (carapace) less than 3-1/4 inches. Such length shall be measured along the length of the body shell (carapace) parallel to the center line from the rear end of the eye socket to the rear end of the body shell (carapace). For the purposes of this subsection, any lobster specified in subdivision (2) of this subsection includes any female lobster which is mutilated in a manner which could hide, obscure or obliterate such a mark.
> (c) When caught, any lobster specified in subdivision (1), (2) or (3) of subsection (b) shall, without avoidable injury, be immediately returned to the waters from which taken.

State regulations have tightened over the years, as biologists at the DEP's Marine Fisheries office in Old Lyme have documented the decline of fish species in the Sound. DEP fisheries biologists have directed particular attention to the decline in the Niantic River winter flounder population, a subspecies of indigenous fish believed to have inhabited the Niantic River Bay area for thousands of years. Winter flounder, once a staple of the local commercial fishing industry, return every winter to Niantic to breed

in the shallow muddy reaches of the river.

In 1970, the first of the three Millstone nuclear reactors went on line at Millstone Point, on Niantic Bay, facing Long Island Sound. Unit 2 followed in 1975, and Unit 3, the largest, in 1986. The three reactors were designed with "once-through" cooling systems, requiring a constant intake of 2 billion gallons of water a day from Niantic Bay.[34]

The Millstone reactors have a variety of established impacts on marine life. They routinely kill billions of larvae—marine life in infant stages—when the organisms are swept into the plants' intake structures.[35] They have routinely impinged—killed or maimed on impact—thousands of juvenile and adult fish and cructaceans slammed against the intake structures' debris screens.[36] They kill thousands of fish and crustaceans by thermal shock when the reactors go into sudden shutdown. Niantic River winter flounder and other species began a precipitous decline when Millstone began its ascension to full power of three nuclear reactors in 1986.

Although commercial, sport, and recreational fishing are closely regulated, Millstone's fish kills are unregulated. There are no limits on Millstone's kills, by season, size, age, or number. The reactors are allowed to operate throughout the critical spawning seasons of the indigenous fish. Although Northeast Utilities, Millstone's owner and operator, was once required to calculate losses due to impingement, DEP permitted NU to suspend its impingement monitoring in the 1990s. Following thermal shock events, NU is required to file post-mortems with DEP, identifying the cause of death. DEP maintains records of fish mortalities at Millstone. In this way, DEP and NU have assumed joint roles as historians of the demise of local fisheries.

In 1982, the state began to address the winter flounder decline by further restricting fishing. Prior to 1982, there were no size regulations in effect. In 1982, a minimum length of 8 inches was established for commercial fishermen's catches of winter flounder. The minimum was increased to 11 inches in 1983.[37]

In 1987, DEP fisheries staff noted a serious decline in the Niantic River winter flounder stock. It was then well known that the Millstone intakes suck in hundreds of millions of Niantic River winter flounder larvae every spring, in addition to billions of larvae of other species. "Under the most optimistic scenarios of spawning stock size and entrainment and mortality of late stage larvae, the 'equivalent adults lost' could be as much as 50 percent of the parent stock," wrote DEP Marine Fisheries Assistant Director Eric M. Smith. (See discussion in chapter 4, this report.) Smith and others were persuaded that the Millstone intakes may have played a significant role in the decline.

Yet, DEP took no action against Millstone to reduce its intake, although it could have required forced outages during spring peak larvae migrations. Instead, DEP imposed more restrictions on fishing. In 1987, the state closed the Niantic River to fishing from December 1 through March 31, the winter flounder breeding season.

In 1992, DEP reissued a Clean Water Act permit to Northeast Utilities with no enforceable restriction on the intakes to protect fish and no requirement for seasonal outages. Instead, DEP imposed a "gentlemen's agreement," requesting that NU "consider" scheduling its refueling outages so they would occur during the peak winter flounder larvae season. Units 2 and 3 were closed for refueling in 1995 during part of the peak season. Larvae capture decreased by 44 percent as a result, according to NU estimates. As all three units were closed in 1996, 1997, and 1998 for safety violations, no "gentlemen's agreement" was necessary to protect the fragile larvae during those years.[38] However, in 1999, NU

planned to restart Unit 2 at the peak of the winter flounder season. In 2000, Unit 3 operated at full power throughout the larvae season.

In its annual environmental monitoring study, issued in 1994, NU noted a continuing serious decline in the winter flounder population the previous year. DEP directed NU to consider alternatives to the once-through cooling system. NU reported that the Millstone reactors could be converted to closed systems, which would virtually eliminate entrainment and impingement, but the plant rejected such a conversion as too costly. (NU projected an $89 million cost for conversion of Unit 3 alone.) DEP, which could have ordered such a conversion, accepted NU's conclusions and, with no opportunity for public comment, permitted "fishing as usual" at Millstone.[39]

Millstone's 1992 Clean Water Act permit, which set limits on the intake operations and discharges, expired in 1997. However, DEP has interpreted state law to permit NU to continue to operate under the terms of the old permit. DEP will not consider imposing forced outages or conversion to a closed cooling system prior to December 31, 2001, the earliest date it has projected to begin public hearings on NU's application to renew the permit. In the meantime, DEP has administratively permitted NU to *increase* water volumes at the intakes and has relaxed numerous standards of radioactive and chemical waste byproduct discharges into the Sound without affording an opportunity for public comment or participation.[40]

In the meantime, as the harbor police maintain their steady watch for offending fishermen, suspending fishing licenses—and livelihoods—for illegal catches, Millstone's fish kills continue unlicensed, unmonitored, and unregulated.

Environmental Gains Disappear into Salem's Murky Waters

Owned by PSE&G, the Salem Nuclear Generating Station has two pressurized water reactors located in Salem County, NJ, on the southern end of Artificial Island on the Delaware River, 50 miles northwest of the mouth of Delaware Bay and 30 miles southwest of Philadelphia.[41]

Unit 1 began operating in 1977; Unit 2, in 1981. Both reactors use a once-through cooling system that, at full power, draws in more than 3 billion gallons of water a day. The cooling system has 12 intake cells, each with mechanically cleaned trash racks 11 feet wide by 51 feet long. Behind these racks are vertical traveling screens (3/8-inch mesh) with fish buckets and a low-pressure spray to wash organisms to a fish-return system and a high-pressure spray to remove "debris." Fish and debris washed from screens are returned to the estuary by sluices at each end of the intake structure.[42]

Bay Anchovy, Weakfish, and Representative Important Species

According to the DEPE consultant, the estimated loss could be 30 million pounds a year of bay anchovy and weakfish entrained or impinged at Salem.

In 1990, a study commissioned by the New Jersey Department of Environmental Protection and Energy (DEPE) estimated that the total annual kills at the Salem intakes translate into fish losses more than four times the total drawn by commercial fishing in the Delaware Estuary. In particular, the study determined that enough eggs, larvae, and young fish are killed by the plant each year that the potential population of weakfish, the most sought after species in the bay, is reduced by 7 percent each year.[43] According to the DEPE consultant, the estimated loss could be 30 million pounds a year of bay anchovy and weakfish entrained or impinged at Salem.[44] This is the equivalent of 342 million adult bay anchovies and 1,120,000 adult weakfish.

The study also determined that the potential for long-term population declines of bay anchovy and weakfish is substantial. The consultant found that entrainment and impingement at the Sa-

lem facility resulted in large losses to early life stages of representative important species populations. In the past, the Salem reactors have also taken federally endangered shortnosed sturgeon. The report projected these losses would impair important spawning and nursery functions for these species, would deplete the food web of the Delaware Estuary, and adversely affect beneficial uses (i.e., commercial and recreational fishing) of the receiving water body. In fact, the state's consultant concluded that plant-related losses are greater than the combined commercial and recreational fishery harvest for many of the representative important species examined.[45] The report clearly instructed the DEPE that, without modifications in intake structures and operating practices, continued operation of the Salem reactors would threaten the protection and propagation of balanced indigenous populations. It also found that only major reductions in entrainment and impingement losses (e.g., greater than 50 percent) would reduce the risk of long-term population and ecosystem level damage.[46]

A Rescinded Order to Retrofit Cooling Towers

On October 3, 1990, the DEPE issued a draft permit, requiring PSE&G to retrofit with closed-cycle cooling. In March 1993, PSE&G submitted a supplement to its application that proposed alternative technologies and supplemental conservation efforts. On June 24, 1993, the DEPE issued a second draft permit, prepared by PSE&G itself, allowing the company to pursue mitigation instead of installing cooling towers.[47] This draft permit allowed PSE&G to continue to operate the plant without cooling towers by conducting a salt marsh restoration experiment in Cape May and Cumberland Counties and pursuing other mitigation measures and studies. Between 1990 and 1993, after a series of closed-door meetings with the utility, the DEPE retreated from requiring PSE&G to install a closed cooling tower as a condition of its Clean Water Act permit.

As late as January 18, 1994, however, the NMFS regional director wrote to the DEPE administrator of environmental regulation, recommending that the DEPE not issue a permit to allow PSE&G to continue withdrawing 3 billion gallons of water a day from the Delaware river to cool the Salem Nuclear Generating Station.[48] The letter went on "to reiterate concern that all measures to avoid or reduce impacts should be pursued prior to formulation of a mitigation plan."[49] However, by March, NMFS admitted that it "realized that maintaining a position of denial until the company constructs cooling towers is probably unrealistic . . . although the proposed mitigation . . . is based on flawed assumptions."[50] By June, the Regional Director for NMFS was recommending a mitigation-monitoring program that would allow the resource agencies to reevaluate the effects of once-through cooling to determine the necessity of cooling towers.[51] The NMFS tentative recommendation was also clear that: "The mitigation proposal proposed by PSE&G to offset the impact of once-through cooling . . . is based as much on conjecture as it is on hard scientific facts."[52] Nonetheless, the final permit was eventually issued in July 1994. The resulting Saltmarsh Restoration Project has caused a storm of controversy. The project originally called for a one-time application of herbicides to the marsh in 1996 that would be followed by touch-up efforts in 1997. The initial application covered 2,422 acres; what was described as the "touch-up" covered 2,212 acres. In 1998, herbicides were applied to an additional 140 acres.[53] In 2000, PSE&G applied for permits to apply herbicides to an additional 1,000 acres in New Jersey. The permit issued allowed application to 533 acres. Glyphosate, the herbicide also known as Rodeo or Roundup, is known to be harmful to marine life. Furthermore, regional environmentalists argue that, aside from potential harm to people and marine organisms from herbicides used in the restoration project, the restored wetlands do nothing to reduce fish kills inflicted by the plant.

Conclusions

When reviewing the damage to fish populations and essential marine habitats by nuclear reactors, it is no coincidence that the conclusions drawn by a polluting utility and those drawn by independent reviewers without a financial interest at stake often vary dramatically. The nuclear industry discounts environmental impacts upon fish stock and marine habitats around the nation while, all too often, the federal and state authorities look the other way, ignoring the damage or even shielding the offending operator from essential restoration efforts.

In fact, these impacts have been known and predicted for quite some time. More than three decades ago, as U.S. nuclear power plants were coming on line, Joseph A. Mihursky, the noted marine biologist, wrote:

> Some environmentalists have been aware for some time of the possible ecological effects of large volumes of artificially heated water on aquatic ecosystems. It has become clear that we are in a developing electric age, an age that is intimately tying itself to nuclear energy, an age which promises to give us *extensive environmental alterations* [emphasis added].[54]

Despite these early glimpses of likely environmental catastrophe, regulators are reluctant to implement sound science and best-technology requirements to protect fish stocks and marine habitats from the destructive effects of routine atomic reactor operation. Regulators either choose or are forced to accommodate the economic interests of the nuclear industry instead of enforcing solutions resulting from years of extensive environmental analysis. In the Salem example, the New Jersey Fish and Wildlife Service was unequivocal in a 1994 pronouncement that a closed-cooling system (cooling towers) was the best technology available to stop the reactors' fish-killing operation. The eventual regulatory outcome settled on a flawed salt marsh experiment, involving repeated herbicide applications, and failed to address the fundamental problem of the once-through cooling system.

In addition to the examples cited above, studies initiated as far back as the 1960s and 1970s have shown that once-through cooling systems destroy and alter the marine environment. In a progress report to what was then the U.S. Energy Research and Development Agency, M. Linton Beaven and Donald R. Heinle reported that "benthic grab samples indicate the immediate discharge area has been scoured clean of sediment, while samples taken directly north and south of the discharge are covered by at least two inches of sediment," in their study of the Calvert Cliffs once-through reactors in Maryland.[55] Beaven and Heinle also found that "other investigators . . . have noted that pumped-entrainment through cooling systems may damage or kill certain algal species, especially small flagellates and diatoms."[56] Heinle and Harold S. Millsaps, in another chapter in the same report, cited "the destruction of up to 30 percent of the zooplankton passing through the Calvert Cliffs power plant."[57]

In reality, the nuclear industry has been allowed to kill fish and other essential marine organisms and destroy habitat, escaping the regulations other industries and beneficial users must follow. State and federal regulators have abrogated their responsibilities to license a class of industrial water polluter and marine predator that can operate in violation of permits above and beyond the intent of duly promulgated law. With many commercial and recreational fish stocks around the nation straining to remain viable and the indigenous coastal marine ecology being scalded and altered, fair and equitable regulation of the various harmful impacts of the coolant intake and discharge system must now be implemented. As evidenced, the utilities have underestimated the extent of their impacts and we are only now struggling to come to terms with the real impacts on the fish stocks and marine habitats. The decided lack of investigation, analysis, and enforcement by the Nuclear Regulatory Commission and other responsible

federal and state agencies has left a void in the patchwork of the regulated protection of fish stocks and their marine ecology.

Notes

[1] Neil McAleer, *Arthur C. Clarke Authorized Biography* (Chicago: Contemporary Books, 1992).

[2] Indian Point Power Plant in Buchanan, NY, entrains and impinges striped bass, white perch, river herring, and bay anchovy. Michael Ludwig, National Marine Fisheries Service (NMFS), Memorandum, December 13, 1999.

[3] Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801 et seq.

[4] 16 U.S.C. 1801 (a) (2).

[5] Sonja V. Fordham, *New England Groundfish: from Glory to Grief* (Washington: Center for Marine Conservation, 1996), p. 26.

[6] Ibid., p. 33.

[7] Joseph Milton, staff counsel, California Department of Fish and Game, Memorandum to California Regional Water Quality Control Board, Draft Cease and Desist Order for Pacific Gas and Electric National Pollution Discharge Elimination System Permit Order 90-09, February 29, 2000, p. 5.

[8] Ibid., p. 3.

[9] 64 Federal Register 120, June 23, 1999.

[10] Fish and Game Code § 5521;Stats.1997, chapter 787, p. 2.

[11] Fish and Game Code, p. 86.

[12] *Department of Fish and Game v. Anderson-Cottonwood Irrigation District* (1992) 8 Cal.App.4th 1554.

[13] Legal Office, California Department of Fish and Game, Memorandum, February 29, 2000, p. 1.

[14] Ibid.

[15] Legal Office, California Department of Fish and Game, Memorandum to Michael Thomas, RWQCB, February 28, 2000, p. 7.

[16] California Department of Fish and Game, Memorandum to Roger Briggs, executive officer, RWQCB–Central Coast Region, February 29, 2000.

[17] Ibid.

[18] Jennifer Soloway, staff counsel, California Regional Water Quality Control Board—Central Coast Region, "Response to Legal Argument Opposing Adoption of Draft Cease and Desist Order 00-032 for Diablo Canyon Nuclear Power Plant, May 5, 2000, p. 2.

[19] Ibid., p. 7.

[20] Ibid., "Response," p. 8.

[21] Staff Counsel, CRWQCB, "Legal Argument in Support of Adoption of Draft Cease and Desist Order 00-32 for PG&E's Diablo Canyon Nuclear Power Plant," March 1, 2000, p. 3.

[22] Hearing Before the California Regional Water Quality Control Board, Central Coast Region, for Consideration of a Cease and Desist Order Against Pacific Gas and Electric Company's Diablo Canyon Nuclear Power Plant for Alleged Violations of the Facility's National Pollutant Discharge Elimination Permit System, *Transcript of the Proceedings,* San Luis Obispo, CA, March 30, 2000, line 24, p. 15–line 1, p. 16.

[23] Ibid. , lines 4-5, p. 79.

[24] Michael Thomas, project manager, CRWQCB, Rebuttal Testimony in Support of Cease and Desist Order No. 00-032, May 5, 2000, p. 6.

[25] NRC Office of Public Affairs, telphone conversation with Paul Gunter, December 7, 2000. In 1997, NRC levied a $2.1 million fine on Millstone that currently stands as the agency's largest fine.

[26] CRWQCB, Legal Argument, March 1, 2000, p. 14.

[27] Ibid.

[28] David Sneed, "Diablo Settlement Reached," *The Tribune,* June 3, 2000.

[29] CRWQCB , Hearing Transcript, lines 5–9, p. 299.

[30] Personal communication, Sgt. Raul Camejo, administrative sergeant, DEP Office of Law Enforcement, Hartford, CT.

[31] Connecticut General Statutes § 26-186.

[32] Ibid. § 26-61.

[33] DEP's conservation officers also act as special deputy agents for the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

[34] Unit 1 has been closed since 1995. Its requirements for cooling water have diminished significantly but not entirely.

[35] Northeast Utilities acknowledged that, had all three units been operating fully during 1997, nearly 500 million winter flounder larvae alone would have been entrained. *Annual Report,* Northeast Utilities Environmental Laboratory, Waterford, CT, April 1998.

[36] In November 1975 alone, NU counted 999 lobsters impinged at Units 1 and 2, combined. Millstone Unit 3 was not yet in operation. "Environmental Assessment of the Condenser Cooling Water Intake Structures," vol. 1 (Waterford, CT: Northeast Utilities Service Company, September 1976), Table 4.10-16.

[37] Northeast Utilities Environmental Laboratory, *Annual Report,* Table 2.

[38] Even with all three units shut down, some entrainment and impingement occurred because the plant has to continually cool highly radioactive components, including the reactor and spent fuel assemblies.

[39] Perhaps in response to citizen pressure, which resulted in lawsuits, DEP has recently revisited this issue. (See chapter 4, this report.) On November 14, 2000, DEP approved a scope of study by which NU has agreed to investigate the feasibility of alternatives to potentially minimize or eliminate once-through condenser cooling water at Millstone. Michael J. Harder, director, DEP Bureau of Water Management, letter to F. C. Rothen, vice president, Northeast Nuclear Energy Company, November 14, 2000. The feasibility report is to be submitted to DEP by August 31, 2001.

[40] Clean Water Act permit conditions are virtually unmonitored by DEP as well. It was only in 1996, after James Plumb, a chemistry technician at Millstone, publicly disclosed flagrant illegal discharges and other environmental violations at Millstone, that state and federal regulators took notice and brought enforcement actions.

[41] Delaware River Basin Commission, Docket No. D-68-20 CP, PSE&G application, June 30, 1995, p. 2.

[42] PSE&G Salem Nuclear Generating Station, NJPDES/DSW Final Permit No. NJ0005622.

[43] Versar Associates, "Report to the New Jersey DEPE on the Salem Nuclear Generating Station and the Delaware Estuary,"Trenton, NJ, 1990, p. 5.

[44] Ibid., Executive Summary.

[45] Ibid., part 3, p. 5.

[46] Ibid., Section 6, p. 4.

[47] Delaware River Basin Commission, Docket No. D-68-20 CP, PSE&G application, June 30, 1995, p. 5.

[48] Letter from Richard B. Roe, regional director, National Oceanic and Atmospheric Administration, to Dennis Hart, administrator, environmental regulation, DEPE, January 18, 1994.

[49] Ibid.

[50] Stanley W. Gorski , NMFS, Memorandum to Jon Rittgers, March 14, 1994.

[51] Allen E. Peterson, Jr., acting regional director, NMFS, Letter to Dennis Hart, administrator, environmental regulation, DEPE, June 3, 1994.

[52] Ibid.

[53] Delawareriverkeeper.org/

[54] Joseph A. Mihursky, "Thermal Loading New Threat to Aquatic Life," *Catalyst* 2 (3) 1969: p. 7, Educational Series no. 85.

[55] M. Linton Beaven and Donald R. Heinle, "Ecological Effects of Nuclear Steam Electric Station Operations on Estuarine Systems," Fifth Progress Report to U.S. Energy Research and Development Agency, Contract No. AT- (40-1) -4328-, part 4, "The Impact of the Calvert Cliffs Nuclear Power Plant Operation on Phytoplankton Production in the Surrounding Waters, Chesapeake Bay," March 4, 1977, p. IV-6.

[56] Ibid.

[57] Donald R. Heinle and Harold S. Millsaps, Calvert Cliffs Report, Part 6, Studies of Zooplankton, quoting Sage,1975, p. VI-II.

3

Dying For a Dollar

The inhumane slaughter of marine mammals, endangered crocodiles, sea birds and other marine species at nuclear power plants, for the sake of economics and plant efficiency.

"The worst sin towards our fellow creatures is not to hate them, but to be indifferent to them: that's the essence of inhumanity." —George Bernard Shaw[1]

Sea turtles, fish, and a variety of smaller marine organisms (covered in other chapters) make up the greatest numbers of mortalities at nuclear reactors, but other endangered and nonendangered marine mammals, reptiles, and sea birds are also victims of once-through cooling systems at nuclear power plants. Even cooling canals and some other alternatives to the once-through system are imperfect solutions that still harm marine wildlife. Among endangered marine species, the manatee, least tern, and the American crocodile were affected at reactors studied for this report. Among nonendangered marine animals, seals and sea lions, greater and lesser scaup, and other varieties of sea duck have been taken at the reactors studied. Nuclear power has even entrained a human being, diver Bill Lamm, who survived the ordeal. (See chapter 1, this report.)

Nuclear power utilities, often with the support of the federal agencies that are meant to regulate them, prefer to put profit before preservation, choosing to sacrifice wildlife to keep their plants running.

Yet nuclear power utilities, often with the support of the federal agencies that are meant to regulate them, prefer to put profit before preservation, choosing to sacrifice wildlife to keep their plants running instead of funding preventive measures. Most large marine animals caught in reactors usually drown, a fate that is both cruel and inhumane—as well as eminently avoidable. But the nuclear industry, by constructing once-through cooling systems instead of cooling towers at 59 of its U.S. units, decided from the start that marine wildlife, not the human perpetrators, should pay the price for the use of atomic technology. This underscores the nuclear industry's pervasive disregard for the value and conservation of the country's rich diversity of wildlife.

Seals and Sea Lions

When seals began turning up dead regularly at the Seabrook reactor on the New Hampshire coast, local environmental and citizens' groups protested. The plant's *Summary of Seal Entrapment Status* documents 55 seal deaths between January 1994 and December 11, 1998, about one seal death a month.[2] The seals were found to have slowly drowned during a deadly journey through Seabrook's three-mile-long intake pipe. It is believed that the primarily juvenile seals swam into the opening of the tunnel through curiosity or in search of prey, then found they could not escape, due to the current inside the pipe and their own disorientation.

The utility owners of Seabrook, North Atlantic Energy Services, eventually opted to investigate mitigation devices, making inquiries overseas in 1998 about seal deterrent grills used successfully at nuclear plants in Britain.[3] But the utility's original aim was to secure a small take permit to kill seals, a request it submitted to the National Marine Fisheries Service (NMFS) in July 1997. NMFS's initial suggested take allowance of 34 seals a year met with howls of protest from environmental opponents. The agency subsequently lowered the annual kill rate to 24 seals, more than double the average number of animals Seabrook was killing annually at the time.

. . . groups such as the Seacoast Anti-Pollution League and Fish Unlimited…pressured Seabrook into taking the mitigation route, even though NMFS was content to issue a license to kill instead.

On May 25, 1999, NMFS issued the kill permit, stating: "NMFS has determined that the taking of up to 20 harbor seals and four of any combination of gray, harp, and hooded seals, annually during the next five years, would have no more than a negligible impact (as defined in §216.3) on these stocks of marine mammals."[4] On the same day, Seabrook formally notified the state and federal environmental agencies that it was proceeding with the installation of seal deterrent bars.[5] Without the actions of groups such as the Seacoast Anti-Pollution League and Fish Unlimited, seals might still be dying at Seabrook. By drawing attention to this issue in the media, the groups pressured Seabrook into taking the mitigation route, even though NMFS was content to issue a license to kill instead.

Seals and sea lions are also at risk around nuclear power plants on the Pacific coast, yet NMFS views these deaths as inconsequential, despite the prohibition under the Marine Mammal Protection Act on taking any marine mammal without a permit**.** At the San Onofre reactors near San Diego, at least 187 harbor seals and sea lions have been found dead since 1983.[6] These numbers suggest that an average of 11 seals or sea lions are killed each year at San Onofre, about the same number as at Seabrook over a similar time span. In a statement to the *Orange County Register* on July 9, 2000, by Kevin Herbinson, San Onofre research scientist, the utility admitted that 10 sea lions had been entrained at San Onofre between January and July 2000 and that 5 of them were found dead.[7] However, the annual fatal take numbers may be much higher. According to a Nuclear Regulatory Commission (NRC) Office of Public Affairs news statement, 23 seals were found dead at San Onofre in 1996, and another 12 were captured alive that year.[8] None of these deaths appeared in the publicly posted NRC Daily Event Reports. However, it is unknown whether San Onofre is reporting seal deaths that NRC fails to post on its Daily Events Reports or whether the utility is simply not reporting the takes. These inconsistencies of reporting make public accounting for animal losses at reactor sites extremely difficult (see other chapters, this report.)

Sea lions are at risk around California reactors with 23 found dead at San Onofre in one year, yet these deaths are not reported by the Nuclear Regulatory Commission. Seals were slowly drowned at Seabrook until watchdogs protested.

NMFS appears to view its role merely as a bean counter, assessing the status of animal populations, but declining to pass judgment on the degree of cruelty involved in the animals' deaths. NMFS Southwest officials take the view that seal deaths at nuclear reactors and elsewhere should not be the focus of concern since the animals are plentiful in the area. To comply with the Marine Mammal Protection Act, the utilities have been granted letters of permission to allow the killing of marine mammals. "People have gotten so attached to marine mammals that they want to save every one . . . It may be time to stop protecting animals that are so numerous and so common," said Joseph Cordaro, NMFS Southwest biologist.[9]

State officials feel differently. "They have recovered to some degree, but they haven't recovered to pre-human levels," Sara Wan, California Coastal chairwoman, said of the seal population in the same article.[10] "What kind of way is that to behave—as soon as the poor creatures' populations recover, we start killing them again?" she added.[11] Wan said her agency was never told about the destruction of seals and sea turtles until presented with the Marine Review Committee Report in 1989. (See chapter 4, this report.) Wan said she was appalled that the commission was not told about marine mammal and endangered turtle entrapment when it was studying environmental damage at San Onofre.[12]

> *"Left alone without criticism, it is unlikely that a bureaucracy like [the fisheries service] will spontaneously right itself and start obeying the law. . ."*

As always, it is left to citizens' groups to ensure that federal agencies enforce the laws designed to protect marine species. "Left alone without criticism, it is unlikely that a bureaucracy like [the fisheries service] will spontaneously right itself and start obeying the law," said Andrew Wetzler, Natural Resources Defense Council staff attorney.[13] Mark Massara, Sierra Club attorney, believes NMFS is out of line in attempting to interpret federal law over marine mammal deaths. "They ought to just enforce the law rather than playing God," he said.[14]

American Crocodiles

The endangered American crocodile is attracted to the warm waters around Florida Power and Light's (FPL) Turkey Point nuclear plant on the Florida coast near Homestead. Crocodiles have, in fact, colonized in the plant's cooling water canal system. However, in just under two years, between August 1998 and July 2000, four crocodiles died in the plant's cooling canal system. In all cases, no definitive cause was given for these deaths, although the report on the third animal, found on December 7, 1999, stated: "It is currently believed that the dead crocodile lost a fight with a larger crocodile."[15] No explanation was given for this theory. The first reported mortality was a female, discovered on August 17, 1998. The report to NRC read: "Although the body was partially decomposed, it showed no signs of trauma. The animal was first identified and tagged on site in July of 1985, and has been residing there since then."[16]

A second crocodile death occurred on June 6, 1999. Again, the plant notified NRC:

> A deceased 4.5-foot long American crocodile was found yesterday (6/6/99) in the suction of one of the cooling canal skimmer pumps. An autopsy was performed, but the cause of death could not be determined. FPL is notifying state and local authorities and is planning a news release to the press. No further actions are planned.[17]

The fact that the crocodile was apparently impinged suggests that the animal may have been impeded from freeing itself from the suction of the skimmer pump. However, no precise details or an autopsy report were made publicly available, and FOIA requests submitted to NRC on Turkey Point yielded only two daily event reports, recording the deaths of the June and December 1999 crocodiles.

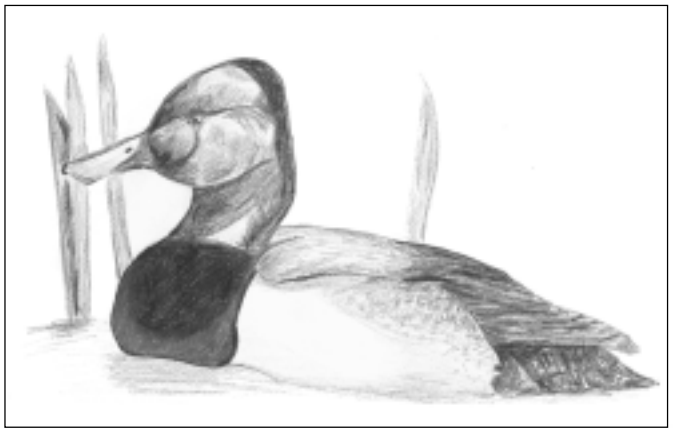
The fourth crocodile, found on July 25, 2000, was described in an event report posted by NRC for FPL as "a dead American juvenile crocodile found in the cooling canals" and stated that "notification was made to the Florida Fish and Wildlife Agency and the Federal Fish and Wildlife Agency."[18] Although the mortality of four animals may be considered a numerically small impact, the lack of detail forthcoming from regulatory oversight agencies on the circumstances of these animals' fate and the potential for harm to crocodiles at the site is cause for concern. While crocodiles may thrive in the warm waters, information on other conditions that may negatively impact the animals such as turbulence, suction,

and the presence of cleaning chemicals such as chlorines in the water, as well as toxic and radiological discharges, is apparently either unknown or unavailable to the public.

Sea Birds

On a single day, January 28, 2000, 103 sea birds, recorded as "blue billed ducks," died at the Nine Mile Point 1 reactor on Lake Ontario in New York state. "The ducks were discovered after the circulating water system was realigned from reverse flow to normal flow," according to Gordon Hunegs, senior resident inspector for NRC at Nine Mile Point.[19] The ducks, identified as lesser or greater scaup, drowned in the plant's intake tunnel.[20] Scaup migrate from western Alaska through the Great Lakes and winter off the north Atlantic coast. The birds that drowned at Nine Mile Point were therefore likely killed during migration. Usually, taking such species without a permit is a violation of the Migratory Bird Act.

Hunegs indicated that the intake structure caused a slight temperature increase in the lake. "The ducks were diving down to look for food and weren't strong enough to overcome the suction," he said. As a result, the birds were "sucked into the plant" through the underwater tunnel and were found dead on the trash rack. A similar event occurred in 1994, according to Hunegs, when 31 ducks of unidentified breed also drowned in the plant's intake system.[21]



103 greater or lesser scaup drowned in a single day, sucked into the intake tunnel at Nine Mile Point.

No punitive or mitigatory actions are known to have been taken subsequent to the drowning of scaup although the impact may be a serious one. The combined population estimate for greater (aythya marila) and lesser (aythya affinis) scaup has declined dramatically since the early 1980s to record lows in 1998. The 1998 estimate of 3.47 million scaup is far below the goal of 6.3 million, set in the North American Waterfowl Management Plan, causing concern among biologists and hunters.[22] According to Dr. Jack Barclay, director of the Wildlife Conservation Research Center at the University of Connecticut and a specialist in scaup, "if such events are repeated at this or many other sites, yet go unreported, the results could have an effect. Since greater scaup and lesser scaup ("bluebills") are known to feed on zebra mussels, and the mussels reportedly grow on water intake screens, the risk to the ducks should be apparent."[23]

Researchers are concerned that impacts on migrating scaup populations around the Great Lakes may affect the species more widely. A paper by multiple authors published in the spring 2000 edition of the *Wildlife Society Bulletin* stated: "If populations in certain wintering or migration areas are exposed to greater contamination or sport harvest, reduced productivity or survival of that population may contribute to a long-term decline on breeding areas."[24] The taking of 103 scaup in a single kill equates with "sport harvesting" and could include key genetic members of a particular flock. Exposure to contaminants acquired on migration or wintering areas is another cause of concern and a realistic danger in waters around nuclear plants.[25] The *Bulletin* authors concluded that "with the scaup population declining at an estimated 150,000 birds annually, the need for action is clear."[26]

Between July 6 and July 17, 1998, 15 endangered juvenile least terns died at the St. Lucie reactor site in Florida. The birds had been nesting on the roof of the plant's training center. After heavy rains, the young

birds were swept into the roof drainage system where inadequate protective netting had collapsed. Eleven birds died on July 6 and an additional 4 on July 17. Although a similar event occurred on July 17, 1991, resulting in the death of 2 least terns, FPL decided to attempt preventive measures only after the 15 mortalities in 1998. "Prior to the next nesting season, the licensee plans to take measures to prevent the birds from nesting in this precarious area," read an FPL event notification submitted to NRC in July 1998.[27] Normally, the least tern nests in colonies on beaches or sandbars, therefore their selection of the plant roof appears to be unusual.[28] Timely and effective measures to prevent nesting at the plant after the earlier fatalities might have avoided the later deaths of these endangered birds. However, the tardiness of FPL's decision to install preventive measures reflects a pattern of disinterest by utilities in the welfare of endangered species as well as significant lack of oversight and enforcement by NRC.

At the Seabrook nuclear station in New Hampshire, 11 unspecified "sea ducks" died at the plant on February 20, 1999. The NRC event report stated only that:

> Eleven dead sea ducks were observed in Seabrook Station's circulating water screen wash debris on February 20, 1999, at approximately 2100 hours. It is not known at this time whether the ducks were alive or dead upon entering the offshore intake structure. Sea ducks are diving birds which feed underwater.[29]

No further information was provided. There are eight species of sea duck with coastal wintering grounds that could include the New Hampshire coast in February.

Horseshoe Crabs

Clean Ocean Action (COA), an organization that follows the effects of the Salem reactors on the marine environment in New Jersey, has observed that horseshoe crabs are dying in large numbers, at least in part as a result of the plant's presence on the Delaware Bay Estuary. The plant, operated by Public Service Electric and Gas Company (PSE&G), also kills endangered shortnosed sturgeon and sea turtles. As part of an "Estuary Enhancement Program," established in 1995 and requiring the utility to mitigate the marine damage the reactors cause, freshwater wetlands have been converted to saltwater wetlands. In cutting a channel to create the saltwater wetlands, PSE&G altered the terrain, eliminating the beach slopes habitually used by horseshoe crabs when they come ashore to lay their eggs.

The tardiness of FPL's decision to install preventive measures reflects a pattern of disinterest by utilities in the welfare of endangered species.

"Horseshoe crabs are used to going uphill to lay their eggs, then downhill to return to the ocean," explained Tony Totah, a COA biologist.[30] "When PSE&G broke the dikes, they created marshlands with totally flat terrain. Consequently, after laying their eggs, the horseshoe crabs cannot find the downward slope to return to the ocean and become disoriented."[31] When the tide goes out, the crabs become stranded, dry out, and die. Furthermore, the commercial crab industry has seized upon this easy harvest. Already a contributing cause to the dramatic decline in the area horseshoe crab population through overharvesting, Totah said the commercial crab harvesters now know about the site and arrive with pickup trucks and tractor trailers to hand-pick the crabs off the marsh.[32]

In addition, dredging to cut the channel caused the destruction of numerous horseshoe crabs. "The dredging activities caused the grinding up of potentially thousands of horseshoe crabs as they did not stop the dredging activities during the breeding season," Totah said.[33]

PSE&G also has conducted large aerial applications of herbicides, spraying 21,000 pounds of glyphosate

on the 2,500-acre marsh to kill phragmites.[34] According to COA, nontarget effects of these sprayings on submerged vegetation or aquatic organisms have not been monitored. However, PSE&G was issued a New Jersey Department of Environmental Protection (NJDEP) Notice of Violation on January 11, 1999, for falsely claiming that glyphosate is harmless to people, animals, aquatic species, and the environment in its phragmite control fact sheet.[35]

Manatees

Endangered manatees are at risk when present around nuclear reactors. At St. Lucie, at least five manatees are known to have been sucked through the turbulent intake pipe, and one dead manatee has been found at the Turkey Point reactor. As with sea turtles, no mitigation solution has been found to prevent manatee takings at the plant. None of the manatee captures at St. Lucie was reported as fatal, although the fate of the manatees after release is not known. Press reports describe only the pet names plant personnel have given the animals and the occasional difficulties encountered in rescuing these mammals weighing a thousand pounds or more. None of the media reports or NRC documents described injury or stress to the manatees after their harrowing experience.

Manatees are attracted to coastal Florida power plants where they have become dependent on the artificially elevated temperatures of the discharge waters. When plants power down or close, the animals, now habituated to this false habitat, fall prey to cold stunning. FPL and other utilities have taken advantage of the presence of these manatees to promote their facilities as "wildlife sanctuaries" and the manatees as a tourist attraction. However, these hollow manipulations have been exposed now that the manatee is in serious trouble due to the artificial environment the plants have created. In response to pressure to keep its fossil fuel plant in Tampa running at full power while efforts are made to relocate the manatees, Winifred Perkins, FPL spokeswoman, told the *St. Petersburg Times:* "Our obligation is to provide power at the least cost to customers. It's not our obligation to keep a plant on for manatees when it's no longer economical."[36]

Given the violent experience of diver Bill Lamm's passage through the intake pipe, it seems unlikely that a 1,000 pound manatee would suffer no injury in transit.

Other power companies have begun preparing manatee protection plans for their plants, but FPL has declined, citing cost factors. "We'd be committing to operating our plant not because it's needed, but because it would help manatees," Mac Harris, FPL spokesman, told the newspaper.[37] These remarks fit the pattern for utilities more concerned with the bottom line than the survival and well-being of endangered species. They reveal a company policy in direct contradiction to the industry's public relations campaign, touting such facilities as wildlife sanctuaries.

The first manatee entrainment at FPL's St. Lucie reactors occurred in the spring of 1991. The victim, nicknamed "Natalie" by plant workers, spent two months trapped in the cooling pond while St. Lucie personnel struggled to capture her.[38] On September 4, 1991 "Pamela" was observed and captured.[39] After this, the broken slabs covering the intake pipes were rebuilt, attempting to correct the defect that was believed to have caused diver Bill Lamm to be sucked through the intake pipe in June 1989. However, three more manatees were entrained after the repair, on December 27, 1995, September 18, 1996 and December 14, 1997.[40] The manatee found in 1997 was reportedly captured in the intake canal and released, "unharmed," into the Indian River the next day.[41]

Just how "unharmed" the manatees are after this experience is unclear. Two were described as having "propeller wounds," a deep wound in one case that Ray Golden, FPL spokesman, said the animal suffered before being trapped in the pond.[42] A St. Lucie report on the September 1996 capture described

the "entry of a manatee in the plant's intake canal" as "rare but plausible, given the design of the ocean intake velocity cap. To date, no manatees have been *seriously* [emphasis added] injured during the process of their entry, capture, or release from the plant intake canal."[43] However, given the violent experience of diver Bill Lamm's passage through the intake pipe, it seems unlikely that a 1,000 pound manatee would suffer no injury in transit and more probable that "propeller wounds" resulted from goring by barnacles on the interior of the intake pipe. (See chapter 1, this report.)

On Florida's West coast, manatees are present around FPC's Crystal River reactor. Although Crystal River appears to have taken only sea turtles, a new health problem has been uncovered that is threatening the manatees' survival. At first thought to be similar to the FP virus that is attacking sea turtles, it is now believed to be related to bovine papilloma virus. However, the disease in manatees, though highly contagious to other manatees, is at present not thought to be life threatening.[44]

Several dozen manatees frequenting the waterways near the Crystal River plant have shown signs of the lesions. Scientists say the lesions may be a simple annoyance or they could progress into problems produced by other similar papilloma viruses. In humans, one papilloma virus causes genital warts that can progress into cervical cancer. In dolphins, a similar virus has been known to kill.[45] Dolphins living in the Indian River near the St. Lucie reactors have also manifested lesions that have perplexed researchers.

Like the sea turtle FP virus, the manatee ailment has raised cause for alarm about the health of the area's marine environment. Joyce Kleen, biologist for the U.S. Fish and Wildlife Service, the agency that has oversight over manatees, believes urgent attention must be paid to the mysterious manatee virus because it is "an indicator of the health of the ecosystem."[46] Like the sea turtle virus, no evidence has yet been produced to pin the cause directly on one or more specific human activity. However, artificially warmed waters, and the pollution and destruction of the marine ecosystem, remain high on the list of potential culprits, factors to which the operation of coastal atomic reactors undoubtedly contribute.

The examples of marine animal killings and takings in this chapter are meant to be illustrative, not comprehensive. Other reactors also kill marine animals, some perhaps of these species, others of different—but no less important—species. (For information on how to find out more about the effects of a particular reactor on the marine environment, see chapter 8, this report.)

Notes

[1] George Bernard Shaw, *The Devil's Disciple,* Act 2.

[2] North Atlantic Energy Services Corporation, *Summary of Seal Entrapment Status,* FOIA# 2000-0185, Appendix A-15.

[3] John Hart, Seabrook Nuclear Station, letter to Peter Haddow, Seal Conservation Society, Aberdeen, Scotland, April 27, 1998; provided to authors by Haddow.

[4] Federal Register 64 ,no. 100/Tuesday, May 25, 1999, Rules and Regulations.

[5] *Seabrook This Week*, May 24–28, 1999, FOIA# 2000-0185, Appendix A-18.

[6] Seema Mehta, "Whirlpools of Death," *Los Angeles Times*, January 9, 2000, www.latimes.com

[7] Maria Sacchetti, "Several varieties are netted on the way back to the sea at San Onofre," *Orange County Register,* July 9, 2000.

[8] NRC Office of Public Affairs newsletter, August 1997, quoting *North County Times,* August 3, 1997, Appendix D1. FOIA# 2000-0128.

[9] "Whirlpools of Death."

[10] Ibid.

[11] Ibid.

[12] Ibid.

[13] Ibid.

[14] Ibid.

[15] FPL daily event notification to NRC, December 7, 1999, FOIA# 2000-0181, Appendix A-1.

[16] FPL daily event report to NRC, August 17, 1998, Event # 34645.

[17] FPL daily event report to NRC June 7, 1999, FOIA# 2000-1018, Appendix A-2.

[18] FPL daily event report, July 25, 2000, offsite notification by FPC, Turkey Point, DER000-726.

[19] Nine Mile Point daily event report to NRC, January 28, 2000, Event # 36639.

[20] Gordon Hunegs, telephone interview by Sarah Sweetman, SECC researcher, May 12, 2000.

[21] Ibid.

[22] Jane E. Austin, Alan D. Afton, Michael G. Anderson, Robert G. Clarke, Christine M. Custer, Jeffrey S. Lawrence, J. Bruce Pollard, and James K. Ringleman, "Declining Scaup Populations: Issues, Hypotheses, and Research Needs, *Wildlife Society Bulletin* 28(1): 254-63.

[23] E-mail from Dr. Jack Barclay, director of the Wildlife Conservation Research Center, University of Connecticut, to Linda Gunter, July 6, 2000.

[24] "Declining Scaup Populations."

[25] Ibid.

[26] Ibid.

[27] FPL daily event notification to NRC, July 6, 1998, Event # 33493 and Event# 34529.

[28] National Geographic Society, *Field Guide to the Birds of North America* (Washington: NGS, [1987]), p. 166.

[29] Seabrook daily event report to NRC, Event #35390, February 21, 1999.

[30] Tony Totah, telephone interview by Linda Gunter, April, 2000.

[31] Ibid.

[32] Tony Totah, telephone interview by Linda Gunter, May 12, 2000.

[33] Ibid.

[34] CleanOcean Action web site item, PSE&G: *"Killing the Marsh with Rodeo,"* www.cleanoceanaction.org

[35] Ibid.

[36] Craig Pittman, "A Chilly Menace to Manatees," *St. Petersburg Times,* South Pinellas Edition,October 15, 2000, p.1B.

[37] Ibid.

[38] Fataima Ahmad, "Sleepy Manatee Rescued from FPL Cooling Pond," *Palm Beach Post,* September 4, 1991.

[39] Ibid.

[40] Ian Trontz, "Like Those Before Her . . . Manatee Rescued from St. Lucie Nuclear Plant," *Palm Beach Post,* September 20, 1996 and FPL, Licensee event report of sea turtle incidents (five pages) to NRC from December 15, 1997, FOIA# 2000-0058, C-27.

[41] Ibid.

[42] "Sleepy Manatee Rescued."

[43] FPL Event Description, Manatee Capture in the St. Lucie Plant Intake Canal, report submitted to NRC, October 10, 1996, NRC PDR, Adock 05000389.

[44] Patti Thompson, staff biologist, Save the Manatee Club, Maitland, FL, e-mail to Linda Gunter, March 27, 2000.

[45] Barbara Behrendt, "Spread of manatee virus raises officials' concerns," *St. Petersburg Times,* March 15, 1999, www.sptimes.com

[46] Ibid.

4

Death, Lies, and Videotape

How nuclear utility owners renege on environmental commitments, avoid protective actions, refuse to acknowledge damage, and cry poverty whenever watchdogs cry foul.

"Down went the owners—greedy men whom hope of gain allured:
Oh, dry the starting tear, for they were heavily insured."
—Sir William Schwenck Gilbert[1]

The nuclear industry has promoted itself through national advertising campaigns as clean, safe, and benign, and—most hypocritically—as helping to "protect the environment."[2] As the electric industry is deregulated, nuclear power is anxious to paint itself as a "green" energy source. However, the reality is far from this hollow boast. At every reactor studied for this report, the industry attempted, usually successfully, to weaken, water down, undermine, or remove altogether any meaningful mitigation requirements that would benefit endangered species and the marine environment. In a few instances, the nuclear utilities agreed upon mitigation requirements as a basis on which plants were constructed or licensed. Once operational, however, the industry hastily sought to renege on its promises.

The Nuclear Regulatory Commission (NRC), consistently more lapdog than watchdog, complies with scarcely a murmur of dissent.

For the economically moribund nuclear industry, the bottom line is always money. Yet, ironically, the industry spends and lobbies frantically to persuade regulatory agencies to bend the rules to suit its financial demands. The Nuclear Regulatory Commission (NRC), consistently more lapdog than watchdog, complies with scarcely a murmur of dissent. Unfortunately, the National Marine Fisheries Service (NMFS) has also become a willing partner in the industry's maneuvering, compliantly shifting the regulatory goal posts after only token opposition. Even state authorities, often the most eager to mount a challenge, can be silenced by industry pressure tactics. Nuclear utilities cry poverty when asked to mitigate the damage, whether it is the installation of costly cooling towers or less financially burdensome protective actions such as video and habitat studies. Yet their coffers are miraculously overflowing when the opportunity arises to bully their way out of reparation by threatening protracted and expensive litigation.

The following are examples of efforts by utilities, at a sample of the reactors studied, to scale down or avoid mitigation requirements. They illustrate how easily NRC and NMFS are persuaded to support the utilities' arguments instead of regulating according to federal law and their own findings.

Notes

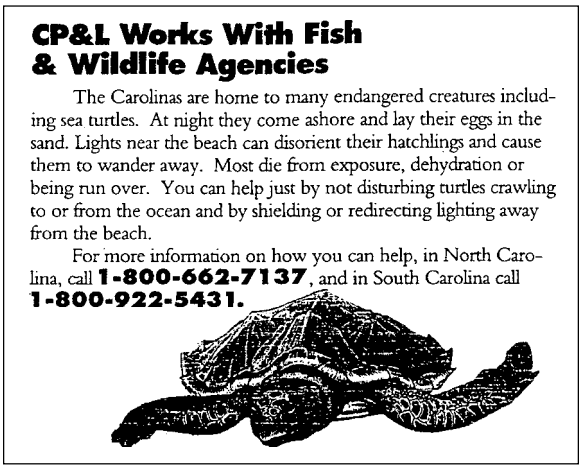
[1] Sir William Schwenck Gilbert, *The "Bab" Ballads,* "Etiquette."

[2] See, for example, "Reliable, Proven, Safe, Clean," four-color Nuclear Energy Institute print advertisement, 1999, published, among other places, in the *New York Times, Washington Post*, and *Atlantic Monthly*.

4-1. Brunswick Steam and Electric Plant
Carolina Power and Light Company, Cape Fear River, NC

CP&L goals: More kills, limitless live captures, less oversight

Carolina Power and Light Company (CP&L), the licensee for the Brunswick Steam and Electric Plant (BSEP), operates two nuclear reactors, using the once-through cooling system at its plant on the Cape Fear River estuary on the North Carolina Coast. Brunswick has captured endangered sea turtles as well as shortnosed sturgeon, an endangered species of fish. CP&L uses token public relations smokescreens to mask its real attitude toward endangered species: to push for higher kill numbers, limitless live captures, and less regulatory oversight.



A CP&L ratepayer bill insert touts hatchling protection without mentioning how its reactors kill or injure numerous adult sea turtles annually.

In making its case to the National Marine Fisheries Service (NMFS), CP&L talks up its customer bill insert on the protection of nesting sea turtles, its funding of beach signs warning of nesting shore birds and sea turtles, and an educational display at the Brunswick Visitors Center at Southport. However, these initiatives are simple, inexpensive actions that fail to mention how the operation of the Brunswick reactors harms the same wildlife that the utility urges the public to safeguard. When CP&L is asked to take meaningful steps toward the protection of sea turtles and shortnosed sturgeon, the utility invariably balks.

To secure changes to take limits for the species it kills and captures, CP&L has to have exceeded its existing annual take limits established by NMFS. The utility, through the Nuclear Regulatory Commission (NRC), then files to NMFS for a "reinitiation of consultation under Section 7 of the Endangered Species Act." (For an explanation of this procedure, see chapter 6, this report.)

Chronology

CP&L began such a reinitiation in December 1997 after it was revealed that the utility had been taking endangered sea turtles without an incidental take statement, a violation of the Endangered Species Act. (See chapter 1, this report.)

Live captures not limited. In its biological assessment, submitted to NMFS in March 1998, CP&L claimed the problem had arisen because more sea turtles than in the past were present in the area. Ignoring the potential for stress and harm to captured sea turtles, CP&L pressed for no limit on the number of live captures allowed at the plant, stating: "CP&L is recommending that no limit be established for nonlethal takes of sea turtles."[1]

Expert opinion challenged by utility. NMFS at first chose to override these requests, establishing reduced take limits for sea turtles in its April 1999 biological opinion. CP&L, immediately challenged these limits and questioned "whether these lower numbers in the proposed incidental take statement are necessary to protect the species."[2] CP&L asserted that "since 1993 the general trend has been an increase in the number [of] sea turtles, including green and Kemp's ridley, taken in the intake canal," and that this increase would account for the greater number of sea turtles captured at the plant.[3] NMFS countered that if more takes at Brunswick are "due to an increase in population, you need to support that with evidence other than increased stranding numbers."[4]

Unable to meet take limits . . . NMFS had cut the take limits by changing the take quota from annual to biennial, effectively halving the amount of allowed captures yearly. This forced CP&L to admit it would be unable to comply with the limits for captures and kills. "Brunswick will not be able to reasonably meet the biennial limits in the incidental take statement," read a CP&L overhead slide at a September 14, 1999, meeting with NMFS and NRC to discuss the utility's problem.[5]

. . . a push for reduced oversight. At the same meeting CP&L bid for a reduction in regulatory oversight. Another slide read: "Can the statement be revised without entering consultation again?"[6] This simply stated request revealed CP&L's desire to avoid formal consultation with NMFS each time the plant took too many sea turtles.

This simply stated request revealed CP&L's desire to avoid formal consultation with NMFS each time the plant took too many sea turtles.

"Causal" versus "noncausal" dodge. CP&L also tried to force a differentiation in category among sea turtles found dead at the plant. Though willing to accept that a few may have died as a result of reactor entrainment, CP&L emphasized that sea turtles that "most likely washed into the intake canal already dead" should be classified as mortalities "noncausal" to the plant's operation and should not count toward the lethal take limit.[7] With a categorization for noncausal takes in the incidental take statement, CP&L would be free to make a subjective judgment about cause of death and effectively report fewer sea turtle deaths, thus staying within the NMFS limits. CP&L had one qualification: "However, the subcategorization for noncausal takes should not reduce the take numbers in the incidental take statement and the biological opinion. In fact . . . the overall numbers of takes should be increased."[8]

True kill numbers misrepresented. Even before requesting changed categorization, CP&L was already omitting "noncausal" lethal takes in its documentation. CP&L's slides and its biological assessment show only 3 lethal takes in 1996, but the plant's Sea Turtle Stranding and Salvage Network stranding reports for that year show 13 mortalities.[9]

Mitigation attempt botched. In its biological assessment, CP&L admitted that an earlier attempt at minor mitigation had failed due to poor design. "In July 1997, CP&L installed experimental fixed six-inch blocker panels on the diversion structure to further decrease turtle entrapment. Larger than anticipated amounts of corrosion on the metal grates of the blocker panels has occurred, causing sections of the blocker panels to be ineffective."[10]

Protective actions weakened or deleted. Among other changes, CP&L asked NMFS to:

- Water down rather than comply with any meaningful regulations that would ensure prompt medical attention for injured sea turtles. In response to the NMFS instruction that "injured sea turtles will be taken to a veterinarian," CP&L suggested the statement be modified to, "CP&L will make appropriate efforts to obtain medical treatment, including veterinarian services as warranted, for turtle injuries."[11]
- Lessen the burden of obligatory necropsies of every dead sea turtle. "CP&L recommends the statement 'necropsy will be performed' be modified to 'necropsy or other action be performed as determined by the NC Sea Turtle Coordinator.'"[12]
- Rid itself of the opportunity to serve a genuine scientific and conservation purpose such as tissue sampling for the genetic identity of sea turtles interacting with the plant's cooling water intake system.[13] CP&L demanded not adjustment but deletion of this requirement as "unwarranted."[14]

Expert opinion defeated. Ultimately, CP&L succeeded in convincing NMFS to back down from its position on tissue sampling, automatic necropsy, and veterinary attention. The utility was aided and

abetted by the ever-present support of NRC. In a cover letter, NRC gave the CP&L biological assessment its blessing—without waiting for the opinion of NMFS, the only agency with any reasonable amount of expertise on the status of endangered species. "The staff agrees with the CP&L conclusion, and believes that the continued operation of the BSEP will not jeopardize the continued existence of the five species of sea turtles evaluated in the BA [biological assessment]."[15]

Ultimately, CP&L succeeded in convincing NMFS to back down from its position on tissue sampling, automatic necropsy, and veterinary attention.

Short-nosed sturgeon snubbed. In February 1999, NMFS had also established a no-take lethal limit for shortnosed sturgeon, suggesting that if one is killed "the action which took the sturgeon [must be] stopped."[16] Again, CP&L objected, despite the NMFS assessment that the removal of just one member of the fragile Cape Fear River population could have fatal consequences for the survival of the entire local species.[17] Instead, CP&L lamented: "Stopping the action which took the sturgeon is not appropriate . . . CP&L . . . believes that a decision in plant shutdown or other extraordinary measures should be based on consideration of the facts during the consultation process."[18] Once again, the fate of an endangered species is of marginal concern to an industry unwilling to look beyond its own profit margin.

Notes

[1] CP&L biological assessment, submitted to NMFS by NRC, March 9, 1998, p. 2, FOIA# 2000-0058.

[2] CP&L comments on the NMFS draft biological opinion, submitted to NMFS by NRC, February 24, 1999, p. 2, FOIA# 2000-0058.

[3] Ibid.

[4] Robert Hoffman, NMFS, e-mail to "Cynthia" (last name not identified) at NRC, July 15, 1999, FOIA# 2000-0058.

[5] CP&L overhead slide, September 14, 1999, meeting with NRC, NMFS, Southport, NC.

[6] Ibid.

[7] Sea Turtle Stranding and Salvage Network—Stranding Report, June 4, 1996, FOIA# 2000-0058.

[8] NRC document sent to NMFS on behalf of CP&L, October 29, 1999. Supplemental Information regarding the impact to sea turtles at Brunswick Steam Electric Plant, p. E1-2. Docket Nos. 50-324 and 50-325. NRC Public Document Room (PDR).

[9] Sea Turtle Stranding and Salvage Network, Stranding Reports, 1996.

[10] CP&L biological assessment, NRC cover letter, p. 1.

[11] Ibid.

[12] Ibid.

[13] CP&L comments to NMFS draft biological opinion, p. E1-3.

[14] Ibid.

[15] Jack W. Roe, acting director, Division of Reactor Program Management, Office of Nuclear Reactor Regulation, NRC, letter to Colleen Coogan, NMFS, March 9, 1998, Docket Nos. 50-324, 50-325, FOIA# 2000-0058.

[16] NMFS draft biological opinion, February 1999, FOIA# 2000-0058.

[17] NMFS biological opinion April 30, 1999, FOIA# 2000-0058.

[18] CP&L comments on the NMFS draft biological opinion, p. 2.

4-2. Crystal River Energy Complex
Florida Power Corporation, Crystal River, FL

FPC's mission: No limits for sea turtle captures, dead or alive

The Crystal River Energy Complex, on Florida's west coast, consists of four coal-fired units and one atomic reactor, known as CR-3. The nuclear unit began to capture the severely endangered Kemp's ridley sea turtle in abnormally large numbers in 1998—42 that year, 5 dead on capture. This compares with an average of 2 turtles a year between 1994 and 1997. The Florida Power Corporation (FPC) was quick to blame other factors for the influx such as an overall increase in sea turtle numbers, ignoring studies that point out various characteristics of the reactor's once-through cooling system that might attract sea turtles to the vicinity. Like other utilities, FPC prefers to make its own assessment of whether a sea turtle death is "causal" or "noncausal" to plant operation and expects the National Marine Fisheries Service (NMFS) to do the same, effectively raising the number of turtles the utility can legitimately kill.

Though willing to send the injured sea turtles it captures to respected rehabilitation facilities in the state, FPC avoids spending its own money to research or install prevention devices for sea turtles or conduct helpful biological research on animals captured at the site.

Crystal River had already caught the federal authorities' attention for disturbing marine life even before the 1998 sea turtle influx. According to Nuclear Regulatory Commission (NRC) documents, the Florida Department of Environmental Regulation, in May 1996, considered thermal effluents from Crystal River "to have substantially damaged the benthic macroinvertebrate and seagrass communities in a 1100-ha (2700-acre) mixing zone around the discharge canal . . . [They] also expressed concern about the entrainment by Crystal River Units 1, 2, and 3 of bay anchovies, crab larvae, and penaeid shrimp larvae."[1]

In its Industrial Wastewater Facility Permit of March 1, 1998, the Florida Department of Environmental Protection (FDEP) required that the combined condenser flow from Units 1, 2 and 3 at Crystal River "shall not exceed 1,897.9 MGD [million gallons per day] during the period May 1st through October 31st of each year, nor 1,613.2 MGD during the remainder of the year."[2] This flow-reduction arrangement would reduce the number of entrained organisms but would not reduce thermal effects.[3] The permit also included "a seagrass monitoring and planting program with a limitation on plant operations to maintain a three-hour average temperature not to exceed 96.5 degrees F and an instantaneous maximum temperature not to exceed 97.0 degrees F."[4]

The high captures and kills of Kemp's ridleys in 1998 prompted NRC to request reinitiation of consultations with NMFS on behalf of the utility, as required by the Endangered Species Act, since it had exceeded the established sea turtle take limits.

Chronology

In October 1998, FPC began its campaign for a distinction between sea turtles killed by operation of the CR-3 reactor and those that had died prior to entrainment.

No kill limit for sea turtles proposed. FPC's biological assessment stated: "FPC cannot accurately predict the levels of annual lethal takes not related to power plant activity due to the variability and increasing numbers of state-wide sea turtle strandings."[5] Despite admitting the difficulty in discerning whether a sea turtle death was "causal" or "noncausal," FPC argued in its biological assessment for exemption from any lethal take limits: "Due to the difficulty in differentiating between plant and non-

plant related causes of death, FPC proposes that no specific numeric mortality limit be established in the incidental take statement. Instead, FPC proposes that sea turtle protection be accomplished through existing FPC protective measures."[6]

No live capture limits also proposed. Next, FPC argued against limits on live sea turtle captures as well. "FPC believes that a numerical limit on live takes is not necessary to ensure the protection of the sea turtle population," FPC commented after reading the NMFS biological opinion, which left unchanged overall take numbers.[7] "However, if established, it should be averaged over a longer time period to allow for periodic higher influxes . . . FPC recommends the time period be averaged over a three- or five-year period. The allowed live incidental take therefore would be increased to 75 over a three-year time period or 125 over a five-year period."[8] Conceding that NMFS might not withdraw a lethal take limit, FPC also recommended that "the lethal incidental take limit also be averaged over the same time span as that recommended for the live incidental takes. This would result in a lethal take limit of no more than 7 sea turtles over a three-year period or 12 over a five-year period."[9]

NMFS is abrogating its regulatory oversight responsibilities by trusting plant personnel to make accurate subjective judgments about the cause of death of sea turtles.

NMFS changes tack, abrogates regulatory responsibility. In its 1997 biological opinion for Public Service Electric and Gas Company's Salem plant, NMFS had argued that the utility should be considered in some measure responsible for mortalities of all sea turtles found at the facility because of the possibility that sea turtles were attracted to the plant by the intake and discharge structures. However, NMFS backed down two years later when assessing Crystal River's case and agreed that some dead sea turtles would not be blamed on plant operation. In the biological opinion it issued for FPC, NMFS declared it

> ". . . agrees with the BA [biological assessment] that dead turtles floating in the canal are not causally related to plant operations . . . NMFS also believes that severely decomposed turtles found on the bar racks are also not causally related to plant operations as the bar racks are continually monitored on a daily basis for turtle strandings. Therefore dead sea turtles not considered causally related to plant operations and verified by the FDEP are not considered taken by CREC [Crystal River Energy Complex]."[10]

Even if these arguments are considered reasonable, NMFS is abrogating its regulatory oversight responsibilities by trusting plant personnel to make accurate subjective judgments about the cause of death of sea turtles and to fully report all takings. The basis for this decision contradicts FPC's own stated difficulty in differentiating with certainty between plant and non-plant–related causes of death. It effectively results in self-regulation by the utility.

Protective measures and useful research avoided. In its draft biological opinion, NMFS stipulated three "Conservation Recommendations." Namely, the Crystal River Energy Complex should:

- Conduct tissue sampling for the genetic identity of sea turtles interacting with plant cooling water intake systems.
- Set up a tagging program for released sea turtles in conjunction with FDEP.
- Continue working on a design for diversion structures to keep sea turtles away from the bar racks.[11]

FPC argued against the first item, saying "the sampling of Kemp's ridleys is unnecessary." It suggested that the third item "should be modified to a recommendation that FPC continue evaluation of methods to reduce sea turtle takes. FPC's concern is that a diversionary structure in the CREC [Crystal River

Energy Complex] intake canal is not likely an effective means of reducing sea turtle takes."[12] No explanation was offered as to why this structure would be ineffective.

NRC backs the utility position. NRC attached its own comments to the FPC response, predictably backing the utility position and questioning NMFS's opinion that conservation measures were needed. With utility economic interests at heart, NRC asked: "What is the purpose of conducting the tissue sampling?"[13] NRC also asked: "Would plant operations not specifically related to the intake or discharge of cooling water into the nuclear plant that resulted in a lethal take be exempt from the takings prohibition of section 9(a)?"[14] This reads as a thinly veiled attempt to allow any other mishaps at the plant involving sea turtles to bypass NMFS interference.

NMFS bows to FPC pressure. In its final biological opinion, NMFS did establish take numbers but bowed to FPC pressure by distinguishing between causal and noncausal takes, stating: "NMFS anticipates 50 live takes due to the rescue of sea turtles from the bar racks (of the five species analyzed in this biological opinion), 5 lethal takes (lethal take being turtle mortalities considered causally related to plant operations and verified by the FDEP) and 8 dead turtles not causally related to plant operations could be incidentally taken every two years."[15] NMFS also backed off its conservation recommendations to which FPC and NRC had objected, abandoning all mention of tissue sampling and agreeing with FPC's wishes for nonspecific evaluation of methods to deter sea turtles.

Notes

[1] Generic Environmental Impact Statement for Licensed Renewal of Nuclear Power Plants, NUREG 1437, vol. 2, Appendix F, May 1996.

[2] FDEP, State of Florida Industrial Wastewater Facility Permit, March 1, 1998, section I.A.1.b p. 2. Submitted to authors by FDEP.

[3] Generic Environmental Impact Statement.

[4] FDEP Permit.

[5] Florida Power Corporation Biological Assessment for Crystal River Unit 3, Summary, p. 1, submitted to NRC, October 1, 1998, FOIA# 2000-0182, Appendix A-5.

[6] Ibid. p. 25.

[7] FPC Comments on Draft Biological Opinion Regarding Impact to Sea Turtles at the Crystal River Energy Complex, submitted to NMFS by NRC June 8, 1999, p. 1, FOIA# 2000-0182, Appendix A-2.

[8] FPC Comments on Draft biological opinion.

[9] Ibid.

[10] NMFS Draft Biological Opinion, 5. Effects of the Action, p. 15, submitted to FPC by NRC, April 8, 1999, FOIA# 2000-1082, Appendix A-3.

[11] Ibid., Appendix A-18.

[12] FPC Comments on draft biological opinion, Conservation Recommendations, p. 1.

[13] NRC Comments on the NMFS draft biological opinion, Regarding the Impact to Sea Turtles at the Crystal River Energy Complex, Enclosure 2, June 8, 1999, FOIA# 2000-0182, Appendix A-2.

[14] Ibid.

[15] Crystal River Unit 3—Section 7 Biological Consultation, NMFS biological opinion, p. 17, forwarded to Crystal River Energy Complex by NRC July 15, 1999, FOIA# 2000-1082, Appendix A-3.

4-3. Diablo Canyon Nuclear Power Plant
Pacific Gas and Electric Company, San Luis Obispo, CA

PG&E: Cover-ups, falsifications challenged—but money talks in the end.
The Diablo Canyon Nuclear Power Plant near San Luis Obispo, CA, operates two nuclear reactors, using the once-through cooling system. Their routine operation was determined to have a damaging effect on the coastal marine environment by the California Department of Fish and Game (DFG) and the California Regional Water Quality Control Board (RWQCB), Central Coast Region. Yet, like other utilities, Diablo Canyon's operating utility and licensee, PG&E, has long attempted to minimize and obfuscate the facts about its impact on the marine environment.

In 1982, PG&E, under its obligation to the water quality control board's San Luis Obispo office, submitted a series of reports about the plant's effect on the surrounding marine environment in Diablo Cove. However, in 1994 the regional board finally discovered, through revelations by the Department of Fish and Game, that PG&E's data contained only information that showed the plant had little or no effect on the marine environment around its reactors. "Evidence indicates PG&E omitted more than half of the actual test results which showed up to a 90 percent reduction in sea life as it passed through the cooling system," the state and federal environmental protection agencies said in a joint statement after the discovery that PG&E had suppressed data detrimental to its claims.[1]

PG&E's track record of withholding data…on the reactors' actual discharge impacts has further undermined the company's credibility.

PG&E's track record of withholding data, for years and even decades, on the reactors' actual discharge impacts has further undermined the company's credibility. These revelations have led to extensive litigation between PG&E and state water authorities, revealing the lengths to which PG&E is willing to go to cover up facts, avoid mitigation, and stall or withdraw from negotiations. Meanwhile, Diablo Canyon's on-going operation further degrades the marine environment.

Chronology

PG&E fined for tampering with and withholding key data. In May 1997, in one of the largest environmental settlements reached since the 1989 Exxon Valdez disaster, PG&E was forced to pay out $14.04 million for tampering with and withholding portions of studies that showed negative impacts on entrained marine life at Diablo Canyon.[2] Sued by California and U.S. Environmental Protections Agencies, the state and federal attorneys general offices and the RWQCB, Central Coast Region, PG&E was found to be in violation of the federal Clean Water Act. The utility's conclusions about the amount of sea life drawn into the system were found to be based on scientifically unsound data—measurements of the amount of fish and other organisms at the outflow of the cooling system.

PG&E refuses to admit guilt, despite overwhelming evidence. After the 1997 settlement, PG&E refused to admit guilt while the RWQCB conceded that the problem might be impossible to correct with the plant already in place. "It's not sure there would be anything that could actually be done the way the plant is currently built," said Paul Jagger, assistant executive officer at RWQCB's San Luis Obispo office.[3] The government agencies that settled with PG&E issued scathing statements about the company, calling the conduct of its senior officials "rogue behavior" and saying its decision not to report findings at Diablo Canyon "lacked integrity."[4]

PG&E stalls mitigation agreements. The terms of the settlement included a new study to be done for Diablo Canyon by Moss Landing Marine Laboratory. Terms also stipulated that $6.19 million of the

$14.04 million penalty would be directed toward environmental enhancement projects. However, agreement on conservation programs between PG&E and the regional water board led to continual breakdowns in negotiations between the two parties, resulting in delays.

Water board submits to PG&E delaying tactics. By November 1999, the regional board was tired of waiting. Prior to a November 19 board meeting, the *San Luis Obispo Telegram–Tribune* reported that the board was considering issuing a cease and desist order against the utility company for violating its water discharge permit by damaging the marine environment.[5] This would have obligated PG&E to submit an analysis and time line for modifying its water discharge system to prevent further degradation of near-shore habitat.[6] At the meeting, PG&E showed a 10-minute video of abundant fish swimming in the cove near the plant, an effort that some board members dismissed as "fluff, misleading and without scientific value."[7] The fish flourishing in the cove were found not to be the indigenous species, but those attracted by the artificially warmed waters. Despite this, the board agreed to yet another delay, giving PG&E until March 30, 2000, to allow the utility to plan adequately for evidentiary hearings on the proposed cease and desist order.

The abundance-of-organisms argument has been shown to be flawed by ecologists and others. As award-winning Harvard Professor of Entomology and conservation scientist Edward O. Wilson pointed out in his landmark book, *The Diversity of Life,* numerical abundance of any species is not necessarily a guarantee of survival. "The age, health and breeding patterns of individuals have an important effect on the genetic trajectory of a population and eventually its very survival," Wilson wrote.[8] "Even if the woods and fields are swarming with plants and animals of a certain kind, the species might be destined for extinction."[9]

Damage proven but PG&E argues against mitigation. By December 1999, PG&E's own new study was made public in draft form. It revealed that Diablo Canyon was killing significant numbers of near-shore fish larvae.[10] "One species of kelp fish suffers 24 percent larvae mortality, two species of sculpin larvae were reduced by 10 percent and 7 percent respectively and 14 percent of monkey-faced prickleback young are killed," the study stated.[11] The study also found that about 90 percent of the black abalone that once inhabited the cove had succumbed to withering syndrome, a fatal disease that has also affected the red abalone. This disease has been attributed to the higher water temperatures created by the plant's discharge system. Despite these numbers, the PG&E legal team continued to argue that "the plant's impacts on the ocean are predictable, minimal and temporary, and no mitigation action is needed."[12] The state Department of Fish and Game and the state Water Resources Control Board disagreed, and both submitted substantial testimony in support of a cease and desist order.

More delays as environmental damage continues. No decision was made at the March 30, 2000, meeting. Testimony and rebuttals from both sides were provided to the board for a decision at the next meeting, on June 2, 2000. In the interim, during evidentiary hearings, PG&E turned down one mitigation proposal from the state—to preserve in perpetuity the 12,000 acres surrounding the plant. Jeff Lewis, Diablo Canyon spokesman, said that handing over 14 miles of valuable coastal land was too high a price to pay. PG&E also declared as financially unacceptable the construction of cooling towers, the less destructive alternative to the once-through cooling system.[13]

Discovery of suppressed evidence shows extensive damage. In May 2000 during the evidentiary hearings, it was discovered that PG&E had withheld, since 1986, infrared images that showed the actual distribution patterns of the thermal plume and impact zones.[14] PG&E had also withheld 20-year-time-series photographs of the monitoring stations. The extensive library of historical photos showed major deterioration of Diablo Cove.[15] PG&E had also collected temperature-monitoring data during 1997

and 1998 from the area north of Diablo Cove. These data were not submitted until May 1, 2000 (even though annual monitoring reports were submitted in 1998 and 1999).[16] The temperature-monitoring data only came to light during the discovery process. The state's testimony further documents that, during earlier evidentiary hearings for the cease and desist order, PG&E's legal counsel had argued "extensively" the degree of elevated temperatures in this same area was "unknown" while PG&E staff, aware of the data, remained silent.[17]

Water board buckles to PG&E pressure. Prior to the final June hearing, PG&E reportedly entertained negotiations with the RWQCB with an offer to spend $75 million to build a deep-water intake and discharge system in lieu of paying any fines levied by the order.[18] However, at the June hearing, the RWQCB instead succumbed to the utility when PG&E threatened protracted and costly law suits if faced with the issuance of a cease and desist order to mitigate fully for the damage it had caused. On October 27, 2000, the utility and the RWQCB settled for a meager $4.5 million restoration package and the preservation of 5.7 miles of company-owned coastline habitat.

Without addressing the ongoing harmful thermal discharges, the settlement included:

- preservation of an unspecified amount of company-owned watersheds draining to the coastline from Fields Cove
- PG&E payment of $4 million for unspecified marine restoration projects in the vicinity of the reactor
- opening of Diablo Canyon Power Plant biological research laboratories to educational organizations for a 10-year period
- payment of $350,000 through company contributions for black abalone restoration through artificial cultivation and transplants
- reduction of PG&E's marine environment monitoring program for the Diablo Canyon discharges
- a narrow provision to protect the settlement against future changes in law, regulations, and permit conditions related to the settlement.

The public intervenors in the California case strenuously objected to the board's adoption of a settlement that failed to address the specific violations of the Diablo National Pollution Discharge System permit as documented by the board's own legal staff.[19] The ongoing thermal discharges continue to violate the provisions of the water discharge permit that states that: (1) there shall be no degradation of indigenous species, (2) there shall be no degradation of marine communities, including plants and invertebrate and vertebrate animals, and also (3) the elevated temperature of the receiving water shall not have any adverse effect on beneficiary uses. The intervenors also objected to the abdication of the board's regulatory responsibilities to protect water resources and marine life from the indisputable ongoing and growing damage from the generator's cooling system.

Had the board approved and issued a cease and desist order, PG&E could have faced fines of millions of dollars a day for the past 15 years.

Had the board approved and issued a cease and desist order, PG&E could have faced fines of millions of dollars a day for the past 15 years. Additionally, PG&E's proposal to extend the hot water discharges farther out into the cove or beyond, tantamount to constructing a superhighway on the ocean floor, would likely have caused new and as yet unexplored harmful environmental consequences and would have required an environmental impact statement. Furthermore, artificially cultivating black abalone and placing them back into the same environment in which they were destroyed, without reducing the rates or temperatures of the discharge water, fails to protect the species' long-term survival. This license to kill black abalone for the foreseeable future could mark the obliteration of the Diablo Cove population.

Notes

[1] Silas Lyons, "$3.6 Million for Morro Estuary," *San Luis Obispo Telegram–Tribune,* May 28, 1997.

[2] See also: Glenn Roberts, Jr., "Estuary Program in the Right Place at the Right Time," *San Luis Obispo Telegram–Tribune,* May 29, 1997.

[3] Ibid.

[4] Ibid.

[5] David Sneed, "Water Board Delays Sanctions," *San Luis Obispo Telegram–Tribune,* November 20, 1999.

[6] Ibid.

[7] Ibid.

[8] Edward O. Wilson, *"The Diversity of Life,"* (New York: W.W. Norton and Company, 1999), p. 237.

[9] Ibid.

[10] David Sneed, "Study: Diablo Killing Fish Larvae," *San Luis Obispo Telegram–Tribune,* December 14, 2000.

[11] Ibid.

[12] David Sneed, "Warm-Water Outflow Has Altered Cove's Ecosystem – but Is That Bad?" *Telegram–Tribune*, January 16, 2000.

[13] Ibid.

[14] Michael Thomas, project manager, California Regional Water Quality Control Board—Central Coast Region, "Rebuttal Testimony in Support of Cease and Desist Order No. 00–032," May 5, 2000, p. 6.

[15] Ibid.

[16] Ibid.

[17] Ibid.

[18] *California Energy Market*, May 12, 2000, p. 7.

[19] Jennifer Soloway, senior staff counsel, California Regional Water Quality Control Board, Central Coast Region, "Response to Legal Argument Opposing Adoption of Draft Cease and Desist Order 00–032 for Diablo Canyon Nuclear Power Plant," May 5, 2000, p. 1.

4-4. Millstone Nuclear Power Station
Northeast Utilities, Waterford, CT

Groups file suit to force reluctant Millstone to save fish

After a three-year shutdown, the U.S. Nuclear Regulatory Commission (NRC) issued a long-awaited letter to Northeast Utilities on April 29, 1999, granting it approval to restart its Unit 2 nuclear reactor in Waterford, Connecticut. NRC approval was required for restart under conditions established by NRC after whistleblower disclosures of safety violations landed Millstone on the cover of *Time* magazine in 1996 and shut down the three-reactor station. Unit 1 never recovered from the blow—for financial reasons, Northeast Utilities (NU) decided to keep it shut permanently. Unit 3 received NRC's go-ahead to restart on June 15, 1998, after an unprecedented two-year shutdown. Unit 2's more serious problems had kept it shut down for an additional year while NU lobbied rigorously for the NRC green light to restart.

A precedent is set. NU's plans to restart Millstone Unit 2 in May 1999 happened to coincide with a springtime phenomenon in the nearby Niantic River—the migration of winter flounder larvae from their spawning grounds south toward Niantic Bay and Long Island Sound. Beginning in late December, the adult winter flounder of the Niantic River subspecies return to their native habitat and settle into the muddy riverbottom to prepare for their annual rite of procreation.

A healthy adult female winter flounder produces 561,000 eggs in February.[1] As the spawn mature, they begin to move downriver in March. For eons, their travels to the Sound have been subject to predation and natural forces. Every year since 1970, when Millstone Unit 1 opened, the larvae's migration has also brought them into the suction zone of the reactors' giant intake structures. By NU's own estimation, 500 million are swept into—*entrained*—in the intake structures during a typical season.[2] At full power, the three reactors required 2 billion gallons of water a day to cool and flush out chemical and radioactive waste byproducts of the fission process. The larvae, once captured by the force of the intake pumps, are spun through miles of coils of circulating heated water and finally spit out into a toxic waste discharge pool, lifeless, and lost to the cause of winter flounder population replenishment.

During the spring of 1999, the larvaes' fate rested in the hands of a Connecticut Superior Court Judge, Robert J. Hale. Led by Fish Unlimited, a coalition of conservation and citizens' groups, public officials, and activists had persuaded Judge Hale to issue a temporary restraining order to enjoin the restart of Millstone Unit 2 to protect the winter flounder larvae.[3] They asked for the injunction, issued on April 27, 1999, to remain in effect until June 15, 1999, the date recognized as the end of the peak entrainment period. When Judge Hale issued the order, it had no practical effect because Unit 2 was already shut down and could not restart without an NRC vote.[4]

The dynamic changed on April 29, 1999, when NU's lawyers presented Judge Hale with NRC's faxed letter, authorizing restart of Unit 2. They implored him to vacate his temporary restraining order to allow Unit 2 to go critical. Judge Hale will long be remembered for his retort: "That letter has no relevance to these proceedings."

And so it was that Judge Hale became the first state court judge to enjoin the operations of a commercial nuclear power plant—otherwise licensed to operate by NRC—to protect fledgling fish larvae in their seasonal migration.[5]

Millstone under the microscope. The Fish Unlimited case lowered a microscope on the routine operations of the Millstone nuclear reactors and their effects on the marine environment. After years of

understating Millstone's effects on Long Island Sound's marinelife, NU faced the credible charge that Millstone was the worst predator of fish in the entire Northeast.[6]

It was undisputed that Niantic River's winter flounder population had declined precipitously since 1986, when Millstone Unit 3 went on-line. Indeed, NU's own environmental monitoring records showed a decline from 200,000 adult winter flounder in 1981 to 4,000 in 1993.[7] NU reported a steady decline in the key index of female stock recruitment (females that survive to adulthood and return to the Niantic River to replenish the stock) from 51,250 in 1977 to 2,938 in 1993.[8] NU attributed the losses primarily to overfishing.[9] The 'Fish' plaintiffs presented evidence that the three Millstone reactors were responsible for a 60 percent loss of recruitment to the population.[10] The suit focused on losses to the Niantic River subspecies of the winter flounder (*Pleuronectes americanus*) because of its importance to the region as an indigenous stock. Losses to other aquatic species, including lobster, tautogs, cunner, anchovies, and others, have also been significant.[11]

Chronology

Predictions of adverse marine impacts prove understated. From the outset, before Millstone 1 received a license to operate, entrainment and impingement, with losses to the native fisheries, were contemplated.[12] Mathematical models were created to predict plant impacts.[13] In 1976, NU predicted that 35 years of three-unit power plant operation would reduce the population of the Niantic River winter flounder by 6 percent through entrainment and by 12 percent through impingement.[14] Altogether, therefore, NU predicted an 18 percent reduction in the Niantic River winter flounder population over 35 years.

NU had no operational basis to predict the extent of impacts to the marine environment from Millstone operations. Thus, the plants were permitted to go on-line and operate at full power, regardless of their environmental impact, as long as NU agreed to create a data base of Millstone adverse impacts as it reined in its profits. The theory was that "the broad scope of the monitoring program and the continuity of the data base over a long time period provides the means to detect impacts from station operation."[15] Since issuance of the first National Pollution Discharge Elimination System (NPDES) permit, NU has been obligated to monitor Millstone's effects on the marine environment and report its findings annually to DEP.

As early as 1980, the DEP Water Management Bureau began to question NU's assumptions, based on sampling results in the affected area:

> Since the original model analysis, the Millstone sampling data has demonstrated that some assumptions used in the model did not accurately reflect characteristics of the real world population. It would appear advisable to readjust the model to more accurately reflect actual conditions, and to develop new impact and recovery predictions.[16]

As time passed, in its annual environmental monitoring assessments, NU reported declines in the native winter flounder population far in excess of 6 percent. However, it acknowledged only a small share of the blame, pointing to postulated overfishing as the primary culprit. It continued to point the finger at overfishing even in the late 1990s, when winter flounder stocks were rebounding elsewhere but still declining around Millstone Point. At trial in 1999, NU conceded Millstone's responsibility for a 14 percent loss to the Niantic River winter flounder due to entrainment alone.

The DEP Marine Fisheries office in Old Lyme, Connecticut, was reviewing NU's annual reports as well and carrying out its own limited monitoring program. The fisheries office began to draw conclusions

about Millstone's role in the continuing collapse of the winter flounder population and other negative impacts. By 1987, the assistant director of DEP's Office of Marine Fisheries observed:

> I feel it is safe to conclude that we now have great concern about the impact of the plant on the winter flounder population of eastern Long Island Sound. Vic [Victor A. Crecco], a staff biologist, in particular, feels very strongly that he has never witnessed a more convincing case of serious adverse impact to a fish stock than that presented by the Millstone data. Frankly, he makes a very compelling argument. Under the most optimistic scenarios of spawning stock size and entrainment and mortality of late stage larvae, the 'equivalent adults lost' could be as much as 50 percent of the parent stock. I reiterate, this is under the scenario most optimistic for [NU]."[17]

The memo followed with a recommendation that potential measures be considered to mitigate losses due to larval entrainment at Millstone.

By 1993, DEP was considering an "emergency strategy" to mitigate what it termed the "current precipitous decline in the Niantic River winter flounder population."[18] The proposed strategy involved:

> Forced Outages—DEP management could explore forced outages at Millstone Nuclear Power Station as a short term emergency strategy to mitigate the current precipitous decline in the Niantic River winter flounder population. The strategy, if employed, would be an extreme stop gap measure until improved fisheries management regulations are implemented. It is the only entrainment mitigation alternative which is capable of providing some immediate benefit to the population.

In 1994, NU reported that the Niantic River winter flounder population "continues to decline with 1993 adult indices at the lowest level since sampling began in 1976." The DEP fisheries staff found "nothing in this report to indicate that the Niantic flounder population will recover anytime soon."[19]

Perhaps bowing to pressure from DEP, NU scheduled refueling in 1995 to coincide with the larval winter flounder entrainment. Unit 2 was shut down for the entire larval period, and Unit 3 was shut down April 14 and resumed operation on June 7. NU estimated the shutdowns coincident with the larval period theoretically reduced entrainment by 44 percent from the total entrainment expected with full operation of all three units.[20]

On November 4, 1995, Unit 1 shut down. On February 20, 1996, Unit 2 shut down. On March 30, 1996, Unit 3 shut down. Millstone landed on the cover of *Time* magazine. The NRC ordered all three units to remain shut down until further order and a Commission vote to restart. Millstone's requirements for circulating water were dramatically reduced, although some water was required to cool the three reactors and their spent fuel pools even in shutdown. The Millstone shutdown was a reprieve for the Niantic River winter flounder.

After the 'Fish' case concluded, DEP Fisheries Office released a new study, challenging, for the first time, assumptions NU had applied for years in its statistical models. The DEP found much to agree with the analysis conducted by Rhode Island fisheries biologist, Mark Gibson, which concluded that Millstone operations may be responsible for a 60 percent loss of recruitment to the Niantic River winter flounder.[21]

NPDES permit and "best available technology." The Millstone reactors are licensed by NRC to conduct nuclear operations. However, certain aspects of the operations are also subject to the Federal Clean Water Act, which controls discharges of thermal plumes and chemical discharges into waterbodies. In Connecticut, the Department of Environmental Protection (DEP) is delegated the responsibility to issue permits under the Clean Water Act. The Connecticut DEP first issued an NPDES permit for Millstone discharges on September 26, 1973. The permits are issued for a maximum term of five years. The Clean Water Act contemplates that, with each successive renewal, the permittee will incorporate latest technologies to reduce pollution so that, over time, pollution will be entirely eliminated (hence the name, National Pollution Discharge Elimination System).

With passage of the Clean Water Act, cooling water intake structures were required to reflect the *best available technology* for minimizing environmental impacts.[22] In successive applications by NU to renew its NPDES permit, the DEP commissioner has consistently determined that:

> [T]he location, design, construction and capacity of the cooling water intake structure represents the best available technology for minimizing adverse environmental impact free from impingement and entrainment pursuant to Section 316(b) of the Federal Act.[23]

Similarly, successive permits have provided identical language:

> The Commissioner has also determined that additional evidence based upon actual operating experience of Millstone Nuclear Power Station, Units 1, 2 and 3 would be desirable in order to corroborate the Commissioner's findings.[24]

Faced with the sharp and steady decline of Niantic River winter flounder, the DEP commissioner required, as a condition of the 1992 permit renewal, that NU submit a report on alternatives to reduce entrainment of winter flounder larvae by January 31, 1993. NU duly filed its report, entitled "Feasibility Study of Cooling Water System Alternatives to Reduce Winter Flounder Larval Entrainment at Millstone Units 1, 2 and 3." The report examined various alternatives, including forced outages and conversion to a closed cooling system. It argued that such alternatives would not be cost effective. The report was not subject to a process of public scrutiny. On January 14, 1994, DEP approved the report as complying with the 1992 permit order, subject to the following condition, among others: "The permittee will continue efforts to schedule refueling outages to coincide with the period of high winter flounder larvae abundance at the intake (typically April 1st through June 15th)."

Other remedies sought. In the 'Fish' suit, in addition to injunctive relief, the plaintiffs sought additional remedies that would assure more lasting protections of the marinelife beyond the end of the seasonal winter flounder larvae migration in June 1999: the plaintiffs sought installation of a fish return and they sought conversion of the unit from a once-through to a closed cooling system.

Fish return. In 1976, NU predicted a 12 percent loss to winter flounder as well as impacts to other aquatic life, due to impingement. In 1988, NU estimated 7,538 winter flounder mortalities at the three intake structures due to impingement. Half the mortalities occurred at Unit 2, which had no *fish return*, an installation that hoses incoming fish away from the intakes toward a sluiceway, which returns them to the Sound. Without a fish return, Unit 2 had a 100 percent impingement mortality rate.[25]

In 1983, NU retrofitted Unit 1 with a fish sluiceway. It was found to be effective in reducing impingement effects to winter flounder and lobster, but less so with other species.

Unit 3, which went into service in 1986, was constructed with a fish return. However, an NU study of the system during its first year of use found that only 41 percent of the organisms impinged on the traveling screens were washed into the sluiceway, as designed. Modifications helped improve results the following year.[26] Continuing modifications failed to protect pelagic fishes, including herrings and small forage fishes, and squid, which continued to suffer almost complete mortality.

The 'Fish' plaintiffs sought equal protection for fish in harm's way of the Unit 2 intakes. As the legal proceedings were getting underway in "Fish," DEP encouraged NU to install a fish return at Unit 2.[27] NU presented technical arguments in court to explain that building a fish return at Unit 2 would not be feasible or prudent. Judge Hale ruled:

> In the light of the evidence brought forth in this hearing the court is of the opinion that at any hearing the DEP will have to give considerable thought to the question of impingement in the light of bonuses paid to top executives, saleable assets of the corporations and the fact that even if the bulk of the decline of the winter flounder population is due to over-fishing, some of it could be avoided by building a fish return at Millstone II within a relatively short time (8-9 mos.) at a reasonable cost and thus reduce the adult fish kill and forestall further litigation .[28]

Twelve months and 16 days after Judge Hale's decision, NU overcame its technical objections to a fish return at Unit 2. On May 23, 2000—25 years after Unit 2 went on-line—a retrofitted fish return was finally installed.

Conversion to closed cooling system. The 'Fish' plaintiffs also sought an order from Judge Hale to NU to convert Unit 2 from a once-through cooling system to a closed cooling system. In such a conversion, the company would disable the giant pumps at the intake structure and drastically reduce requirements for cooling water. A closed cooling system works much as a decorative fountain, constantly recycling the same water from a pool. Such a modification could completely eliminate entrainment and impingement of marine species and would have the additional positive effect of significantly reducing the introduction of corrosive chemicals into the plant's cooling system to offset the degrading effects of seawater. At present, these chemicals are flushed out into Long Island Sound. An order to convert a commercial nuclear power station from once-through to closed cooling would not be without precedent.[29] Numerous inland reactors, located in areas of restricted water availability, were built with closed cooling systems, including Three Mile Island in Londonderry, Pennsylvania, Catawba in Clover, South Carolina, and others.

A closed cooling system works much as a decorative fountain, constantly recycling the same water from a pool. Such a modification could completely eliminate entrainment and impingement of marine species.

NU's 1993 environmental assessment put the cost of converting Unit 3 to a closed cooling system at $89 million.[30] Its study found such a conversion would be effective in significantly reducing entrainment and was feasible. However, at trial, NU protested vigorously against an order to convert Unit 2 to a closed system. In the end, Judge Hale looked favorably upon the prospect of a conversion from a once-through to a closed cooling system. In his Memorandum of Decision issued on May 7, 1999, Judge Hale stated:

> Although there is substantial cost and a time element involved, the building of a cooling tower or other device does not seem insurmountable, appears to be highly desirable and would forestall both entrainment and impingement over the long run.[31]

NPDES permit renewal and enforcement. The DEP last issued NU an NPDES permit on December 15, 1992. Its term was for five years, which expired on December 14, 1997.

Did the permit expire? NU has maintained that it is entitled to operate under the provisions of the 1992 permit because it applied for renewal of the license 180 days prior to expiration, pursuant to a state law. Citizen groups again brought suit in the Connecticut Superior Court, in April 2000, to close the Millstone Station on grounds that the NPDES permit had expired.[32] The suit alleged that when NU applied for renewal, its operations were not ongoing (all three units were shut and could not restart without NRC approval), and therefore it was not entitled to the benefit of the 180-day rule.

The case was assigned to Judge Hale, who accepted NU's argument that the plaintiffs had an adequate administrative remedy available, namely, the proceedings that DEP would eventually conduct on the renewal application. The plaintiffs argued that DEP, by accepting the renewal application and the application fee, had already made a decision that the renewal application was valid, and therefore there was no meaningful administrative remedy available to them. Besides, DEP had issued a schedule forecasting that it would not commence a hearing on the NU renewal application before December 31, 2001, thereby depriving the plaintiffs of a meaningful remedy.[33] On appeal, the Connecticut Supreme Court agreed with Judge Hale that the plaintiffs had an adequate administrative remedy, the DEP proceedings on the renewal application, and it left them to seek recourse at the DEP.

An end run around enforcement? NU has significantly modified its activities subject to the 1992 NPDES permit, although there have been no public proceedings, and the earliest will take place no sooner than December 31, 2001.[34]

Under an obscure provision of the Connecticut Environmental Protection Act,[35] NU has routinely applied for and obtained successive "emergency authorizations" to increase the volume of intake water and to allow discharges of highly toxic chemicals such as hydrazine and ethanolamine at locations and in quantities otherwise forbidden by the NPDES permit.[36] The statute permits the DEP commissioner to issue emergency authorizations only in limited circumstances: upon a finding that "such authorization is necessary to prevent, abate or mitigate an imminent threat to human health or the environment." However, dozens have been issued to NU, and they are routinely renewed without a showing of emergency conditions and imminent threat to the public or the environment.[37] Under the statute, the DEP is not required to publish notice or notify the affected area of the emergency authorization applications. When Fish Unlimited intervened in 10 emergency authorization applications in 1999, the DEP commissioner waited until after granting each of them to serve notice upon Fish Unlimited that its intervention had become moot because the emergency authorizations had already been issued. A suit challenging issuance of the emergency authorizations was transferred to the "complex litigation docket" of the Connecticut Superior Court at the request of NU's lawyers.[38] It was summarily dismissed on grounds of the plaintiffs' alleged failure to exhaust administrative remedies. The suit is pending on appeal to the Connecticut Appellate Court.

Ownership of the Millstone Nuclear Power Station may pass out of NU's hands before the appeal is resolved. Under Connecticut's 1998 electricity deregulation law, NU is required to divest its nuclear "assets" by the year 2004. On August 7, 2000, NU and Dominion Resources, Inc., of Richmond,

Virginia, announced that Dominion had placed the winning bid in the divestiture auction. Dominion's takeover requires numerous federal and state approvals. Late in 2000, Dominion's representatives were meeting with DEP officials to plan the transfer of NU's expired NPDES permit and emergency authorizations. At least one citizen's group has intervened in the proceedings.[39]

Notes

[1] "Monitoring the Marine Environment of Long Island Sound at Millstone Nuclear Power Station, *Annual Report 1997,* Northeast Utilities Environmental Laboratory, Waterford, CT,1998, p. 11.

[2] Ibid., p. viii.

[3] The plaintiffs in *Fish Unlimited et al. v. Northeast Utilities Service Company et al.* were: Fish Unlimited, Don't Waste Connecticut, STAR Foundation, New York State Assemblyman Fred Thiele, and the North Fork (NY) Environmental Council, Inc.

[4] Unit 1 was already shut down permanently. Unit 3 was also shut down for a scheduled refueling outage.

[5] Judge Hale lifted the injunction on May 7, 1999, after listening to NU witnesses predict power brownouts if Unit 2 were not immediately returned to service. In fact, the state suffered no blackouts or brownouts during the extended period the three reactors at Millstone were shut down, beginning in 1996.

[6] Mark Gibson, fishery biologist with the Rhode Island Division of Fish and Wildlife, who testified for the plaintiffs in the case, characterized the Millstone plants as a "mortality agent," effectively, "a predator which consumes larvae." (Testimony, April 27, 1999, p. 23) Millstone is not the only power plant fish predator in Connecticut; it is simply the most voracious. There have been losses due to entrainment and impingement at other coastal power plants. See Victor A. Crecco, "Cumulative Effects of Impingement and Entrainment from Coastal Power Plants on Winter Flounder in Connecticut Waters," Connecticut Fisheries Division, Old Lyme, CT, March 14, 1994. Millstone was the leader in entrainment. "High winter flounder entrainment at the Millstone Nuclear Power Station (145.9 X 106) was due to the enormous water withdrawal (858.13 m X 106) which exceeded the combined withdrawals from the other seven plants." The study also found Millstone first-ranked in impingement of age-1 flounder (17,000 fish).

[7] Crecco, DEP, Memorandum to Eric Smith, DEP assistant director, Marine Fisheries Office, July 19, 1993.

[8] "Monitoring the Marine Environment," *Annual Report 1997,*" p. 76, Table 31.

[9] The plaintiffs also presented the testimony of Alfred Maderia, a third-generation fisherman descended from the Portuguese immigrants who settled in the hamlet of Stonington around 1900 and established a fishing fleet that survives to this day. Maderia questioned NU's assertion that overfishing was responsible for the continuing collapse of the winter flounder population. He testified that the once-plentiful fishing stock in the Niantic Bay area had become so depleted by the early 1990s that the area was no longer commercially fished. Maderia and a fellow fisherman have brought suit, seeking monetary damages against NU for interfering with their business expectations and creating nuisance conditions deleterious to the marine fisheries. Their case is pending in the Connecticut Superior Court.

[10] Gibson, Testimony, April 27, 1999, p. 25.

[11] For example, a DEP supervising fishery biologist reported on September 20, 1990, that "NU is facing an impact crisis similar to winter flounder with tautog." Simpson, Memorandum to Eric Smith.

[12] *Impingement* here refers to the collision of marinelife with screens attached to the intake structures. The collisions occur with great force and leave the aquatic victims either dead on impact or gravely injured.

[13] No predictions were made regarding fish kills that result from thermal stress, the shock of a sudden release of boiling water into the frigid waters around Millstone. Such releases typically accompany a sudden unplanned reactor shutdown. In May 1972, for example, the Connecticut DEP attributed the sudden death of more than 10,000 menhaden off Millstone Point to thermal stress. In June 1974, the National Marine Fisheries Service ascribed the loss of 2.5 million flounder at Millstone to thermal shock. Michael Steinberg, *Millstone and Me* (Niantic, CT: Black Rain Press), pp. 56–57. Some 220 dead fish and crabs were discovered on August 26, 1998, after a Millstone Unit 3 shutdown and startup. NU reported a rise in temperature from 68.5 degrees F to 95.5 degrees F. This difference exceeded the NPDES permit limit of a 24 degree F rise on August 25, 1998. (F.C. Rothen, vice president-nuclear services, Northeast Nuclear Energy Company, letter to DEP, September 1, 1998.)

[14] Ibid., pp. 5-36, 5-38.

[15] Charles Fredette, supervising sanitary engineer, DEP Interdepartmental Memo to Wesley Winterbottom, April 7, 1980.

[16] Ibid.

[17] Eric Smith, Interdepartmental Message to Robert A. Jones, director, DEP-Fisheries, October 5, 1987.

[18] Fredette, Interdepartmental DEP Memorandum to Robert Smith, bureau chief, DEP Water Management Bureau, December 22, 1993.

[19] Simpson, DEP supervising fishery biologist, Memorandum to Eric Smith, October 28, 1994.

[20] Simpson, Memorandum to Eric Smith, September 11, 1995.

[21] Crecco, "Evaluation of Millstone Power Station Operations and the Niantic River Winter Flounder Population," Memorandum Report, DEP, Old Lyme, CT, January 25, 2000.

[22] The text of Section 316 is as follows: (b) Cooling water intake structures Any standard established pursuant to section 1311 of this title or section 1316 of this title and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

[23] Ibid., p. 2.

[24] See, for example, NPDES permit, issued on December 15, 1992.

[25] Northeast Utilities Environmental Lab, "Winter Flounder Impingement at Millstone Nuclear Power Station," Waterford, CT, January 1988.

[26] Northeast Utilities Environmental Lab, "Progress Report on the MNPS Fish Return Systems," Waterford, CT, October 20, 1994, p.2

[27] Michael J. Harder, director, DEP Water Management Bureau, letter to Rothen. (". . . Unit 2 does not currently have an aquatic species return system. It is my understanding that an effective return system was physically not possible when all three units were in operation. Now that Unit 1 is permanently off-line, it is requested that NNECO begin the engineering design and administrative approval process of installing such a facility. Return systems are necessary to minimize and prevent impingement losses. It is therefore requested that NNECO begin this process at this time, and not wait for a directive under a reissued NPDES permit, as it may take several months to render a Final Determination on this application.")

[28] Memorandum of Decision, May 7, 1999, pp. 6–7.

[29] Karl R. Ràbago, "What Comes Out Must Go in: Cooling Water Intakes and the Clean Water Act," *Harvard Environmental Law Review* 16(2) 1992: 463, fn. 215 and 216.

[30] Northeast Utilities Environmental Lab, "Feasibility Study of Cooling Water System Alternatives to Reduce Winter Flounder Larval Entrainment," Waterford, CT, 1993.

[31] Memorandum of Decision, p. 7.

[32] *Fish Unlimited et al. v. Arthur J. Rocque, Jr., Commissioner, Department of Environmental Protection et al.*

[33] DEP, "Draft Millstone Permit Schedule," Hartford, CT, 2000.

[34] Ibid.

[35] Connecticut General Statutes Section 22a–6k.

[36] Previously, NU had discharged such chemicals illegally in violation of the NPDES permit. It pleaded guilty to illegal discharges of hydrazine under the 1992 NPDES permit in violation of the Clean Water Act in the U.S. District Court on September 27, 1999. An enforcement proceeding was brought by the Connecticut DEP in December 1997, alleging similar illegal discharges of hydrazine and other violations of the NPDES permit. A settlement required NU to pay a $l.2 million fine. The day after the settlement was signed, NU released yet another illegal hydrazine discharge. Both enforcement actions derived from public allegations by James Plumb, a chemistry technician at Millstone, of widespread and flagrant environmental violations at Millstone. With the routine issuance of emergency authorizations by the DEP, NU is able to avoid criminal and civil liability in conducting activities otherwise in clear violation of the expired 1992 NPDES permit.

[37] One emergency authorization renewal dated December 20, 1999, bears a notation by a member of the DEP staff as follows: "I really hate these. Statutes are very limited in what they define as "emergency." Continuing emergency is <u>not</u> even contemplated."

[38] *Connecticut Coalition Against Millstone et al v. Arthur J. Rocque, Jr., Commissioner, Department of Environmental Protection et al.*

[39] Notice of Intervention of Connecticut Coalition Against Millstone, November 22, 2000, filed with Connecticut DEP November 30, 2000.

4-5 Oyster Creek Nuclear Generating Station
Amergen, Forked River, NJ

Oyster Creek: special dispensation to avoid regulatory oversight.
Amergen now operates the single once-through cooling reactor on the mouth of the Forked River near Barnegat Bay on the New Jersey coast through a license transfer from former owner and operator General Public Utility Nuclear Corporation (GPUN). Unlike other reactors studied, Oyster Creek is the beneficiary of special dispensation from the National Marine Fisheries Service (NMFS) concerning the implementation of the Endangered Species Act (ESA). In 1993, NMFS established an arrangement it reiterated in 1996, whereby GPUN is not required to reinitiate formal consultation under Section 7 of the ESA should Oyster Creek exceed its sea turtle allowance. This is a departure from usual ESA procedure. This benefit - to utilities, not sea turtles - was tested in October 1999 when Oyster Creek reported the taking of a dead green sea turtle, technically over its allowed limit. No reinitiation was filed at the time. The exemption was demonstrated again in July 2000 when a dead Kemp's ridley was retrieved from the dilution intake structure trash bars. Again, despite this exceeding the allowed lethal take limits, no reinitiation was filed by the utility nor requested by NMFS.

Chronology
Dead green doesn't count against utility. When a green sea turtle was killed at Oyster Creek on October 23, 1999, it was sent, like several in years past, for necropsy to Dr. Stephen Morreale at Cornell University, in Ithaca, NY. According to Dr. Morreale, this arrangement is an unofficial one made between himself and NMFS and not bound by any legal obligations.[1] GPUN recorded this as the first green sea turtle ever captured at Oyster Creek.[2] This mortality was not reported by the utility to the Marine Mammal Stranding Center in Brigantine, NJ, which keeps detailed records of all sea turtle captures and mortalities in the state. Oyster Creek's original incidental take statement stipulated that a reinitiation of consultation under ESA Section 7 must be filed by the U.S. Nuclear Regulatory Commission (NRC) if a single Kemp's ridley or green sea turtle is lethally taken at the plant in a 12-month period. However, NMFS has not enforced this requirement at Oyster Creek.

The inconsistent and erratic availability of data on sea turtle captures at Oyster Creek underscores a wider unreliability of information supplied to the public.

GPUN off the hook for sea turtle kill filings. Instead, as far back as 1993, NMFS had opted to excuse GPUN from filing for formal reinitiation if the Oyster Creek reactor captured more sea turtles than permitted under its Incidental Take Statement. Instead, NMFS substituted three criteria:

- Increase the level of awareness of key station personnel regarding sea turtle identification and notification requirements.
- Report future sea turtle captures to both the NMFS and the NRC.
- Deliver any captured sea turtles to the MMSC to ensure their proper evaluation and release to the environment.[3]

NMFS bends the rules for Oyster Creek
This flexible policy was reiterated in a 1995 biological opinion and cover letter from NMFS. The opinion states: "Reinitiation is required if, during any one year, twelve turtles are taken and/or there is a lethal take of one Kemp's ridley OR one green turtle."[4] However, a clarification is included in the cover letter which shows that NMFS will not require reinitiation: "NMFS will clarify that takes equaling the incidental take allowance will mandate informal consultation rather than the formal consultation as may be construed in the current take statement."[5]

In fact, Amergen, on behalf of Oyster Creek, did not file for reinitiation of consultation under Section 7 of the ESA until September 2000, the date on which the plant's incidental take statement (ITS) expired. NMFS' biological opinion of 1995 was declared by the agency as good for five years, with the cover letter absolving the utility of formal consultation apparently regardless of whether it exceeded its live or lethal take limits. It remains unclear why Oyster Creek was given an ITS of five year's duration. It is also unclear why the implementation of the ESA regarding incidental takes of sea turtles at nuclear reactors should be subject to alteration of judgment by NMFS on a plant-to-plant basis.

Furthermore, while records of four Oyster Creek turtle captures in 2000, including the dead Kemp's ridley, can be found in the NRC Public Document Room (PDR), only one of these (a loggerhead captured alive on September 18) was posted by NRC on its Daily Event Reports (DER) bulletin found on the agency's web site. A fifth Oyster Creek capture (a loggerhead captured alive on June 23) appears in the records of the MMSC and Amergen but not anywhere in NRC public records. The MMSC was not informed of the lethal Kemp's ridley take.

Amergen states that the Oyster Creek reactors took no sea turtles at all during the first 22 full years of operation between 1970 and 1991.[6] Amergen attributes this anomaly to dredging in Barnegat Bay that enhanced accessibility for sea turtles into the inlet and a possible increase in sea turtle populations in the 1990s. What remains unclear is how scrupulously facility personnel checked for the presence of sea turtles or what kind or reporting mechanism was in place at the time. Nevertheless, Amergen uses this statistic to posit the argument that 17 captures, including 6 mortalities over 30 years comprises an acceptable average loss of species. In fact, the true statistic should reflect 17 captures and 6 mortalities in nine years.[7]

Oyster Creek Nuclear Generating Station Sea Turtle Incidental Captures

DATE OF COLLECTION	TIME OF CAPTURE	SPECIES AND LIFE STAGE	CARAPACE LENGTH (cm) & WEIGHT (kg)	CAPTURED AT CWS OR DWS/# PUMPS OPERATING	INTAKE TEMP. deg. F (deg C)	ALIVE WHEN CAPTURED?	FRESH DEAD?	BOAT PROP WOUNDS?	RELEASE SITE
6/25/92	10:00 PM	Loggerhead juvenile	35.5 cm/9.6 kg	DWS/2 pumps	70.8 F(21.6 C)	No	No	Yes	N/A
9/9/92	6:00 PM	Loggerhead juvenile	46.7 cm/19.1 kg	CWS/4 pumps	78.2 F(25.6 C)	Yes	N/A	No	NJ
9/11/92*	2:00 PM	Loggerhead juvenile	46.7 cm/19.1 kg	CWS/4 pumps	79.2 F(26.2 C)	Yes	N/A	No	NJ
10/26/92	3:00 AM	Kemp's ridley subadult	32.0 cm/5.7 kg	CWS/4 pumps	52.4 F(11.3 C)	Yes	N/A	No	NC
10/17/93	12:00 Noon	Kemp's ridley juvenile	26.0 cm/3.0 kg	CWS/4 pumps	62.0 F(16.7 C)	No	Yes	No	N/A
6/19/94	1:30 PM	Loggerhead juvenile	36.8 cm/9.8 kg	CWS/4 pumps	81.1 F(27.3 C)	Yes	N/A	No	NJ
7/1/94	10:00 AM	Kemp's ridley juvenile	27.7 cm/3.6 kg	DWS/2 pumps	78.3 F(25.7 C)	No	Yes	No	N/A
7/6/94	6:40 AM	Loggerhead subadult	61.4 cm/40.4 kg	DWS/2 pumps	80.5 F(26.9 C)	No	No	Yes	N/A
7/12/94	10:40 PM	Kemp's ridley juvenile	26.7 cm/3.3 kg	DWS/2 pumps	83.2 F(28.4 C)	No	Yes	No	N/A
9/4/97	3:18 AM	Kemp's ridley subadult	48.8 cm/18.1 kg	DWS/2 pumps	73.2 F(22.9 C)	No	Yes	No	N/A
8/18/98	9:59 AM	Loggerhead subadult	50.8 cm/22.4 kg	CWS/4 pumps	80.5 F(26.9 C)	Yes	N/A	No	FL
9/23/99	3:10 AM	Kemp's ridley subadult	26.4 cm/2.9 kg	DWS/2 pumps	67.2 F(19.6 C)	Yes	N/A	No	VA
10/23/99	2:00 AM	Green sea turtle juvenile	27.0 cm/2.8 kg	DWS/2 pumps	62.8 F(17.1 C)	No	**	No	N/A
6/23/00	1:00 AM	Loggerhead juvenile	47.8 cm/17.2 kg	DWS/2 pumps	77.5 F(25.3 C)	Yes	N/A	No	NJ
7/2/00	3:00 PM	Kemp's ridley juvenile	27.3 cm/3.2 kg	DWS/2 pumps	78.1F(25.6C)	No	**	No	N/A

NOTE: No sea turtles were captured during the first 22 full years of OCNGS operation, 1970-1991.
* Loggerhead captured on 9/11/92 was the same turtle that was captured on 9/9/92.
* To be determined by necropsy.

This chart was supplied by Amergen as part of its Biological Assessment submitted in July 2000. It therefore does not reflect the three subsequent captures of 2000. These were: 8/3/00, live green; 8/28 live Kemp's ridely; and 9/18 live loggerhead.

Under the requirements of Oyster Creek's fall 2000 formal reinitiation, the utility has been asked by NMFS to supply:

- Sea turtle strandings in the State of New Jersey from 1985 to Present, sorted by Species and Month of stranding; and
- Sea turtle strandings in the State of New Jersey from 1985 to Present, sorted by Species and County.

In addition, as part of the formal consultation process, NMFS has asked the utility to obtain necropsy results and probable cause of death on four dead sea turtles sent to Dr. Morreale between July 1994 and October 1999. According to correspondence from the utility to Dr. Morreale, none of these necropsy results has been received.[8] Dr. Morreale confirmed that several of the necropsies have not yet been performed.[9] Although NMFS has required stranding and necropsy data, this is not necessarily an indication that the agency will lower the future take limits at Oyster Creek. The pattern, as illustrated in this report, indicates that NMFS is more likely to increase take allowances when confronted with the dual pressures of NRC and a reactor licensee that has exceeded its current limits.

In a 1993 necropsy performed on a dead Kemp's ridley captured at Oyster Creek, Dr. Morreale wrote:

> The lack of any obvious trauma would tend to implicate drowning as the cause of death to this animal. The lack of fluid in the lungs is not necessarily contradictory to this conclusion. It is my opinion that sea turtles suffocate underwater rather than inhaling water. The superficial scrapes on the plastron and neck were very fresh and probably occurred on the intake grates. [10]

Morreale's only qualification was that the animal appeared slightly more decomposed than he would have expected for a fresh impingement if the time of death and water temperature information he had been given was accurate. However, he told the authors of this report that necropsies were inevitably highly superficial as a means to assessing cause of death. This could be mainly ascertained based on the level of decomposition in the animal at the time he received it. A freshly dead sea turtle was a more likely victim of drowning through impingement on the reactor intake grate. A decomposed animal had more likely become impinged post mortem.[11]

The inconsistent and erratic availability of data on sea turtle captures at Oyster Creek underscores a wider unreliability of information supplied to the public. Members of the public wishing to track or monitor capture of endangered species at nuclear reactors cannot rely on these incidents being comprehensively posted by NRC as Daily Event Reports on its web site. Instead, the public must request documents 'on spec' from the NRC's PDR or submit Freedom of Information Act (FOIA) requests to NRC and NMFS. (See chapter 8, this report.) Even then, there is no guarantee that the utility has fully reported its takes to either agency.

Notes

[1] Phone conversation between Dr. Morreale and Linda Gunter, January 2, 2000.

[2] Michael Roche, OCNGS, Letter to Barry Zalcman, NRC, November 1, 1999. FOIA# 2000-0098. Appendix B-1, p.1.

[3] John Barton, GPUN, Letter to Michael Masnik, NRC, regarding Sea Turtle Agreement with NMFS, February 3, 1993. FOIA# 2000-0098, Appendix C-1.

[4] NMFS Biological Opinion, September 21, 1995, p.15. FOIA# 2000-0098, Appendix B-4.

[5] Michael Roche, GPUN, Letter to Scott Newberry, NMFS, May 6, 1996, p.1. FOIA# 2000-0098, Appendix B-4.

[6] Assessment of the Impacts of the Oyster Creek Nuclear Generating Station on Kemp's Ridley (Lepidochelys kempii), Loggerhead (Caretta caretta), and Atlantic Green (Chelonia mydas) Sea Turtles, July 2000, p. 6-13. NRC PDR ML# 00375 1892.

[7] Ibid. P.7-10.

[8] Malcolm Browne, Senior Environmental Scientist, Oyster Creek, Letter to Dr. Stephen J. Morreale, Cornell University, December 6, 2000, p.2. NRC PDR, 50-219.

[9] Telephone conversation with Morreale.

[10] Malcome Brown letter to Morreale, p.2

[11] Telephone conversation with Morreale.

4-6. Salem Nuclear Generation Station
Public Service Electric and Gas Company, Lower Alloways Creek Township, NJ

Salem: use of best technology available avoided in favor of restoration package.
Salem Nuclear Generating Station (SNGS) consists of two reactors using the once-through cooling system, resulting in the intake of more than 3 billion gallons of water a day and the thermal discharge of this water back into the neck of the Delaware Bay. In 1994, the New Jersey Department of Environmental Protection (NJDEP) allowed Public Service Electric and Gas Company (PSE&G) to embark on "a mitigation package" that includes creation of a 10,000 acre wetland creation and enhancement project. This was a blunt reversal of the NJDEP's initial position, which had required PSE&G to retrofit a closed-cycle cooling system to fulfill the requirements of the Clean Water Act (CWA), Section 316(b), which would have reduced impingement and entrainment effects by 95 percent. Section 316(b) mandates the use of best technology available to minimize adverse environmental impacts of intake structures. However, instead of insisting on the implementation of best technology available, the agency acquiesced to the utility's preference for a wetlands restoration project. The project has proven troublesome and flawed, and some observers have argued that it has caused more environmental damage than reparation.[1]

Chronology
NJDEP bows to PSE&G's financial lamentations. PSE&G filed a permit renewal application on June 1, 1990. On October 3, 1990, NJDEP issued a first draft permit, requiring the utility to retrofit its two Salem reactors with closed-cycle cooling systems, which usually consist of cooling towers. The order came in response to a study conducted by the Versar Group, a Maryland environmental consulting firm, that showed the two Salem reactors were killing billions of fish, fish eggs, and larvae every year.[2] The Versar report found three significantly damaging effects: impingement of fish and crabs against the intake screens; entrainment of small marine organisms through the entire cooling system; and the release of unnaturally warm water back into the river's fragile ecosystem.[3]

Instead of insisting on the implementation of best technology available, the agency acquiesced to the utility's preference for a wetlands restoration project.

Despite these findings, on June 24, 1993, NJDEP issued a second draft permit, allowing PSE&G to pursue a mitigation experiment instead of installing cooling towers. NJDEP had opted to accept PSE&G's claims of exorbitant cost and lack of significant negative impact (from PSE&G's comments to the 1990 permit), instead of enforcing its best technology policy. PSE&G claimed retrofitting cooling towers would cost the utility $2 billion (a figure challenged during the permit process) and produced new figures showing current fish kills that were not subjected to independent review. The NJDEP's draft permit allowed PSE&G to continue to operate the plant without cooling towers and granted its request that it be allowed to fulfill the CWA requirements by conducting a $30 million, 12-year, salt marsh restoration experiment and by pursuing other mitigation measures and studies. The permit allowed PSE&G to conduct the 12-year restoration experiment despite the fact that clean water permits are valid for only 5 years.

Enhancement or destruction? The wetlands project, the "Estuary Enhancement Program," has proven controversial from the start. Though intended to provide new habitat for fish and offset the loss of fish entrained by Salem's reactors, a position never documented by scientific study, environmental opponents have dubbed it the "Swamp Destruction Program."[4] According to opponents, the program has resulted in the deaths of thousands of horseshoe crabs. (See chapter 3, this report.) Other detriments noted by opponents include "the town of Thompson's Beach reduced to a ghost town, acres and acres of mudflats, uplands and woodlands destroyed by salt water intrusion, massive use of toxic pesticides, acres and acres of dead zones created by toxic spray."[5]

Profit over environmental protection. Environmentalists view the Estuary Enhancement Program as a clear-cut case of profit triumphing over the law as set forth in the CWA. "The only reason PSE&G is doing this is to avoid complying with the Clean Water Act to keep corporate profits high," stated a letter from a coalition of concerned citizens led by the Delaware Riverkeeper Network, based in Washington Crossing, PA.[6] "Bottom line profits and losses rule here, not altruism."[7] They argue that now that the permit is up for renewal, the project should be canceled as a failure. Jane Nogaki, a member of the New Jersey Environmental Federation, who has attended PSE&G's most recent presentations, asserts that "as far as actual documentation of creating fish, the scientists were not producing the numbers" through the program.[8] Adds Maya van Rossum, executive director of the Delaware Riverkeeper Network: "A critical issue is the absence of any science to document that food or habitat were limiting factors for fish species at issue in the Delaware Estuary. They had no baseline data to make this assessment, nor do they have that data now to document this success or lack thereof."[9]

Sea turtles in jeopardy, but PSE&G declines to help. A reinitiation of the ESA consultation process was begun by Nuclear Regulatory Commission (NRC) with NMFS on behalf of PSE&G and its Salem reactors in 1997 after the utility had exceeded its take limit for sea turtles. In its draft biological opinion, NMFS at first required Salem to conduct a sea turtle "monitoring program," but PSE&G quickly requested deletion of this program.[10] True to form, NRC supported this deletion, asking NMFS to "remove the requirement to obtain more definitive habitat data (Requirement 7) from the incidental take statement."[11] PSE&G also asked the NRC for a revision in the trash rack cleaning requirement to allow less than daily cleaning. In mandating daily cleaning, NMFS had stated that it would "minimize the impact of the circulating water intake system on threatened and endangered sea turtles."[12] PSE&G's communication to NRC said it preferred that it was granted "the ability to avoid daily trash cleaning."[13]

ESA and CWA requirements annulled. PSE&G at first petitioned NMFS directly for withdrawal of the requirements to which it objected. This bypassing of NRC is not unique to PSE&G and suggests utilities view formal consultation as a burden and would prefer to avoid the closer scrutiny of appropriate regulatory oversight. NRC, noticing it had been cut out of the process by its own licensee, for which it has liability, hastily attempted to correct the situation. In an internal e-mail, an NRC official wrote: "It sounds like they [PSE&G] want to deal directly with NMFS to get relief. That's not how the endangered species act works . . . The NRC is the implementing agency under ESA."[14]

By March 17, 1999, NMFS had agreed to omit the sea turtle study requirement from the Salem incidental take statement.[15] NMFS also agreed not to enforce its earlier request for annual meetings with the utility in favor of meetings "as needed."[16] This retreat by NMFS follows a common pattern of regulator capitulation to utility needs at most of the reactors studied. The NJDEP's earlier decision to reverse its original best-technology requirement and allow Salem to experiment with the wetland restoration program instead of installing cooling towers allowed the industry to escape the regulation imposed by CWA, Section 316(b). In fact, the lack of enforcement of best technology available by lax federal and state agencies has resulted in a virtual reversal of the goals laid out in the CWA.

Notes

1 Letter to The Editor, *The Herald*, October 21, 1999, from Norm Cohen, Coalition for Peace and Justice, UNPLUG Salem Campaign; Tony Totah, Clean Ocean Action; Maya Von Rossum, Delaware Riverkeeper; Jane Nogaki, New Jersey Environmental Federation; and Alan Muller, Green Delaware.

2 Ibid.

3 Estuary program strives to give back to nature, *Press of Atlantic City,* November 20, 1999, by Doug Bergen.

4 Letter to the Editor, *The Herald,* October 21, 1999.

5 Ibid.

6 Ibid.

7 Ibid.

8 *Press of Atlantic City,* November 20, 1999.

9 Comments to authors from Maya van Rossum, Executive Director, Delaware Riverkeeper Network, November 7, 2000.

10 Undated memo from Leonard N. Olshan, Office of Nuclear Reactor Regulation, NRC, to Leon R. Eliason, PSE&G. FOIA# 2000-103, Appendix B1.

11 Undated memo from Thomas H. Essig, NRC, to Dr. Andrew A. Rosenberg, NMFS. FOIA# 2000-103, Appendix B-3.

12 Letter to NRC from L. Storz, PSE&G re: "additional information to revise technical specification", July 7, 1998, page 2. FOIA# 2000-103, Appendix B-13.

13 Ibid.

14 E-mail from Claudia Craig, NRC, to Patrick Milano, NRC, April 22, 1998, FOIA# 2000-103, Appendix B-22.

15 Letter to Harold Keiser, PSE&G from Patrick Milano, NRC, re: "Proposal to delete requirement to develop more definitive habitat utilization data from NMFS Incidental Take Statement, Salem." FOIA# 2000-103, Appendix B-25, page 1.

16 Ibid.

4-7. San Onofre Nuclear Generating Station
Southern California Edison Company, San Clemente, CA

Edison promises mitigation but reneges on pledge to protect marine environment.
Edison's San Onofre Nuclear Generating Station, on the Pacific coast north of San Diego, uses the once-through cooling system for all three of its reactor units. Unit 1, the oldest, is closed and set to be dismantled soon at an estimated cost of $460 million, although the utility is still using its water intake system to boost production at the plant. Units 2 and 3 were issued a construction license in 1973 but, due to construction delays, did not come on line until 1983 and 1984, respectively. The operating permits for these two units were conditional on Edison's submitting to a detailed study on the marine environmental effects of reactor operation.

The resulting study showed extensive damage. Nonetheless, and despite Edison's prior agreement to compensate for destruction of the surrounding marine environment, the company has delayed, avoided and ultimately negated the bulk of its mitigation requirement, with devastating results to the marine ecosystem around the plant.

Chronology
A finding of significant damage. San Onofre's 1974 permit required Edison to submit to a comprehensive environmental impact study of the operating effects of Units 2 and 3. The study was to be conducted by an independent panel of marine scientists, appointed by the California Coastal Commission. In 1989, the panel, the three-member Marine Review Committee (MRC), completed its 14-year examination at the cost of $48 million. Edison agreed to accept whatever mitigation the MRC findings might require, a trade-off the utility made to convince the coastal commission to permit licensing of the reactors.

San Onofre was killing fish and larvae and clouding the ocean floor through the discharge of the pulverized remains, inhibiting kelp growth by blocking light.

According to Nuclear Regulatory Commission (NRC) documentation, the MRC study found significant damage to the marine environment in the area of the reactors, including a reduction of up to 70 percent in several species of fish. Some species of sea urchin and snail were reduced by up to 90 percent.[1] Other MRC findings included:

- The plant's cooling system, which sucks in about 1.7 million gallons of water a minute, kills 4-5 billion fish eggs and larvae and at least 21 tons of fish a year—more than 100,000 fish a day.[2]
- The cloudy discharge water creates a shadow effect and inhibits the growth of young kelp.[3] The study predicted entrainment and the shadow kills could reduce the offshore kelp forest by 6 percent.[4]

Damage repair ordered, and the wrangling begins. On July 16, 1991, based on the MRC study's findings, the commission ordered San Onofre to restore 150 acres of coastal wetland and build a 300-acre artificial reef north of the plant as a habitat for young fish and kelp. The mitigation package also committed Edison to maintaining an opening at the mouth of the San Dieguito Lagoon. These requirements came after a lawsuit brought by Earth Island Institute to force the mitigation had already put pressure on Edison. The suit alleged, as supported by the MRC findings, that San Onofre was killing fish and larvae and clouding the ocean floor through the discharge of the pulverized remains, inhibiting kelp growth by blocking light. Edison settled the suit on January 27, 1993, for $17 million and agreed to compensate for the environmental damage by restoring wetlands, funding research, expanding a park and creating an educational center.[5]

Restoration scaled back; damage scaled up. Instead, in 1995, Edison began to back out of the mitigation plans. The utility conducted its own "scientific" damage assessment study. In the meantime, and despite opposition from the state Department of Fish and Game and environmental groups, the state Regional Water Quality Control Board gave San Onofre permission to continue pumping water through its Unit 1 reactor, even though the reactor had been retired for three years. Thus, Edison avoided another opportunity to decrease environmental damage. Unit 1 intakes and discharges about 14 million gallons of water a day. "You are going to kill a lot of fish and invertebrates that have become accustomed to that area," said William Paznokas, environmental specialist for the state Department of Fish and Game. "There isn't any written justification" for this permit.[6]

Ratepayer-funded environmental restoration becomes stockholders windfall. In 1996, Edison delivered the results of its study and argued that claims of marine damage had been exaggerated. The utility suggested a scaled back wetlands restoration plan, eliminated the lagoon mouth maintenance project, and proposed a smaller, 17-acre reef. Edison alleged that adherence to the original 1991 requirements would cost the company close to $160 million instead of the $30 million price tag estimated at the time.[7] According to V. John White, executive director of the Center for Energy Efficiency and Renewable Technologies, Edison had already collected $80 million from ratepayers earmarked for marine mitigation programs.[8] Warner Chabot, Pacific Region director for the Center for Marine Conservation, put the estimate even higher. "To compound the insult, the [state approved for] Edison a price for electricity that included more than $100 million to cover anticipated ocean mitigation costs for this power plant," Chabot said.[9] The Public Utilities Commission (PUC) estimated the fund at $106 million.[10] A coastal commission staff report quoted the Public Utilities Commission Office of Ratepayer Advocates as stating that the utility's stockholders would be able to keep any of the mitigation funds collected from ratepayers that were not spent on restoration work.[11]

Editorial opinion urges Edison to keep promises. On November 13, 1996, the *San Diego Union Tribune* ran an editorial entitled: "Stick to the deal/Edison should mitigate fish kill."[12] It said:

> The problem with Edison's reasoning is that it looks only at new scientific evidence supporting its position, while ignoring evidence against it . . . It wants to scale back not only its kelp forest mitigation, but also it commitment to coastal wetlands that are nurseries for young fish . . . Now, Edison wants to scale back those mitigation plans, including its agreement to keep the mouth of the river open to the sea. Without the river mouth open, wetlands upstream are useless as fisheries . . . The Coastal Commission should not let Edison pick and choose among the facts.[13]

While Edison continued to stall and delay, the *San Diego Union Tribune* again urged the utility to keep its word. "A deal is a deal," said a second editorial the following April. [14]

> We're too far along on this mitigation plan to stop now. And there's no convincing scientific reason to do so, anyway . . . The sea water intake system at the San Onofre nuclear plant kills about 26 metric tons of fish each year . . . The Coastal Commission should tell SCE to stop delaying and get to work now.[15]

Commission bows to Edison's scheme to reduce environmental commitment. After numerous delays and postponed decisions, the coastal commission eventually agreed to Edison's scaled-down proposals. "We have set a world record in terms of studies and [delays]," lamented Rusty Areias, commission chairman.[16] "Twenty years is long enough."[17] The commission required Edison to spend $3.6 million on fish hatcheries and do the

150 acres of wetland enhancement. But by May 1997 Edison had persuaded the commission it would build only the smaller 17-acre experimental reef, not the full 300 acres.[18] By November, Edison had whittled down the wetlands acreage as well—to 117 acres, instead of the required 150 acres.[19]

Hike in discharge temperatures allowed, despite conclusive heat damage. In a further move that allows San Onofre to increase instead of diminishing its degradation of the marine environment, the San Diego RWQCB, by a 6 to 3 vote in February 1998, gave Edison permission to raise the temperature of its discharge water by 5 degrees above the allowable limit, to 25 degrees warmer than the normal temperature of the ocean. The State Water Resources Control Board adopted this decision on April 14, 1999.[20] Edison argued that the temperature had to be raised to generate more power and that the increase would not harm the marine environment. This is contrary not only to the wealth of evidence contained in the MRC study but also to the findings at the Diablo Canyon plant where temperatures raised to 22 degrees above normal were shown to have caused severe damage to the marine environment. (See chapter 2, this report.) Dr. Rimmon Fay, a marine biologist, oceanographic chemist, and a coauthor of the MRC study, responded that Edison should be required to install cooling towers at San Onofre and not be permitted to raise the discharge temperatures.[21] Edison officials reportedly considered the cooling tower option but again rejected it because of the high cost.[22]

Scalding killed 4,800 pounds of fish in a single day. Hot water caused further problems in September 1999, when 4,800 pounds of fish, predominantly yellow fin croaker, were killed in a single day at San Onofre.[23] The fish were scalded "inadvertently," according to Steve Hansen, plant spokesman, during a heat treatment to clean barnacles at the plant.[24] The NRC dismissed the event and said probably no action would be taken against the plant.[25] "It is not a nuclear safety issue," said Breck Henderson, NRC spokesman. "No regulations were violated."[26] A letter from Edison to NRC explained that "generally a heat treatment results in the loss of less than 1,000 pounds of fish."[27]

Edison stockholder windfall off ratepayer fees could reach $103 million. On September 29, 1999, Edison announced that a 22.5 acre artificial reef had been completed at a cost of $2.7 million.[28] To date, this is all Edison has spent on mitigation, and no other restoration efforts are reported to have been accomplished. If PUC calculations about unused mitigation fund profits are correct, Edison stockholders stand to pocket up to $103.3 million paid out by ratepayers for environmental restoration efforts but not used by Edison for that purpose. Moreover, on March 11, 2000, San Onofre received a license extension to 2022, nine years beyond the date the plant was to have shut down.

Seals and sea turtles—an on-going mystery. Although NMFS records show that San Onofre has been capturing sea turtles, seals, and sea lions, NRC Daily Event reports do not reflect these captures or mortalities. NMFS records show 136 marine mammal mortalities at San Onofre over a span of 13 years, although records are incomplete or missing for some years.[29] Joe Cordaro, NMFS Southwest biologist, told the authors his office has no direct dealings with NRC but does receive reports of seal captures at San Onofre directly from the plant biologist.[30] NMFS has issued San Onofre a letter of permission to take seals and sea lions, but there is to date no official incidental take statement. No records could be found of mitigation attempts to address these issues, similar to those at Seabrook, and it is not known why NRC, which has liability for marine mammal deaths at its licensees' plants, has failed to oversee these captures under its regulatory obligations. Cordaro also provided records of three green sea turtle deaths and seven live green sea turtle captures at San Onofre between 1983 and 1991, although two of the interim years were missing so the records are incomplete.[31] None of these records surfaced in Freedom of Information Act submittals to NRC.

Notes

[1] NRC, NUREGS/SR1437/V2/part 0.9.

[2] Steve La Rue , "$17 Million Deal Resolves N-Plant Suit, *San Diego Union–Tribune,* January 27, 1993.

[3] Rimmon Fay, marine biologist, Venice Beach, CA,telephone conversation with authors, November 1999.

[4] Steve La Rue, "Nuclear Plant Owners Seek Environmental Break/Coastal Panel Asked to Relieve Artificial Reef Costs, *San Diego Union–Tribune*, August 20, 1996.

[5] Ibid.

[6] Steve LaRue, Pumping of sea water at Onofre reactor OK'd despite worries, *San Diego Union–Tribune*, February 10, 1995.

[7] Nuclear plant owners seek environmental break.

[8] V. John White, executive director, Center for Energy Efficiency and Renewable Technologies. "What's at Stake in the Coastal Commission Flap," opinion-editorial, *San Diego Union–Tribune,* July 12, 1996.

[9] Nuclear plant owners seek environmental break.

[10] Steve La Rue, "N-plant Mitigation Plan in Spotlight," *San Diego Union–Tribune*, April 8, 1997.

[11] Ibid.

[12] Editorial, "Stick to the Deal/Edison Should Mitigate Fish Kills," *San Diego Union–Tribune,* November 13, 1996.

[13] Ibid.

[14] Editorial, "Restore the Wetlands/SCE Should Keep Its Promise on Lagoon, *San Diego Union–Tribune,* April 7, 1997.

[15] Ibid.

[16] Terry Rodgers, "Edison Told to Repair Damage From Onofre, *San Diego Union–Tribune,* April 10, 1997.

[17] Ibid.

[18] Terry Rodgers, "Utility Planning to Build Kelp Reef/Dredging of Lagoon Also Part of Coastal Reclamation Project, *San Diego Union–Tribune*, May 10, 1997.

[19] Terry Rodgers, "Edison Resolves Wetlands Expansion Dispute/Coastal Commission Approves Preliminary Plan with Utility, *San Diego Union–Tribune*, November 6, 1997.

[20] State Water Resources Control Board resolution, April 14, 1999, www.swrcb.ca.gov

[21] Terry Rodgers, "San Onofre Plant Permitted to Discharge Warmer Water," *San Diego Union–Tribune,* February 12, 1998.

[22] Ibid.

[23] John Berhman, "Onofre Nuclear Plant Cleanup Kills 4,800 Pounds of Fish," *San Diego Union–Tribune,* October 30, 1999.

[24] Ibid.

[25] Ibid.

[26] Ibid.

[27] R. Krieger, Letter to NRC, Special Report—Unusual Fish Kill, San Onofre, October 21, 1999. FOIA# 2000-0128, Appendix C3.

[28] Terry Rodgers, "Kelp Forest Study Under Way on Artificial Reef, *San Diego Union–Tribune,* October 13, 1999.

[29] U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NMFS, Southwest Region, California Marine Mammal Stranding (CMMS) Network Database, January 25, 2000.

[30] Joe Cordaro, biologist, NMFS Southwest office, Long Beach, CA, telephone conversation with Linda Gunter, January 2000.

[31]CMMS Network Database.

4-8. Seabrook Nuclear Plant
North Atlantic Energy Service Corporation, Seabrook, NH

Environmental group action halts seals drownings in Seabrook's long intake tunnel.
Seal drownings in the Seabrook nuclear plant's 3-mile long intake tunnel have been halted since environmental groups, in December 1998, brought this problem to light. According to the North Atlantic Energy Service Corporation (NAESC), 55 seals drowned at Seabrook over a five-year span.[1] The plant's event reports, submitted to NRC, show 19 seal deaths between October 1997 and June 1999.[2] All of the seals, curious or searching for prey, had been entrained via the strong current inside the pipe. Disoriented or unable to fight the current, they drowned slowly en route to the plant's forebays. The National Marine Fisheries Service (NMFS) readily agreed to North Atlantic's initial request for a permit to kill seals, but after public pressure grew, the utility instead opted to install deterrent bars.

Disoriented or unable to fight the current, they drowned slowly en route to the plant's forebays.

Chronology

"We have a seal problem" and conservationists provide the fix. On April 27, 1998, Peter Haddow of the Seal Conservation Society in Aberdeen, Scotland, received an interesting e-mail. "I am the Environmental Compliance Manager at Seabrook Nuclear Station in New Hampshire and we have a seal problem," wrote John Hart.[3] Hart asked about the "similar problem" at the Dungeness B Station, a nuclear reactor on Britain's Kent coast, "which you fixed by installing 'seal grills' . . . We are looking into putting some sort of grill on our intakes but are concerned about fouling and loss of flow. I would like to find out more about your experience."[4]

Pleas for prevention fall on deaf ears at NMFS. Haddow had already written about the Seabrook problem to Michael Payne, chief of NMFS's Marine Mammal Division, in October 1997. "The problem of seals entering or being sucked up into intake pipes is one which looks easy to solve," Haddow wrote.[5] "It would therefore be of concern if Seabrook were allowed the incidental take without implementing as soon as possible some means of preventing seals from entering its intake pipes."[6] Haddow received no response to his letter and wrote again to Payne in March 1998 after the successful installation of excluder grills at Dungeness. "Due to the success of these grills, the Seal Conservation Society would now like to get in touch with power stations and other installations, both in the U.K. and the U.S., that have experienced similar problems in order to suggest that they could consider installing such grills," Haddow wrote. "The Seal Conservation Society aims to minimise [U.K. spelling] preventable take of pinnipeds and we see this particular problem as one for which there is a feasible solution."[7] Again, Haddow received no response from Payne and NMFS.

Humane Society urges preventive measures. Dr. Naomi Rose, the marine mammal scientist at the Humane Society of the United States (HSUS), also wrote to NMFS, submitting her views as part of the official public comment period while the agency reviewed its decision on seal take limits at Seabrook. In a document dated August 22, 1997, she urged swift intervention:

> The lethal take of seals at Seabrook seems an imminently solvable problem; it is reasonable that [mitigation] ideas would still be under consideration, since the problem has so recently been identified, but it is also reasonable to expect a solution to be found relatively promptly.[8]

NMFS readies its license to kill, but citizens protest. When New England–based environmental groups, the Seacoast Anti-Pollution League and Fish Unlimited, drew media attention to the inhumane slaughter of seals at Seabrook in December 1998, the groups hoped to prevent NMFS from issuing Seabrook a permit that would allow the reactor to kill 24 seals yearly without violating the Marine Mammal Protection Act (MMPA). This kill total was already more than double the average number of seals killed annually at the site. After public opposition, NMFS had already lowered to 24 its original proposed annual kill limit of 34 seals.[9] The protests put pressure on Seabrook to stop the killing by installing deterrent barriers. However, in July 1997, the utility had also submitted an application to NMFS for a small take permit to allow the killing of seals.

Seabrook installs deterrents and gets NMFS license to kill. By 1999, the public revelations from environmental groups, public comments by experts, and headlining stories in the media had put mounting pressure on Seabrook to move toward mitigation and away from endorsement of the slaughter. Seabrook commissioned the New England Aquarium in Boston to design and test excluder bars that would prevent the seal drownings at the plant. On May 25, 1999, Seabrook notified state and federal environmental agencies that it was proceeding with the installation of seal deterrent bars.[10] On the same day, NMFS granted Seabrook an incidental lethal take permit of 24 seals annually.

A violation of Marine Mammal Protection Act also forgiven. NMFS, which is overseen by the National Oceanic and Atmospheric Administration (NOAA), even backed away from punishing Seabrook for its past takings, which were in violation of the MMPA. "While seal takes at Seabrook Station in the past constitute a violation of the MMPA, NOAA has discretion on whether to enforce the provisions of the MMPA . . . NOAA has determined that no benefit would be gained by issuing notices of violation at this time."[11]

Public pressure wins rare victory over regulatory bureaucracy. By August 1999, the bureaucratic hurdles had been overcome and the barriers installed. Since then, no dead seals have been reported at Seabrook. A December 22, 1999, update sent to NMFS by North Atlantic stated:

> No seals have been entrapped since the installation was completed . . . As a result, North Atlantic believes that the Seal Deterrent Barrier is a fully effective mitigation measure for precluding the entrapment of seals into Seabrook Station's offshore intake structures.[12]

In the case of Seabrook, it appears that the utility bowed to public opposition to the slaughter. In contrast, NMFS remained unresponsive to efforts to mitigate the problem and licensed the plant to kill seals at more than twice its existing mortality rate, even as the utility itself was poised to install deterrent measures.

Notes

[1] North Atlantic Energy Services Corporation, Summary of Seal Entrapment Status, undated document. Freedom of Information Act (FOIA)# 2000-0185, Appendix A-15.

[2] Seabrook Event Notification Reports submitted to NRC October 1997–June 1999.

[3] John Hart, environmental compliance manager, Seabrook Nuclear Station, e-mail to Peter Haddow, Seal Conservation Society, Aberdeen, April 27, 1998, submitted to authors by Haddow.

[4] Ibid.

[5] Haddow, letter to Michael Payne, chief of marine mammal division, NMFS, October 21, 1997, submitted to authors by Haddow.

[6] Ibid.

[7] Haddow, letter to Payne, March 6, 1998, submitted to authors by Haddow.

[8] Dr. Naomi Rose, HSUS, letter to Chief, Marine Mammal Division, NMFS, August 22, 1997, provided to authors by Haddow.

[9] Federal Register/vol. 64, no. 100 (May 25, 1999), Rules and Regulations, p. 28117.

[10] *Seabrook This Week*, May 24–28, 1999. FOIA# 2000-0185, Appendix A-8.

[11] U.S. Department of Commerce, NOAA, 50 CFR Part 216, Taking and Importing Marine Mammals; Taking of Marine Mammals Incidental to Power Plant Operations, Final rule, May 25, 1999, pp. 37511–12.

[12] North Atlantic Letter of Response to NMFS on Seal Impact Mitigation Measures, December 22, 1999, PDR Adock 05000443.

4-9. St. Lucie Nuclear Plant
Florida Power and Light Company, Hutchinson Island, FL

FPL: Sea turtles by hundreds caught yearly, as FPL resists effective prevention.
The St. Lucie Nuclear Plant on Florida's East coast near Fort Pierce, operates two reactors using a once-through cooling system connected to a long water intake pipe extending 1,600 feet out into the Atlantic Ocean. St. Lucie captures more sea turtles than any other nuclear power plant in the country. This is believed to be partly due to its location on the sea turtles' migratory path and in a loggerhead nesting area. The problem is exacerbated by the intake pipe that sucks in as much as 3 billion gallons of water a day to cool the plant's two reactors. Sea turtles, manatees, fish, larvae, and other marine organisms are drawn through the intake tunnel into the plant's cooling canal. There, some animals are rescued; the rest die.

As a result of the huge number of sea turtles entrained annually at St. Lucie—a peak of 933 in 1995—FPL has been under constant pressure to find ways to reduce the takes. Over the years, utility owners modified the intake canal system in an attempt to cut sea turtle deaths, installing barrier nets and other devices. But on economic grounds, FPL has always objected strenuously to any fully effective mitigation options. Minor repairs to the intake velocity caps at the mouth of the intake tunnel have not prevented sea turtles from entering the pipe opening.

Chronology
First barrier net not fully effective as sea turtles continue to drown. In 1978, an eight-inch mesh barrier net was installed across the cooling canal near the route A1A bridge running through plant property on Hutchinson Island. Though intended to prevent sea turtles that had already been drawn through the intake pipe from traveling farther into the reactor, the net has to be lowered whenever it becomes loaded with algae or other forms of life referred to by the nuclear industry as "nuisance organisms." When lowered to allow the intake water flow to continue unimpeded, sea turtles can pass over the net, becoming trapped farther into the intake system. Some sea turtles also drown after becoming entangled in the net itself.

FPL study dismisses sea turtle deterrent devices. In 1985, FPL completed a study of sea turtle deterrent devices that could be used at the mouth of St. Lucie's intake pipe.[1] The 1985 study examined such options as: light and bubble curtains; electrical fields; pneumatic guns; strobe lights with bubble curtains; and physical barriers. Ultimately, these devices were dismissed from consideration, largely on the basis of cost.[2] After the completion of a second sea turtle entrainment study in March 2000, FPL again dismissed all the deterrent options, saying "none proved effective in the offshore environment."[3] Ocean intake barrier designs were discounted due to cost and effect on plant efficiency. "The capital and maintenance costs for a physical barrier system would be prohibitive and could likely cause a reduction in intake canal flow," FPL stated.[4]

Although not one of these devices was ever used, FPL touts these studies as examples of its efforts to solve the sea turtle problem. In fact, the company uses these investigations to suggest regulatory burdens should be eased. In a letter proposing an increase in the plant's take limits for sea turtles, FPL suggested these research efforts strengthened its case, claiming it had "initiated many efforts to reduce plant impact on local sea turtle populations . . . These efforts include several deterrent studies, which were conducted during the early to mid-1980s."[5]

FPL admits its operations harm sea turtles. St. Lucie installed an underwater intrusion detection system (UIDS) in December 1986 and a second five-inch mesh barrier net in the intake canal in 1996. However, sea turtles have continued to drown in the UIDS. Dredging equipment and the mechanical rakes have also injured sea turtles. In its 1998 *Annual Environmental Operating Report,* FPL admitted:

> Previous analyses of capture data identified drowning in nets (A1A barrier net, UIDS barrier and tangle nets), drowning in the intake pipes, during periods of reduced intake flow, injuries sustained from dredging operations, and injuries sustained from the mechanical rakes used in the intake wells as probable mortality factors (ABI, 1987) (FPL, 1995). Although difficult to quantify, the entrapment and subsequent demise of injured or sick turtles has probably accounted for a portion of observed mortalities.[6]

FPL says most sea turtle deaths "noncausal" to reactor operations. Like other nuclear utilities, FPL has argued for a distinction between "causal" and "noncausal" takes of marine animals at its reactors. During a November 1998 meeting with federal agencies, FPL proposed that the stranding of a sea turtle in the intake canal due to injury or illness not caused by plant operation not be counted against the authorized level of lethal takes in its incidental take statement.[7] However, in its 1998 *Annual Report,* FPL admits that ascertaining the precise cause of a sea turtle's demise can be difficult: "the extent to which entrainment and entrapment is responsible (for loss of sea turtle vitality) is often indeterminable."[8] Nevertheless, at the November 1998 meeting, FPL produced its own criteria for sea turtle mortalities it believed should be considered noncausal to plant operation:

> (1) Any fresh dead turtle found free-floating in the intake canal or impinged upon, but not entangled in, the barrier nets with extensive injuries clearly sustained outside the intake canal system (e.g., boat collision) such that a live turtle in that condition would have been unlikely to survive and would have been euthanized at a rehabilitation facility; (2) Any fresh dead turtle found free-floating in the intake canal or impinged upon, but not entangled in, the barrier nets in such condition due to disease or other illness (e.g. fibropapilloma) that a live turtle in that condition would have been unlikely to survive and would have been euthanized at a rehabilitation facility; and (3) Any extremely decomposed carcass or partial remains found free-floating in the intake canal or impinged upon the barrier nets in a location where the daily surveillance of the canal is sufficient (east of the primary barrier net) that a fresh dead or moribund turtle could not have escaped notice long enough to become severely decomposed, and it is reasonable to presume the carcass or remains were entrained into the canal in that condition.[9]

These stipulations ignore the possibility that a sea turtle might get hurt inside the intake pipe en route to the canal system, a causal injury not referred to in any of the St. Lucie stranding reports but recognized by the 1990 NAS study and referred to in FPL's own 1985 study. (See chapter 1, this report.) They also presuppose that canal checks are made regularly, as the utility claims, and are effective under all conditions.

FPL sees reporting as burdensome, and NRC agrees. In 1998, FPL asked for a reduction in regulatory oversight, telling NRC it is "difficult and burdensome to comply with the 4-hour reporting requirement."[10] NRC supported FPL's desire for informal adjustments in its take limits. When St. Lucie exceeded its lethal take limit for green sea turtles in October 1999, the NRC recalled having successfully bypassed formal consultation with NMFS the previous year. An internal memo read:

> When this happened last (maybe it was 1998?) we apparently called NMFS and temporarily raised their limit to 6. Please let me know if we can do the same now. . . I discussed this with FPL and they said they would prefer if the limit was raised permanently.[11]

The more sea turtles captured, the bigger the NMFS-allowed kill. NMFS bases its calculations for the annual lethal take limits for sea turtles at St. Lucie on a percentage of the total capture numbers, not on an assessment of the species' population status. St. Lucie's kill rates are based either on a fixed numerical allowance or 1.5 percent of total captures, whichever total is higher. The more sea turtles the plant captures, the more it can kill, regardless of other impacts that might be reducing sea turtle numbers such as the FP virus, sudden mass strandings, or fishing activities. For example, in 1998, the St. Lucie lethal take limit for loggerheads was 2 animals, but high captures that year meant FPL could in fact kill more than 2. In October 1998 FPL noted that "since we have captured over 327 turtles to date, the limit for this year will be at least 5."[12]

More kills, less oversight, demands FPL. Even with the liberal NMFS assessment of permitted lethal takes, FPL seeks permission to kill even more turtles whenever consultation occurs with the agency. For example, claiming that "the trigger to reinitiate consultation is perhaps too sensitive," after consultations had to be reinitiated in both 1997 and 1999, FPL proposed "that individual year limits be set higher, at 6 green turtles or 3%, with a 'lifetime' program limit of 1.5%."[13] To support this increased kill rate, FPL touted its token conservation programs such as its "Canal Capture and Release Program," its "Beach Nesting Survey Program," its "Public Service Turtle Walk Program," and its "Participation in the Sea Turtle Stranding and Salvage Network."[14] FPL also insisted that the presence of more sea turtles in the area, instead of the lure its plant provides, was causing the increase in capture numbers and refused to take responsibility for its negative impacts on the animals. "This study indicates that increased entrapment rates of turtles are most likely due to increases in sea turtle populations in the area offshore of the plant and not any change in plant operating characteristics," plant personnel wrote in a March 2000 attachment to the entrainment study.[15] This argument ignores the possibility that depletion of localized populations of sea turtles, even if those numbers are indeed on the rise, may still have serious consequences for the ability of the species as a whole to recover from its rapid decline.

No take limits at all for live captures. FPL habitually argues for an abolition of take limits for live turtles. After publication of the March 2000 entrainment study, FPL concluded:

> Variability in the rate of turtle entrapment at the St. Lucie Plant is considered to be primarily a function of the local abundance of turtles, since the operational characteristics of the intake structures have remained constant over the years. In recent years, green turtle entrapment has increased at a dramatic and unpredicted rate and may continue to increase. Therefore, no take level will be specified for entrapment, capture, and release of any species of turtle.[16]

Required sea turtle study, opposed on grounds of cost. The entrainment study required by NMFS as part of FPL's reinitiation of consultation with the agency, and eventually completed in March 2000, proved to be the biggest bone of contention. FPL at first objected to the study requirement, especially the request for video data to "elucidate the effect of various factors on turtle entrapment."[17] The utility even resisted the written portion, "Physical and Ecological Factors Influencing Sea Turtle Entrainment Levels at the St. Lucie Nuclear Plant," which was eventually compiled by Ecological Associates for FPL. A telling May 1997 internal NRC e-mail clarified the FPL position at the time:

> The study that NMFS is requesting FPL to perform originally seemed grudgingly ok to the licensee. I just learned today however that FPL senior management is strenuously opposed to spending the money for the study, and so the tone of our meetings will likely be different, i.e. more to the point of the licensee trying to convince us that the study is unnecessary and not including it in our requirements.[18]

NRC cooks up plan to "save face" for all. In the end, face-saving was more important to the regulatory agencies than protecting endangered species. In May 1997, revealing its true colors, NRC went to bat for FPL, convincing NMFS that the study "was not one to fall on their sword over."[19] Instead, NRC and NMFS conjured up a plan that let everyone off the hook. "[NMFS] suggested that we send the letter to the licensee imposing the incidental take statement," read NRC 's plan.

In the end, face-saving was more important to the regulatory agencies than protecting endangered species.

> They respond with a letter saying they plan to implement the program except the infamous study and raise their other issues as well. We then reinitiate consultation by letter to NMFS stating that the infamous study be deleted and put in as a conservation recommendation and maybe they could do the levage [sic] study so that NMFS doesn't lose face."[20]

NMFS decides study must happen but may not enforce its recommendations. At a January 20, 1998, meeting, an NRC representative observed that "the FPL St. Lucie licensing representative stated that licensee management was strongly opposed to any further studies."[21] By then, pressured by NRC, NMFS was already capitulating to FPL's financial worries by at least backing away from potential enforcement of any mitigation efforts recommended by the study, should it go ahead:

> Responding to licensee concerns on the potential cost of implementing actions as a result of any study, and the cost and difficulties of a video study, he [NMFS representative] indicated that even if the study indicated ways to prevent turtle entry, such methods would be evaluated against costs, the number of turtles being captured, and the benefit of the scientific data gained by the turtle captures.[22]

No one apparently questioned the value of doing a study if its recommendations were likely to be ignored. Nor did they question NMFS' apparent endorsement of entrainment through a reactor intake pipe as a suitable method to collect sea turtles for scientific study. However, the NMFS assurance guaranteed FPL that its financial concerns would be a priority.

Delays, deals, and no videotape. Inevitably, with the customary support of NRC, FPL won the battle over the video portion of the study. In correspondence to NMFS, NRC wrote: "FPL feels the [video] study will cost approximately $500,000 and will produce no useful information to turtle conservation."[23] By March 1999, NMFS had agreed to abandon the video project as NRC clarified: "Based on the meetings at the site, NMFS and FDEP[the Florida Department of Environmental Protection] agreed with FPL that such a [video] study was not feasible."[24]

Notes

[1] J.R. Wilcox, "Sea Turtle Intake Entrapment Studies," FPL, April 9, 1985. PDR Adock 05000389.

[2] Ibid., pp. 8 and 18.

[3] Green Turtle Lethal Take Discussion, St. Lucie Units 1 and 2. Docket nos. 50-335 and 50-389, Attachment 2, Ecological Associates, cover letter to St. Lucie Sea Turtle Entrainment Study, March 2000. NRC PDR.

[4] Ibid.

[5] Ibid.

[6] FPL St. Lucie Unit 2 Annual Environmental Operating Report, 1998, 3.3.2.8 Mortalities, p. 13. FOIA# 2000-0058, Appendix A-12.

[7] NRC Summary of Meeting on January 20, 1998, Regarding Environmental Protection Program for Sea Turtles—St. Lucie Units 1 and 2. February 9, 1998, p. 2. Appendix A-19. FOIA# 2000-0058.

[8] FPL, "Annual Operating Report," 1998, p. 13, Appendix A-12.

[9] NRC Summary of Meeting on January 20, 1998, Proposed Rationale for the Determination of Sea Turtle Mortalities Causal to Plant Operation.

[10] Notes from the St. Lucie conference call, regarding reporting requirements and proposed changes to Appendix B of operating license. Kimberly D. Leigh, NRR/PGEB, Memorandum to file, March 24, 1999. FOIA# 2000-0058, Appendix C-19.

[11] Bill Gleaves, NRC, e-mail to Barry Zalcman, NRC, October 7, 1999. FOIA# 2000-0058, Appendix C-22.

[12] FPL, Daily Status Report, submitted to NRC October 13, 1998. FOIA# 2000-0058, Appendix A-15.

[13] Green Turtle Lethal Take Discussion, p. 1.

[14] Ibid.

[15] Ibid.

[16] FPL, Environmental Protection Plan Revision, Attachment 3, p. 3. FOIA# 2000-0058, Appendix A-17.

[17] Ibid. Attachment 1, p. 5.

[18] Leonard Wiens, NRC, e-mail to Claudia Craig, NRC, May 1, 1997. FOIA# 2000-0058, Appendix C-5.

[19] Michael Masnik, NRC, e-mail to Craig and Wiens, NRC, May 21, 1997. FOIA# 2000-058, Appendix C-6.

[20] Ibid.

[21] NRC summary of meeting on January 20, 1998, p. 2.

[22] Ibid.

[23] Undated NRC Chronology for St. Lucie Green Sea Turtle Issue, May 6, 1997, Appendix C-3, FOIA# 2000-0058.

[24] Office of Nuclear Reactor Regulation, Draft Safety Evaluation Report Input relating to the St. Lucie Plant, Units 1 and 2, Facility Operating Licenses DPR-67 and NPF-16 Docket Nos. 50-335 and 50-389, Section 4.2.2.2, "Terms and Conditions of the Incidental Take Statement," March 30, 1999, Attachment p. 3. FOIA# 2000-0058, Appendix C-20.

Conclusion

Utility financial interests prevail over those of endangered species. St. Lucie captures many more sea turtles than any other plant studied in the report. Endangered least terns have also died at the plant, and five manatees have been reported as live captures. (See chapter 3, this report.) Yet regulators give FPL, and other reactor owners, extraordinary leeway to continue to capture and kill these endangered animals, for no other reason than to spare the utility the cost of prevention. FPL has persuaded both NRC and NMFS to support its arguments for more kills, less oversight, and hugely reduced mitigation efforts. Yet experience, as at Seabrook, has shown that prevention measures are both technically possible and financially affordable. Experience at Diablo Canyon also throws doubt on utility excuses that it cannot pay for such measures, since Pacific Gas and Electric is quite willing to spend millions of dollars on litigation to preempt such requirements.

The inevitable conclusion is that regulatory agencies comply too easily with utility wishes. A sea turtle study can be challenged, then emasculated to eliminate meaningful research that would benefit the survival of sea turtles. Even should a study be conducted, the requirement to enforce any recommendations may be withdrawn by regulatory agencies in advance to placate the utility. Despite evidence that hotter water damages the marine environment and detrimentally alters the make-up of flora and fauna, the San Onofre plant was given permission to raise its water discharge 25 degrees above ambient temperatures. This occurred despite overwhelming evidence at Diablo Canyon that water discharge just 22 degrees above ambient temperatures was responsible for the substantial destruction of the surrounding marine environment. (See chapter 2, this report.) Edison has collected mitigation fees from San Onofre ratepayers for years, yet indulges in delays and obfuscations to reserve this war chest for stockholder profit instead of spending it on the environmental restoration efforts it agreed to under licensing. In New Jersey, the Public Service Electric and Gas Company fought a state requirement to retrofit its Salem reactors with cooling towers. Instead, the utility was allowed to carry out an "enhancement program" that appears to have done more harm than good to the local estuarine environment and runs contrary to the requirements of the Clean Water Act.

Individual citizen and environmental groups have worked to bring these environmental delinquencies to public attention. These groups include, in California, Mothers for Peace, Sea Turtle Restoration Project, and Earth Corps; in New England, Seacoast Anti-Pollution League, Connecticut Coalition against Millstone and Fish Unlimited; and, in New Jersey, Unplug Salem Coalition, The Riverkeepers, and Clean Ocean Action among many others. However, it is time for NRC and NMFS to act upon their mandate to uphold laws such as the Clean Water Act or the Environmental Protection Act, instead of bending them to suit the profit motives of a polluting, environmentally destructive, and short-sighted industry.

5

Enough to Turn You Green

How deceptive industry propaganda portrays nuclear power as operating in harmony with nature while reactor once-through systems routinely kill marine wildlife.

But all was false and hollow; though his tongue
Dropt manna, and could make the worse appear
The better reason.

—John Milton[1]

For decades, the nuclear power industry has portrayed itself as an environmentally friendly technology that is beneficial to wildlife. Through advertising, brochures, handouts, and in-house magazines, the industry's front group, under its various incarnations—as the U.S. Council for Energy Awareness (CEA) and currently as the Nuclear Energy Institute (NEI)—has spent tens of millions of dollars on claims that nuclear power is beneficial to the environment. Now, with the deregulation of the electricity industry and concerns about global climate change, nuclear power advocates see an opportunity to sell this technology to environmentally conscious consumers as a green power source, using unsubstantiated and misleading claims about its benefits to the air, water, and wildlife.

Individual nuclear power utilities also produce self-promoting but misleading publicity materials that tout their atomic reactors' environmental records while hiding the true destruction. Utility bill inserts, sponsored public signs, educational exercises such as "turtle walks," and web site newsletters are favored vehicles for nuclear utilities to present a publicly green face.

The nuclear industry's most brazen hypocrisy is found in its promotional use of glossy color photos in advertisements and company magazines—featuring the same animals it kills.

The nuclear industry's most brazen hypocrisy is found in its promotional use of glossy color photos in advertisements and company magazines—featuring the same animals it kills. Sea turtles, seals, and American crocodiles are pictured as creatures reactors protect, directly covering up the truth. The industry parades photographs of these animals as friends to nuclear power living safely around its operating reactors.

In the 1990s, the nuclear industry trotted out one piece of propaganda after another describing itself as "green." An article entitled "Wilderness" in the summer 1990 edition of *Nuclear Industry,* a CEA house publication, actually claimed that "electric utilities are living in harmony with nature. That's good news for endangered species and habitat."[2] The self-serving feature used headers that read: "A Safe Haven . . . for Endangered Species. Preserving Marine Life . . . from Fish to Falcons." Not mentioned is the wholesale

In a Nuclear Industry *article in 1990, the industry claimed reactors provide safe havens for endangered species and that American crocodiles "live happily" at Turkey Point. At least four have died there since 1998.*

slaughter of fish and larvae, and the daily destruction of habitat through entrainment and thermal discharge at coastal reactors, or the routine destruction of endangered species and other marine life.

Photos accompanying the promotional piece showed sea turtles, eagles, seals, and fish apparently living contentedly around nuclear power plants. A caption accompanying the sea turtle photo read: "In Florida, loggerhead turtles nest on the beaches close by the St. Lucie nuclear plant," without referring to the high percentage of female loggerheads entrained and killed by the reactor while attempting to nest or the fact that the plant was built on an established loggerhead nesting beach. The American crocodile received similar treatment. "The endangered American crocodile lives happily in the waterways around the Turkey Point nuclear plant."[3] Yet Nuclear Regulatory Commission (NRC) reports reveal that the endangered crocodile's well-being around Turkey Point can be more jeopardized than "happy." At least four crocodiles have been found dead there since August 1998, according to NRC daily event reports.[4]

The claim in *Nuclear Industry* that nuclear power "preserves" marine life is perhaps the most audaciously deceptive of all. "Sea creatures and nuclear plants get along well," read the text below a photograph of elephant seals at Diablo Cove.[5] No mention is made of the seals drowned by nuclear power plants on both coasts, from Seabrook on the Atlantic to San Onofre on the Pacific. Nor is there any admission of the billions of sea creatures sucked into the once-through cooling systems of coastal atomic reactors or the devastating toll nuclear power reactors have taken on marine ecosystems through thermal discharge, as revealed by studies such as those around the Diablo Canyon and San Onofre plants in California and the Calvert Cliffs reactors off the Maryland coast.

In another attempt to woo environmentalists, the CEA ran an advertisement in 1990 with the slogan "Every day is Earth Day with nuclear energy."[6] In 1992, a CEA advertisement pictured a tiny sea turtle hatchling on a beach near the St. Lucie plant to claim that nuclear power "peacefully coexists with the environment."[7]

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A bill insert picturing a sea turtle and sent to electricity customers in 1992 by Carolina Power and Light (CP&L) bore the headline "CP&L Works with Fish and Wildlife Agencies."[8] The insert, a promotional piece on nest protection, claimed that most nesting sea turtles "die from exposure, dehydration, or being run over."[9] What is conveniently left out is CP&L's entrainment of many of those same sea turtles once they reach adulthood and the much more serious impact to populations by the killing of these adult animals. On its web site, the company lists its "Contributions to the Public Waters" as encouraging "public use of the lands and waters surrounding its facilities" for activities that can prove fatal to sea turtles, including "fishing...boating, skiing."[10]

Florida Power and Light (FPL) makes similar claims on its web site while carefully omitting mention of its St. Lucie and Turkey Point nuclear plants and their detrimental effect on wildlife and the marine ecosystem. On its "turtlebook" page targeted at children, FPL says of the sea turtle crisis: "Populations continue to decline as habitat is lost and the trade in sea turtle products continues. Every year, thousands of sea turtles drown in shrimp trawls and other fishing gear and others die from pollutants or from swallowing trash mistaken for food."[11] Again, no mention is made of the high sea turtle captures at St. Lucie, which have reached nearly 1,000 a year on several occasions, nor of the fact that the plant was built on an established loggerhead nesting beach.

FPL, in its own documentation, vigorously opposes efforts to protect sea turtles because of concerns over loss of profit.

"Concern for the plight of sea turtles is growing and people around the world are working to protect them,"[12] FPL continues. Yet the company, in its own documentation, vigorously opposes efforts to protect sea turtles because of concerns over loss of profit. (See chapter 4, this report).

FPL agrees that stress can increase the sea turtle mortality rate but does not cite the trauma of being sucked through the turbulent St. Lucie intake pipe as a potential stress factor. "Man and his activities, however, have greatly increased the mortality rate of turtles during all life stages," FPL declares on its turtlebook web page."[13] "As a result many juveniles are not surviving to maturity and adults are not surviving to reproduce for many years as they would in an unstressed population."[14] Thus, FPL sets itself up as an educational information source for young people while deliberately obfuscating its own role in preventing sea turtles from "surviving to maturity" or "surviving to reproduce" due to the stress of entrainment as well as fatalities at its reactors.

Finally, FPL makes an undefined claim on its web site that should not be left unchallenged. "Florida Power & Light Company (FPL) maintains a number of federal permits that require their facilities to cause 'no harm' to sea turtles," the utility states.[15] FPL's definition of "no harm" apparently includes killing an average of at least eight sea turtles a year, according to FPL's reporting data, and capturing, even injuring, several hundred more.

The web site of Public Service Electric and Gas Company (PSE&G) contains the irony-loaded "Environmental Educational Grants" program, designed "to help children make the real-life connection between the environment and their well-being."[16] These "competitive grants" ignore the "real-life connection" between the polluting role of both nuclear and fossil fuel power plants and children's health.

The 1998 NEI ads continued running with only slight modifications in 1999, picturing grateful owls saying "thank you" to the industry for "clean air," smiling families in well-lit homes, blue waters around nuclear plants, and happy hikers perched on rocky peaks.[17] Slogans accompanying the photographs read: "Reliable Electric-

The NEI ads featured grateful owls thanking the industry for being "a safe, proven technology" without mentioning how the operation of nuclear power destroys wildlife.

ity, Proven Economical, Consistently Safe, and Environmentally Clean."[18] The advertisements made claims that nuclear power "helps protect the environment" while tag lines, now abandoned perhaps because they lent themselves too obviously to satire, read: "Nuclear, more than you ever imagined."[19] The NEI ran advertisements with similar messages on radio stations and sponsored underwritings on National Public Radio at key listening times such as *Morning Edition.*

Until recently, these claims remained unchallenged. But in 1998, 15 environmental, consumer, public policy, and business organizations (including report authors Safe Energy Communication Council and Nuclear Information and Resource Service) won an important judgment from the National Advertising Division of the Council of Better Business Bureaus (NAD). NAD ruled that the 1998 NEI ads were "misleading" and advised that they should be "discontinued."[20] The NAD's ruling came in response to a claim filed by the 15 groups and found in favor of the petitioners on all counts.[21] The NAD rejected NEI's claims that: its advertisements were political speech, aimed only at decision makers; nuclear power is "environmentally clean" and produces electricity "without polluting the environment"; nuclear electricity does not "pollute the air"; and "nuclear energy generates electricity without polluting the water."[22]

The New York Times

Page One, Business Section

Thursday, December 10, 1998

Advertising

Better Business Bureau Says Nuclear Group Ran False Ads

Headlines in the New York Times revealed that the Better Business Bureau had ruled the NEI advertisements deceptive and misleading. After the industry continued to run the advertisements, the Bureau referred the case to the Federal Trade Commission.

The NAD ruling was viewed as an unequivocal reprimand, but NEI chose to ignore the warnings and continued with a new round of barely modified advertising messages. NAD therefore referred the case to the Federal Trade Commission (FTC). In December 1999, the FTC ruled that "because the discharge of hot water from cooling systems is known to harm the environment, and given the unresolved issues surrounding disposal of radioactive waste, we think that NEI has failed to substantiate its general environmental benefit claim."[23]

The FTC also agreed with the NAD's decision "that NEI has not substantiated its statement that the production of nuclear power does not pollute the water."[24] The FTC warned the NEI that its advertising campaign, touting nuclear power as environmentally clean, was without substantiation and recommended that the NEI "take to heart the evaluation of its advertising that has been rendered by its peers."[25] The FTC also warned the NEI that it "will be monitoring marketing claims in order to prevent unfair and deceptive practices."[26]

As a result, the NEI has been forced to back away from its broad, vague claims that it provides green power that is environmentally benign and beneficial to wildlife. For now, nuclear industry advertisements show no more pretty photographs of endangered sea turtle hatchlings and other marine life. The NEI has also replaced "nuclear, more than you ever imagined," with the new tag line "Nuclear, the Clean Air Energy." This claim disguises the fact that a reduction in CO_2 emissions through the use of nuclear power is hardly an environmentally responsible trade-off. In exchange for the alleged benefit of cleaner air, nuclear power technology destroys marine ecosystems, kills endangered species, and bequeaths to future generations huge volumes of radioactive waste and the threat of more catastrophic accidents like those at Chernobyl and Three Mile Island.

As long as the nuclear industry attempts to cover up its true environmental destruction with spurious advertising claims of benefits to wildlife and endangered species, watchdog groups will continue to

challenge these deceptions. Despite the industry's retreat from some of its wildlife claims, utility promotional items and web sites still spread falsehoods about the true destructive impacts upon the many species and habitats victimized by their proximity to nuclear reactors. (For more on challenging deceptive nuclear industry advertising and public relations campaigns, see chapter 8, this report.)

Notes

[1] John Milton, "Paradise Lost."

[2] Alice Clamp, "Wilderness," *Nuclear Industry* (Summer 1990): 20–26.

[3] Ibid.

[4] NRC, Daily Event Reports, NRC files. FOIA# 2000-0181.

[5] "Wilderness," p. 24.

[6] CEA advertisement, 1990.

[7] Some Arguments for Nuclear Energy are Smaller than Others, CEA advertisement, 1992.

[8] CP&L customer bill insert on protection of nesting sea turtles and sea birds, 1992. CP&L Biological Assessment, March 9, 1998, p. 32. ADOCK 05000324. NRC Public Document Room (PDR).

[9] Ibid.

[10] CP&L web site, www.cplc.com.

[11] Reprinted from Florida's Sea Turtles, Florida Power & Light Company, 1992. www.fpl.com/html/kid_turtlebook.html

[12] Ibid.

[13] Ibid.

[14] Ibid.

[15] Ibid.

[16] Children's Issues are a Major Focus of PSEG's Involvement in the Community. www.acnj.org/child_initiatives/psegacnj8_99htm

[17] NEI advertisements, 1999.

[18] Ibid.

[19] Ibid.

[20] National Advertising Division, Council of Better Business Bureaus, Ruling regarding the NEI advertising campaign, December 9, 1998, pp. 21–22, New York, NY.

[21] Natural Resources Definse Council, et al., complaint filed with Better Business Bureau, July 20, 1998.

[22] NAD Ruling.

[23] Federal Trade Commission, letter to Joseph Colvin, president and CEO, NEI, December 15, 1999.

[24] Ibid.

[25] Ibid.

[26] Ibid.

6

Protecting Endangered Species—Or the Industry?

How federal and state regulatory systems operate in relation to nuclear power.

"Once to every man and nation comes the moment to decide,
In the strife of Truth with Falsehood, for the good or evil side."

—James Russell Lowell[1]

The Atomic Energy Act of 1954 created the Atomic Energy Commission (AEC), with a mandate to both regulate and promote the use of nuclear power.[2] The AEC's mission was clearly to protect the industry from being placed at a costly disadvantage with its fossil-fueled competitors, but, at the same time, the agency was charged with protecting the public from pollution from nuclear power stations. This conflict of interest provoked strong public criticism, particularly over the AEC's refusal to require atomic reactors under construction to install equipment to eliminate or reduce the harmful environmental consequences of entrainment and hot water pollution.

While the fishing and lobster industries are heavily regulated and takings of certain animals limited or illegal, nuclear power plants suck up billions of fish, spawn, larvae and lobster with no regulatory limits or oversight.

Most nuclear utilities with easy access to large bodies of water quickly determined that using the water to cool and discharge heat with once-through cooling systems was cheaper than building cooling towers. This decision was made despite early laboratory experiments showing that increasing the water temperature by only a few degrees, especially in summer, could cause 100 percent mortality in some aquatic species.[3]

Environmental impact models for the various cooling systems were developed and analyzed by the utilities and studied by an increasingly ecologically conscious public during the construction and operation licensing phase. Cost-benefit analyses were performed, weighing the price of building and maintaining component systems, their effect on reactor power efficiency, and access to water resources. In the rush to promote atomic energy, however, the risks and consequences to the marine environment were largely ignored.

By the mid-1970s, Congress split the AEC and created the Nuclear Regulatory Commission (NRC) to regulate nuclear power and the Energy Research and Development Administration (ERDA) to promote the industry.[4] The NRC is charged by Congress with the primary responsibility to ensure, through its licensing and regulatory functions, that the generation and transmission of nuclear power do not unrea-

sonably threaten public welfare. The NRC has the ultimate authority in matters related to the licensing of both construction and operation of nuclear power plants.[5] The states have been preempted from regulating the nuclear safety aspects of the plants, which is entirely the responsibility of NRC.[6] Other regulations such as those governing water quality and discharge limitations, intake structures, fisheries, air emissions, and the nonreactor operations at commercial nuclear power plants, comprise an overwhelming patchwork of regulatory authority shared by the states and various federal agencies. This chapter examines this interwoven regulatory system, with special attention to the fundamental problems that allow avoidable marine ecosystem degradation to continue.

Regulating the Marine Environment

Congress vests the Environmental Protection Agency (EPA) with the authority, as the permitting agency, to regulate discharges into the marine environment. However, EPA must also delegate this permitting authority to the states when the states choose to take on the process. Therefore, a reactor that is going to use cooling water must get a Clean Water Act (CWA) permit from either EPA or the state.

In matters that concern endangered or threatened species, NRC acts as an agent for the reactors and must consult with the National Marine Fisheries Service (NMFS), the agency that administers the federal programs supporting the conservation and management of most marine creatures and with the U.S. Fish and Wildlife Service (USFWS) for management of terrestrial and shoreline animals as well as some marine mammals and reptiles. Under the terms of the Endangered Species Act (ESA),[7] all federal agencies must ensure that all actions they authorize, fund, or oversee are not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of critical habitats.[8] Therefore, the operating license that NRC grants a commercial nuclear plant is subject to the ESA, and NRC is ultimately responsible for ensuring that the licensees operating nuclear reactors in the United States comply with the ESA.

The National Environmental Policy Act

The congressional intent behind the National Environmental Policy Act of 1969 (NEPA) is the implementation of a broad plan to protect the natural environment and the human experience.[9] NEPA requires a federal agency to take a hard look at the environmental consequences of its proposed action *before* taking any action.

Contents of an EIS. To accomplish this, the federal agency must prepare an environmental impact statement (EIS) before that agency can take a major federal action that would have significant environmental impact. In this case, NRC would be responsible for preparing an EIS for its proposed actions and would be required to examine the direct, indirect, and cumulative effects of its decision to take, or permit a licensee to take, a certain action.

The EIS is a comprehensive review of the environmental impacts of an agency's proposed action and of the impacts of alternatives, including no action. The purpose of the EIS is to give an agency enough information on the environmental effects to make an informed decision, based on the probable environmental impacts of its proposed action in relation to other alternative actions or decisions. Essentially, then, the EIS outlines in detail the agency's proposed action with alternative actions, lists what it believes are the environmental consequences of those actions, and requests comments from the public on the proposed action, the alternatives, and the possible environmental impact.

Public participation. Public participation is an integral and vital part of the NEPA process.[10] The agency (NRC in this case) must publish the draft EIS to get comments from the public and must make

it available to any interested party, including EPA and the Council of Environmental Quality (the agency that implements NEPA). NRC may hold public hearings on the draft EIS, and, under implementing regulations, *must* hold public meetings where there is a significant controversy. Interested private parties may contact the individual federal agencies, including NRC, to be placed on the agency's mailing list to receive future environmental reviews and assessments.

Public participation is an integral and vital part of the NEPA process.

The final EIS again describes the proposed action and the alternatives but incorporates the information received from the public or other agencies. The final EIS responds to the comments received from all parties and explains the agency's reactions to and thought processes concerning the various comments. While announcing the agency's chosen course of action, the final EIS should also discuss why the chosen action was better than the alternatives. Although an agency is not precluded from taking an action that has adverse environmental consequences, it should strive to mitigate the adverse effects as much as possible and should discuss the mitigation measures in the final EIS.

The Endangered Species Act

The USFWS, in the Department of the Interior, and NMFS, in the Department of Commerce, share responsibility for administration of the Endangered Species Act (ESA) as established to reverse the alarming trend of human-caused extinction that in turn threatens the entire ecosystem.[11] Congress was clear in enacting a policy that "all federal departments and agencies shall seek to conserve and promote endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this act."[12]

If an agency has the authority to regulate in an area that is affecting a listed species, the agency (in the case of atomic reactors, NRC) assumes responsibility for the protection and preservation of the endangered or threatened species.[13] Indeed, once a species is listed, the agency responsible for that species must do far more than merely avoid the elimination of the protected species. It must bring these species back from the brink so that they may be removed from the protected class.[14] Among other requirements, these protective provisions of the ESA impose on NRC the affirmative duty to conserve the species, and promote its recovery, and the prohibition on the take of any member of the listed species.[15]

ESA, Section 7. ESA, Section 7, requires NRC to consult with the secretary of commerce (NMFS in this case), before taking any action likely to jeopardize the existence of any listed fish, marine mammal, or reptilian species or that could result in destruction or adverse modification of critical habitat.[16] Legally, the Section 7 consultation occurs when NRC, on behalf of the licensee, enters into consultation with NMFS. The utility is an interested party in the consultation, but the final responsibility for guaranteeing compliance with the ESA rests with NRC.

ESA, Section 9. ESA, Section 9, prohibits the taking of federally listed species without appropriate authorization. In part, "take" is defined by the ESA as "killing, harming, or harassment" of a federally listed species.

ESA, Section 10. ESA, Section 10, is the mechanism that allows NMFS to authorize an exemption in the form of an "incidental take permit (ITP)," allowing killings that are "incidental to, and not the purpose of, otherwise lawful activities." The incidental take permit is subject to NEPA.

Permitting criteria. Certain criteria guide the agency in determining the issuance of a permit and, once issued, its modification. These criteria include the status of the stock of the species to be taken, likely availability of monitoring programs, the use of best technology available to minimize and mitigate im-

pacts, and a review of comments received during a 30-day public notice and comment period. The incidental take permit is issued only if it is determined that the take will not "appreciably" reduce the likelihood of species survival and the applicant is seriously attempting to minimize and mitigate the impacts.

An ITP is issued based on an analysis of how many species the facility is aware of killing or capturing. A nuclear utility must report its kills and captures to the relevant federal agency, depending on the species affected. In most cases studied for this report, the agency in question was NMFS. Once reported, compliance is viewed to be proper, therefore continued timely reporting of takes is all that is required. A utility must first provide a biological assessment to identify any threatened or endangered species or critical habitat that may be harmed by station operations. If such species and habitat are identified, an analysis must be performed of the adverse impacts and alternative actions that may provide conservation measures. NMFS and NRC review the biological assessment, and both agencies provide responses. NMFS first issues its response as a draft biological opinion, followed by the final opinion establishing the incidental take statement.[17] These recommendations then help form the basis of the take limit established through the issuance of a biological opinion by NMFS and agreed to by NRC. The NMFS biological opinion states whether or not the NRC-licensed action is considered likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. Should a licensed utility exceed, or have reason to believe it will exceed, its take limit, NRC must reinitiate a consultation with NMFS for its licensee before increasing the established limit.

The implementation of the ESA at commercial nuclear facilities poses a basic problem in that utilities are allowed too much leeway to make subjective decisions about take, and NRC must rely on utility owners to accurately report their takes. The problem is exacerbated by the fact that utilities and NRC may be unaware of one or more listed species present at the site. Operation of the power plant or associated facilities may consequently be adversely affecting those species without the knowledge of regulators or licensees.[18] As illustrated in the 1997 Pacific Northwest Laboratory study of U.S. reactors, utilities were sometimes unaware of species impact because of "inadequate systematic monitoring programs" to detect incidental takes.[19] The study concluded that there are:

> [U]ncertainties concerning the potential impacts . . . because the potential effects are dependent on the particular species in question, how it is distributed in relation to the power plant . . . and the species specific responses to facility operation and maintenance.[20]

Therefore, the failure to monitor for impacts adequately and systematically and too heavy reliance on utility scientists for data have resulted in a system that allows takings or impacts that are not obvious. Sea turtle problems have received some attention because the turtles are large and conspicuous. However, ESA requirements can be avoided for less visible but nonetheless biologically important species.

The Clean Water Act

The Clean Water Act (CWA) of 1972[21] defines *pollution* as the man-made or man-induced alteration of the physical and biological integrity of water. The Act was intended by Congress to restore and maintain the chemical, physical, and biological integrity of the nation's natural water resources through the regulation and conservation of its beneficial uses. In particular, sections of the Act prescribe regulations for oversight of intake and discharge of coolant water by many users, including the electrical and manufacturing industries.

When the CWA was enacted, Congress declared a national goal of eliminating the discharge of pollutants into the navigable waters by 1985.[22] The major impact on the industry was the requirement that permits regulate all nuclear reactors that intake and discharge cooling water to the marine environment.[23]

Congress included Section 316 in the CWA expressly to allow EPA regulation of the intake and discharge of water resources into the marine environment through National Pollution Discharge Elimination System (NPDES) permits. The EPA has, in turn, delegated permitting authority to 43 states and one U.S. territory as long as they demonstrate compliance with a list of requirements and agree to be monitored to enforce the terms of the permits.[24] Unless the EPA administrator determines that a proposed state program does not meet the specified requirements, the proposal must be approved.[25]

The federal government retains some oversight authority. Should EPA determine that a state is no longer in compliance with the CWA, it may withdraw its approval from the state program.[26] Additionally, EPA retains oversight authority over individual permits issued under approved state programs, as states are required to submit applications and proposed permits to EPA. The EPA can veto a permit if it feels that it violates the CWA.[27] The CWA operates as a "base standard," set by the federal government, which the states are allowed to improve upon. However, no state may allow a discharge permit that is less stringent than that set by the federal government.

CWA, Section 316(a). Section 316 provides the regulatory framework for the thermal effluent standards applicable to point source discharge of pollutants. Section 316(a) states that EPA or the states are supposed to impose an effluent limitation that will "assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water."[28] However, the operator of a thermal pollution source has the option to demonstrate to EPA or the state that a discharge limitation is more stringent than necessary to assure the protection and propagation of "a balanced, indigenous population."

CWA, Section 316 (b). Section 316 (b) mandates that "a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts."[29]

This regulation applies only to the intake of water and not to the discharge, with the major goal of minimizing the impingement and entrainment of fish and other aquatic organisms drawn into a facility's cooling water intake.

Best technology available requirement tested in court

The nuclear industry has long sidestepped the best technology available requirement, despite the CWA tenets, by arguing that currently adopted technology at reactors already minimizes any adverse impact to the marine environment and that any harm is predictable and temporary. The industry has even suggested that the marine ecosystem will miraculously return to its former constituents once a reactor is permanently closed down. Even during operation, utility owners allege, thermal discharge plumes will quickly disperse and dissipate without significant consequence. The utility argument that degradation of natural resources in one area should be permitted because there is so much of that resource elsewhere has been exposed as specious by the California Department of Fish and Game in its attempt to apply a cease and desist order to the Diablo Canyon Power Plant near San Luis Obispo. (See chapter 2, this report.) Power plant operators argue in favor of the once-through cooling system on the grounds that industrial supply is a designated beneficial use of water resources and that the protection of marine ecosystems should therefore not be favored over industry's ability to continue to use the ocean for reactor operations.

The nuclear industry has long sidestepped the best technology available requirement, despite the CWA tenets.

Nevertheless, CWA, Section 316(b), established that EPA was required to promulgate these regulations obliging utilities to use the best technology available to minimize environmental impacts. However, EPA has failed to achieve that goal. In 1977, EPA issued draft guidance for best technology available but did not provide a national standard of minimum requirements on intake structures and mitigation.

To date, EPA and the states have meandered through the cooling water intake issues case-by-case in NPDES permits for large steam generator units. However, a federal lawsuit brought by a coalition of individuals and environmental groups, including The Riverkeepers, confronted this failure to establish national performance standards. After a federal judge denied a motion to intervene by 56 utilities and three utility trade groups, the environmental coalition and EPA entered into a settlement in 1995. The federal court ordered EPA to meet a deadline of July 20, 2000, to propose national performance standard regulations under Section 316(b) for implementation at all new facilities by July 20, 2001. The standards were to use the best technology available to minimize the impingement and entrainment of aquatic life with the intake coolant water.[30] The proposed rule would add language to EPA's NPDES permitting regulations at Section 40 of the Code of Federal Regulation, part 125, subpart I, to establish those standards.

The same court order requires EPA, under a separate rule (Phase II), to propose regulations for cooling water intake structures at existing facilities by February 8, 2002, for final action by August 28, 2003. The EPA is obliged to examine closely the consequences and costs of the best technological options. According to EPA, existing facilities are likely to have less flexibility in redesigning and locating their cooling intake systems. Although they might need to upgrade or modify existing intake structures and cooling water systems to meet the promulgated national standards, such an upgrade is likely to impose greater costs than use of the same best technology available at new facilities.[31] The reevaluation of 316(b) for existing facilities will require extensive negotiations between industry, regulators, conservationists, and environmentalists as well as persuasive public comment to determine the applicable standard. While EPA is required to take into consideration the cost of achieving the effluent reduction and any nonwater quality environmental impact and energy requirement, the best technology available standard does not explicitly include any consideration of the costs to ensure that cooling water intake structures reflect the best technology available, although EPA has historically done so.[32]

The long-standing controversy over best technology available, which accompanied many of the reactors during their original licensing proceedings, persists today. Mounting environmental data indicate that previous studies on the once-through cooling system have underestimated the consequences of this technology and that significant harm is being done to the marine ecosystem. Hanging in the balance is the determination of whether to protect the industry profit margin or to preserve the many important and indigenous species and a balanced habitat.

Notes

[1] James Russell Lowe, *The Present Crisis.*

[2] 42 U.S.C. § 2232 (a) (1999).

[3] Dr. Joseph Mihursky, Department of Environmental Research, University of Maryland, "Thermal Loading: New Threats to Aquatic Life," *Catalyst* 2(3): 6, Educational Series No.85.

[4] The Energy Reorganization Act of 1974 (codified as amended at 42 U.S.C .§ 5802–5879 [1999]) abolished the AEC and transferred regulatory authority to NRC.

[5] See generally, 42 U.S.C. .§ 5801–5879 (1999).

[6] Pacific Gas and Electric Co. v. State Energy Resource Conservation and Development Commission, 461 U.S. 190, 212 (1983).

[7] 16 U.S.C. § 1531, et seq.

[8] 50 C.F.R. part 17.1, et seq.

[9] 16 U.S.C. § 1531, et seq.

[10] 40 C.F.R. § 1506.6

[11] 16 U.S.C. § 1531

[12] Ibid. at § 1531 (c)(1).

[13] Loggerhead Turtle v. County Council of Volusia County, Florida, 896 F. Supp. 1170, 1181 (MD. Fla. 1995).

[14] Fund for Animals v. Babbit, 903 F. Supp. 96, 103 (D.D.C. 1995).

[15] 16 U.S.C. § 1536(a)(1), 1538(a)

[16] See generally, 16 U.S.C. .§ 7.

[17] Biological Assessment of Impact to Sea Turtles at Carolina Power and Light Company's Brunswick Steam Electric Plant, December 1997, p. 1.

[18] M.R. Sackschewsky, Pacific Northwest National Laboratory, "Threatened and Endangered Species Evaluation for 75 Licensed Commercial Nuclear Power Generating Plants," DOE Contract DE-AC06-76RLO1830, March, 1997, p. 47.

[19] Ibid.

[20] Ibid., p. 48.

[21] Federal Water Pollution Control Act (commonly referred to as the Clean Water Act), 33 U.S.C..A. .§ 1251. [FWPCA .§ 101].

[22] Ibid. at .§ 101 (a) (1).

[23] Ibid. at § 401.

[24] Ibid at § 402(b)(1)–(9), 33 U.S.C. § 1342(b)(1)–(9).

[25] Save the Bay, Inc. v. EPA 556 F.2d 1282, 1285 (5th Cir. 1977).

[26] American Forest and Paper Association v. EPA 137 F.3d 291 (5th Cir. 1998).

[27] Ibid.

[28] 33 U.S.C. 1326 (a), FWPCA § 316 (a).

[29] Ibid. at (b).

[30] Cronin v. Browner, No. 93 Civ. 03149(AGS) United States District Court, Southern District of New York.

[31] Ibid., p. 49064.

[32] Ibid., p. 49065.

7

"Too Cheap to Meter"— Too Expensive to Fix

How U.S. nuclear reactors work and what they do to the environment.

"My advice is to look out for engineers. They begin with sewing machines and end up with nuclear bombs. "
—Marcel Pagnol[1]

After a decline in number throughout the 1990s, 103 commercial nuclear power reactors were still operating in the United States as of January 2001. These remaining reactors use two basic designs: the boiling water reactor (BWR) and the pressurized water reactor (PWR). Each design operates on the fundamental principle of "nuclear fission," where atoms of enriched uranium in the form of nuclear fuel rods in the reactor core are allowed to fission, or split, in a controlled reaction. This reaction releases a tremendous amount of energy that heats water to produces steam to generate electricity. The amount of heat released by the fission reaction for the sole task of boiling water is an inefficiency of colossal proportions—a huge proportion of heat is generated simply as waste. For each watt of electricity generated by an atomic reactor, two watts of heat energy are rejected to the environment. This task of boiling water by splitting the atom has been compared to "using a chain saw to cut butter" or "ringing a doorbell with a cannon ball." It is this same fissioning process that also creates tremendous amounts of deadly radioactivity in the form of both short-lived and long-lived radioactive waste by-products.

This task of boiling water by splitting the atom has been compared to "using a chain saw to cut butter" or "ringing a doorbell with a cannon ball."

Boiling Water and Pressurized Water Reactors

All 34 BWRs operating in the United States were manufactured by General Electric. The BWR system generates steam within the reactor pressure vessel at approximately 1,000 pounds per square inch (psig) that is piped directly to a turbine generator. The 69 PWRs operating in the United States were manufactured by Westinghouse, Combustion Engineering, and Babcock and Wilcox. They utilize a two-loop steam generation feature where water, highly pressurized (2,200 psig) and super-heated (600 degrees F), transfers heat from the reactor primary loop to a secondary loop system through two to four steam generators before carrying steam to the turbogenerator.

Steam, in both the BWR and PWR, spins the turbogenerator to produce electricity and enters a condenser, where it is cooled down and turned back into water. The BWR system returns the water directly to the reactor for reboiling. The PWR recycles the condensed water via the secondary loop back to the

steam generators. The heat transferred from the steam condenser is managed through a cooling system, where water from the outside is cycled through to carry off the waste heat.

The reactor type plays little role in the destruction of marine life and habitat. What is crucial is the type of condenser cooling water discharge system chosen by the nuclear utilities and reactor manufacturers when the reactors were first built. (See Appendix A for a list of operational U.S. reactors and their cooling system types.) Following is a brief description of each type of cooling system.

The Cooling Tower

Thirty-three reactors rely exclusively on cooling towers to remove and dissipate the large volumes of waste heat generated during the production of electricity. While the cooling tower (such as those dominating the horizon over the reactors at Three Mile Island, PA) is emblematic of nuclear power, it is neither unique nor the industry's most widely employed cooling system. Fossil-fueled electricity generators also use cooling towers.

A typical natural draft cooling tower for either a boiling water or pressurized water nuclear power station.

The nuclear power industry operates two basic designs of cooling towers exclusively or in tandem with other cooling systems at 44 units—the mechanical draft cooling tower and the natural draft cooling tower. Essentially, they perform the same function. The cooling tower is a component of the circulating water system and is designed to remove the bulk of the power station's steam heat load coming into the condenser from the turbo-generator. The cool service water is pumped through a large diameter pipe to a series of condenser water boxes in the turbine building for steam cooling purposes. The now hotter service water is pumped back to the cooling tower system through a large discharge pipe and through an extensive system of piping to spray heads where the water is misted into the tower.

The large concrete natural draft cooling towers, typically 500 feet tall, utilize natural convection—the chimney effect—to draw the mist up the cooling tower. There it is released into the atmosphere as evaporation, seen as large, billowing clouds of water vapor coming out of the top.

The smaller mechanical draft cooling tower system uses a series of smaller towers (30 to 50 feet tall) that depend upon electrical fans to force the misted water up through the tower where the water vapor is released through evaporation. To replace the evaporation losses, a typical 1,000 megawatt power reactor pumps 20,000 gallons of water a minute (28 million to 30 million gallons a day) into the cooling tower basin from the river, lake, or ocean.

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Under normal operations, these water vapor clouds are not radioactive. The drifting of condensation clouds from towers have, however, created some localized terrestrial problems associated with atmospheric conditions, including low-lying fog or the freezing-over of nearby sections of highways.

An additional 5,000 gallons a minute of heated service water is discharged as "blowdown" from the cooling tower back into the river, lake, or ocean. A caustic chemical is added to the water system to control and maintain water chemistry and prevent scale-forming compounds from damaging

the cooling tower. The station service water system provides makeup water to the circulation water system to replace the water lost through evaporation. Single stationary screens, which can be removed for cleaning, are located in the circulation pumps to prevent debris from entering the pumps, piping, and condensers.

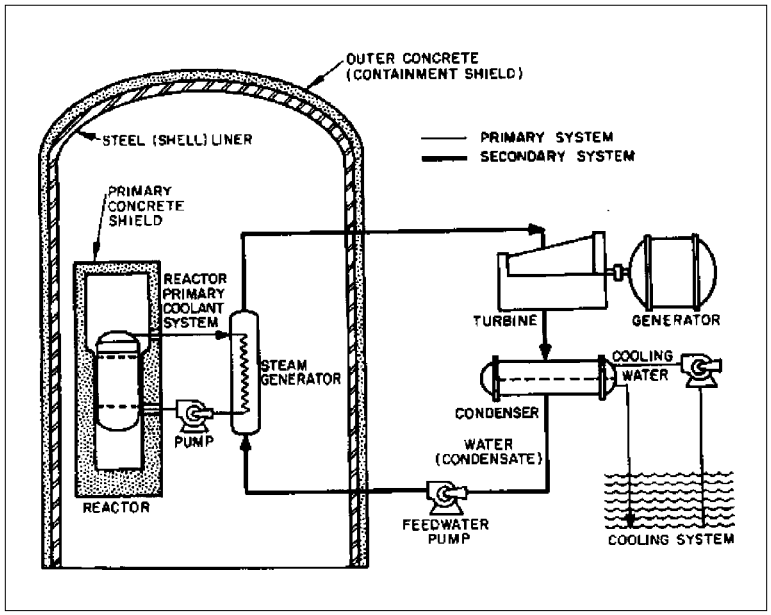
The Once-Through Cooling System

The once-through condenser cooling system is also a circulating water system, used to remove the bulk of the power station's heat load. Tremendous amounts of water are drawn into the power station's steam condensers and discharged back into the source water body. In contrast to cooling towers, the once-through cooling system for a 1,000-megawatt reactor pumps 500,000 to 1,000,000 gallons a minute, (1.5 billion to 3 billion gallons of water a day), from a river, lake, or ocean, runs it through the condenser, and discharges the heated water back into the same water body for thermal dilution. Essentially, the power station uses the river, lake, and ocean as the "ultimate heat sink."

In contrast to cooling towers, the once-through cooling system for a 1,000-megawatt reactor pumps 500,000 to 1,000,000 gallons a minute, 1.5 billion to 3 billion gallons of water a day, from a river, lake, or ocean, runs it through the condenser, and discharges the heated water back into the same water body for thermal dilution.

Fifty-nine reactors rely on the once-through cooling system to remove waste heat. Of that number, 48 use the once-through system as a stand-alone system drawing in water and discharging directly into the receiving waters. The remaining 11 units have a once-through system that is shared with a cooling tower system or a cooling pond to reduce the discharge temperatures. All of these reactors are located directly on or very close to large lakes, reservoirs, estuaries, oceans, and rivers. Some reactors are located on shorelines where cooling water is drawn in through powerful pumps and the heated water is discharged at the shoreline. Other nuclear utilities, whose reactors are situated farther from the shore, have constructed underground tunnels or pipes (9 to 19 feet in diameter) that extend under the shoreline, beach, or dunes to submerged intake structures located anywhere from 1,000 feet to 3 miles from the reactor. The pipes or tunnels lead directly to the reactor or connect the reactor to the water resource through intake and discharge canals.

A number of reactors also use a dilution water system that simultaneously draws in and mixes cooler water with the heated effluent water before being discharged back into the environment. Other reactor designs draw cooler water from the depths of the water source and discharge the heated water to the warmer surface water, capitalizing on the differences in temperature gradients between surface and deep water.



Schematic of the once-through cooling system for a pressurized water reactor.

Each nuclear utility is regulated by federal and state agencies for maximum intake water velocities and maximum temperature differences between the intake and discharge water (an approximate increase on the range of 10 to 33 degrees F) and maximum effluent discharge temperature (106 to 110 degrees F).

The circulating water system intake structures consist of a series of separate, independent bays. Each water intake bay is equipped with its own trash bar and traveling screen system. The trash bar, a narrow set of steel bars with a mechanical trash rake and screening system, protects each intake port by preventing large debris from entering the cooling water system by collecting logs, grass, and seaweed and either mechanically or manually removing debris. Behind the trash bar, each intake bay is equipped with vertical traveling fish-removal screens made of stainless steel mesh designed to divert fish back into the intake canal. The screened service water is then pumped to the reactor condenser system.

The Cooling Ponds, Reservoirs, and Canals

The nine remaining reactors in the United States, located farther away from large natural water resources, rely on man-made reservoirs, ponds, and canals, covering a range of 1,600 to 7,300 acres. These reservoirs and canals provide the surface area for the condenser cooling water through the process of evaporation as a stand-alone system or are used in conjunction with one of the other circulating water systems as the ultimate heat sink.

According to NRC documents:

> [A]lteration of groundwater quality in shallow, unconfined aquifers may occur at the nine nuclear power plant sites that use cooling ponds . . . The extent of ground water contamination by cooling ponds has not been documented at this time. Off site ground water monitoring is not standard practice at these sites, and there are no data with which to characterize the significance of potential off-site contamination."[2]

Thermal Discharge Pollution

The electric power industry is the largest user of water in the United States, accounting for 47 percent of all national withdrawals (more than 190 billion gallons a day). Surface water is the source of 99 percent of all water withdrawals for electric power generation, and saltwater sources supply 31 percent of these withdrawals.[3]

The electric power industry is the largest user of water in the United States, accounting for 47 percent of all national withdrawals (more than 190 billion gallons a day).

Atomic reactors generate significantly less electricity (19 percent of national power use) than coal, natural gas, and oil-fired power stations, but they have a disproportionate impact on water resources. Depending on the type of cooling system used, nuclear reactors require between 19 percent and 65 percent more cooling water per unit of generation and discharge into receiving waters and between 20 percent and 69 percent more heat per kilowatt hour (kWh) than fossil fuel-fired stations.[4] This is due to the technical characteristics of nuclear versus fossil fuel stations. The volume of water used by a power station and the thermal discharges stemming from electricity generation are a function of three factors: the plant's efficiency (or heat rate); the thermal losses through stack gases or within the power station itself (a factor in overall heat rate); and the type of cooling system used (once-through cooling or cooling towers or ponds) before discharging cooling water back into its source.

Nuclear reactors are less thermally efficient than comparably sized fossil-fueled power stations. A reactor has a heat rate equivalent to an average coal-fired plant (10,500 British thermal units [Btu]/kWh) but is less efficient than new advanced coal plants (8,900 Btu/kWh) and significantly less efficient than combined cycle natural gas units (6,350-8,100 Btu/kWh).[5] Therefore, they generate more heat per kWh of generation than comparable fossil-fueled power stations.

A fossil-fueled power plant loses heat load through combustion gases emitted with polluting carbon emissions through the chimney stack into the atmosphere. The releases through the chimney reduce the heat load discharged to cooling water. By comparison, nuclear stations do not discharge this heat load through a chimney—it goes directly into the water. Nuclear reactors typically lose between 3 percent and 5 percent of generated heat inside the plant. Fossil-fueled plants lose between 10 percent and 15 percent of generated heat in the plant and through these combustion stack gases.[6]

Therefore, nuclear power produces more heat per kWh of electricity generated and discharges a larger percentage of generated heat to cooling water systems. This results in larger cooling water intake requirements and in hotter thermal discharges to rivers, lakes, and coastal waters than the fossil-fueled power stations. Herein lies a distinct trade-off for the nuclear industry's clean air energy claims, which also ignore the problems of long-lived radioactive waste and the risk of catastrophic accident. It is evident that of the power plant polluters in the United States, nuclear reactors, using the once-through cooling system, do more marine damage through entrainment as well as thermal discharge than their fossil fuel counterparts.

The Cooling System's Environmental Consequences

The major difference between the cooling tower system and the once-through cooling system involves the tremendous disparity in the consumption of water: about 30 million gallons a day with cooling towers versus as much as 1.5 billion gallons a day with the once-through condenser cooling system. It is quite obvious that cooling towers can greatly reduce the volume of water drawn into the power generators and, to a large degree, alleviate disruption to the marine environment resulting from the intake of cooling water and the release of waste heat and thermal pollution into a receiving body of water. The historical and continued resistance by nuclear utilities to the use of cooling towers can be explained by economics and efficiency. A once-through cooling system keeps the condenser at a lower vacuum than a cooling tower system. The lower the condenser vacuum, the better the steam is 'sucked' out of the turbine, which results in greater production of electricity. However, the environmental impact of diverting 1.5 billion to 3 billion gallons of water per day per reactor site from a river or ocean, heating it up and discharging it back into its source raises significant environmental issues that have continued to haunt the industry.

Screens, racks and bars cannot be installed to such a narrow gauge as to prevent the coolant water intake systems from also sucking in countless quantities of small fish, larvae and spawn, together with vast amounts of marine nutrients such as algae and microorganisms, in an unavoidable process called *entrainment*. Entrainment in the tremendous rush of coolant intake water, inevitably leads to the entrapment (*impingement*) of larger fish, marine mammals, and even endangered species such as sea turtles upon the prevention barriers, where many are injured, drowned, or suffocated. Thus, the installation of "prevention" barriers and nets merely changes the hazard category. Smaller mesh size reduces the number of animals entrained but may increase impingement. Larger mesh reduces impingement but increases the number of species entrained. The only method to ensure a reduction in harm is a reduction in the amount of water consumed by the plant.

Once in the coolant system, marine organisms and nutrients are destroyed upon passage through the reactor's condenser system and, with the heated water, are discharged as sediment back into the water source. The thermal pollution resulting from this discharge water has a visible adverse effect on marine environments. Clearly, continued use of the once-through cooling system is a major cause of destruction of marine life by routine reactor operations.

Notes

[1] Marcel Pagnol, Critique de Critiques.

[2] Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Power Plants, NUREG/1437, U.S. Nuclear Regulatory Commission, vol. 1 § 4.8.3.

[3] Wayne B. Solley; Robert R. Pierce, and Howard Perlman, "Estimated Use of Water in the United States in 1995,"U.S. Geological Survey Circular 1220, Washington, 1998, p. 48.

[4] Calculated from: Roger A. Hinrichs: "Energy: Its Use and the Environment," (Orlando, FL: Harcourt Brace, 1996), pp. 300–02, Table 9-4. Secondary citation from R. Rimberg, "Utilization of Waste Heat from Power Plants," (Park Ridge, NJ: Noyes Data Corporation, 1974), Table 1, p. 33. Assumes fossil-fueled plant with thermal efficiency of between 33 percent and 40 percent (heat rate of 8,600–10,500 Btu/kWh) and nuclear station with heat rate of 10,500 Btu/kWh.

[5] Heat rates for the following technologies were compiled from the following sources: nuclear from Hinrichs , Energy: Its Use and the Environment, (pp. 300–01); and Energy Information Administration, Annual Energy Outlook, U.S. Department of Energy, Washington, Table 37; conventional coal and combined cycle gas from Electrical Power Research Institute, Technical Assessment Guide, (Palo Alto, CA: EPRI, 1993) pp. 8-12, 8-13; advanced combined cycle natural gas from EIA, Annual Energy Outlook, T able 37.

[6] Ibid. Calculated from Hinrichs.

8

What You Can Do

"What Then Must We Do?" —Leo Tolstoy[1]

To help prevent further degradation of the marine environment by nuclear power, we all need to learn about any nuclear reactor near our homes and work places. There are many issues to examine. Does the reactor use the once-through cooling system either exclusively or in combination with cooling canals or cooling towers? How much water does it draw in every day? Are wildlife and marine organisms being entrained, impinged and scalded at the reactor nearby? Is protection of the marine environment inadequate and underregulated? Are the discharge requirements too lenient? These and many other questions take time and effort to answer.

Each of us can participate in the effort to stop the environmental pollution of our oceans and waterways and further destruction of endangered species, marine wildlife and ocean habitat by nuclear power. Here's how to find out more and how to draw public attention to these and related problems.

- ***Search the NRC library system.*** NRC documents and correspondence with its licensees are generally available in the NRC Public Document Room (PDR). The PDR is located at NRC Headquarters in Rockville, MD. The PDR librarians can be contacted by calling the NRC switchboard at 1-800-368-5642 and asking for the PDR. Searches for documents can be requested. Specific requests should be made for Reports of Impingement and Entrainment of sea turtles and marine mammals, available from the PDR. This will ensure all reports of takes received by NRC are discovered as the Daily Event Report system is inconsistent and unreliable (see below). Documents will be copied and mailed to the inquirer at the recipient's expense.

Groups like the Humane Society of the United States and the Sea Turtle Restoration Project have been willing to put on sea turtle costumes and demonstrate against the World Trade Organization and others who fail to protect endangered sea turtles.

- ***Search NRC electronically.*** Alternatively, NRC has an electronic information resource available via its web site at www.nrc.gov. Once there, click on "News and Information." Within this section are two information sources. One provides the Daily Event Reports (DER) from the utilities to NRC. This is where reports of captured or killed marine animals will be found. A section entitled "Previous Reports" will provide a search of DERs dating back to 1997. However, NRC does not post all records it receives of wildlife takes to this site. It is therefore not to be relied upon for a full record of takes and the PDR

should also be accessed (see above). The other system available through the NRC web site is known as ADAMS—Agency-wide Document Access Management System. This is found at: http://www.nrc.gov/NRC/ADAMS/index.html. The authors have found this service to be extremely quirky, slow and problematic. The NRC is making overtures to replace the faulted system. Reporters with *Inside NRC* recently discovered, through their own FOIA submissions, that "numerous letters and papers were never released" to the ADAMS system.[2] However, it is NRC's only electronic document system to access current documents. Additionally, an archival search of NRC documents, dating from 1978 through October 1999, is available using the agency's Bibliographical Retrieval System (BRS) via computer modem. You will need to call the PDR to request assistance to initially log onto the BRS.

- ***Submit a FOIA request.*** Information not currently available through the NRC PDR about individual nuclear power plants can be requested from NRC through the Freedom of Information Act (FOIA), as provided in the U. S. Code of law [5 U.S.C. 552(b)]. Information on nuclear plants pertaining to any other federal agency can be obtained in this same way. A FOIA or Privacy Act (PA) request to NRC must be submitted in writing and may be sent by mail, fax, or e-mail to:

  FOIA/Privacy Act Officer
  U.S. Nuclear Regulatory Commission
  Mail Stop T-6 D8
  Washington, DC 20555-0001
  Fax: 301-415-5130
  E-mail: foia@nrc.gov

In accordance with the law as provided through FOIA and NRC regulations in the U.S. Code of Federal Regulation (Chapter 10 CFR Part 9), any person can request access to NRC or other federal agency records. The FOIA requires the agency to allow the public to have access unless the information is exempt under the FOIA from disclosure (e.g., classified national security, business proprietary, personal privacy or investigative).

Broadly, a FOIA request should adequately describe the specific records or type of records sought so that NRC can make a full search. Guidelines on how to write a FOIA request or obtain information through the PA are available in 10 CFR Part 9. This can be found at: http://www.nrc.gov/NRC/CFR/index.html or by calling the Information Services Branch at 301-415-7169 between 7 A.M. and 4 P.M. (See Appendix B for a sample FOIA letter.)

- ***Join the organizations that published this report.*** Stay informed about the issues covered in this report. And let our organizations know about the facts you uncover.

- ***Volunteer or become an intern with one of our organizations.*** Volunteering with the publisher organizations or local affiliates will enable you to learn more about the detrimental effects of nuclear power on the environment and wildlife and what you can do to stop it.

- ***Contact and join your local environmental organizations.*** Perhaps they already have ocean issues on their agenda. If not, are they aware of this problem? Will they put it on their agenda? Will they support your work?

- ***Work to promote alternatives to nuclear power such as wind and solar energy.*** Surf the web to find the many nongovernmental organizations with expertise on these renewable energy tech-

nologies. (See Appendix C, this report, for a list of renewable energy organizations.) Renewable energy provides an economical, efficient, environmentally friendly and safe method to generate electricity.

- ***Access the web sites of the organizations that published this report.*** The web sites will provide updated information subsequent to the release of the report and its findings. We are constantly researching new information and posting it on our sites.

- ***Access the web sites of other groups referenced in this report.*** **Many of the organizations that con**tributed information to this report, or helped to support it, have action alert networks that always need and welcome new participants.

- ***Surf the web.*** Look in the archives of newspapers located near reactors sites. Examine stories they may have written on this subject. Use the research posted to the web by major organizations referenced in this report and others that act as watchdogs to prevent the decline of the oceans and the negative effects of coastal nuclear power operation. Use this information to help build a dossier on your local reactor.

- ***Start your own web site.*** A web site is an excellent way to publicize your watchdog investigations into your local nuclear reactor and its environmental record, using hot links to our sites and this report.

- ***Contact the media.*** As you gather information, contact journalists in your area to let them know about your findings. Show them that both you and your web site provide timely, accurate and relevant information for new stories and updates on this issue.

- ***Write letters and opinion-editorials.*** Send letters and op-ed pieces to your local newspapers. Contact their news and environmental reporters, too, drawing attention to this issue. Mention this report, and use the facts you have gathered yourself through FOIA, the Internet and other sources to tell the story about your reactor and how it destroys marine wildlife and habitat.

- ***Contact elected officials.*** Make sure to include your local water board, state environmental protection agencies and other state authorities who may have jurisdiction over the plant's activities and may be willing to act on enforcement. As a model for this action, use the Diablo Canyon story featured in this report. (See chapters 2 and 4, this report.)

- ***Monitor industry propaganda.*** Watch for the latest round of nuclear industry advertising and public relations efforts. If you believe they constitute misleading and deceptive information, contact us to establish a new challenge to industry propaganda.

- ***Show the "Licensed to Kill" video.*** This short, informative video is an ideal educational tool for local groups, schools, colleges, church organizations, and other interested parties. You can obtain a VHS copy of the video from the Safe Energy Communication Council (telephone: 202-483-8491) or Nuclear Information and Resource Service (Tel: 202-328-0002). The film tells the story of the effects nuclear power plants, using the once-through cooling system, have on endangered species and the marine environment.

- ***Help us raise money.*** Our ability to research and produce this report hinged on generous contributions from foundations and individuals. To enable this work to continue, you can contribute by contacting any of the publisher organizations.

- ***Follow the latest developments at EPA.*** EPA rules regarding power plants are being revised right now. Submit opinions and testimony to EPA to ensure that new and current power plants are forbidden to use the once-through cooling system. For more information, contact the Office of Science and Technology, U.S. Environmental Protection Agency, Aerial Building, 1200 Pennsylvania Avenue, NW, Washington, DC 20460. Information on rule changes can also be found on the EPA web site: www.epa.gov.

- ***Consider filing a citizen suit.*** Follow the example of the successful lawsuit filed by The Riverkeepers and others that forced EPA to set new standards for best technology available at intake structures of power plants, under the terms of the Clean Water Act. CWA's citizen suit provision allows private individuals to sue EPA in federal district court "where there is an alleged failure of the Administrator [of EPA] to perform an act or duty under [the Act] which is not discretionary with the Administrator."[3]

- ***Circulate a petition.*** A petition can be a powerful tool. Circulate one in your area to build opposition to the destruction of marine wildlife and explain why it needs to end. Submit the petition to state and federal authorities such as the Water Quality Control Board or the regional office of the National Marine Fisheries Service.

- ***Send letters to NRC regional offices.*** Urge NRC to take action to stop the killing and harming of marine wildlife and the destruction of habitat. Remind NRC to put the best interests of marine wildlife and the environment first, not the financial interest of the nuclear power industry.

- ***Talk to local academics.*** Take a copy of the report to academics at your local universities who may have researched this issue or be interested in doing so now that attention has been drawn to the problem. Ask them to put a copy of the report in their institution's library for research purposes.

- ***Set up an information table.*** An information table at local, regional or even national events, focusing on animals, the environment and impacts by industry, is an effective way to educate a wide cross-section of the public. Talk to people about the effects of nuclear power on the marine environment. For example, be sure to set up your information table at the local event celebrating Earth Day on April 22.

- ***Make your own news story.*** Organize nonviolent demonstrations and direct actions outside your local nuclear power plant and/or the utility owner's offices in opposition to the killing of wildlife. Contact the Nuclear Information and Resource Service (telephone: 202-328-0002) for information on how to organize at your local nuclear plant or utility.

Notes

[1] Leo Tolstoy, *What Then Must We Do?*

[2] Jenny Weil, "Inconsistencies in Release of Documents Continues to Plague ADAMS," *Inside NRC* 22 (17): 1–9 (August 14, 2000).

[3] 33 U.S.C. § 1365(a)(2)(1988).

Appendix A

Utility and Nuclear Power Station and Cooling Systems Listing By State

Reactors	Site	Cooling system	Water source
ALABAMA			
Browns Ferry 2	Decatur, AL	OT w/ tower	Tennessee River
Browns Ferry 3		OT w/ tower	
Farley 1	Dothan, AL	MDCT	Chattahoochee River
Farley 2		MDCT	
ARIZONA			
Palo Verde 1	Wintersburg, AZ	MDCT	Phoenix City Sewage
Palo Verde 2		MDCT	Treatment Facility
Palo Verde 3		MDCT	
ARKANSAS			
Arkansas Nuclear 1	Russellville, AR	OT	Dardanelle Reservoir
Arkansas Nuclear 2		NDCT	
CALIFORNIA			
Diablo Canyon 1	San Luis Obispo, CA	OT	Pacific Ocean
Diablo Canyon 2		OT	
San Onofre 2	San Clemente, CA	OT	Pacific Ocean
San Onofre 3		OT	
CONNECTICUT			
Millstone 2	Waterford, CT	OT	Long Island Sound
Millstone 3		OT	
FLORIDA			
Crystal River 3	Red Level, FL	OT	Gulf of Mexico
St. Lucie 1	Hutchinson Island, FL	OT	Atlantic Ocean
St. Lucie 2		OT	
Turkey Point 1	Florida City, FL	CP	Biscayne Bay
Turkey Point 2		CP	

OT = once-through cooling system; MDCT = mechanical draft cooling tower; NDCT = natural draft cooling tower; CP = cooling pond, reservoir or canal.

Source: United States Nuclear Regulatory Commission.

Reactors	Site	Cooling system	Water source
GEORGIA			
Hatch 1	Baxley, GA	MDCT	Altamaha River
Hatch 2		MDCT	
Vogtle 1	Waynesboro, GA	NDCT	Savannah River
Vogtle 2		NDCT	
ILLINOIS			
Braidwood 1	Braidwood, IL	CP	Kankakee River
Braidwood 2		CP	
Byron 1	Byron, IL	NDCT	Rock River
Byron 2		NDCT	
Clinton	Clinton, IL	OT	Salt Creek
Dresden 2	Morris, IL	CP	Kankakee River
Dresden 3		CP	
LaSalle 1	Seneca, IL	CP	Illinois River
LaSalle 2		CP	
Quad Cities 1	Quad Cities, IL	OT	Mississippi River
Quad Cities 2		OT	
IOWA			
Duane Arnold	Palo, IA	MDCT	Cedar River
KANSAS			
Wolf Creek	Burlington, KS	CP	Wolf Creek
LOUISIANA			
River Bend	St. Francisville, LA	MDCT	Mississippi River
Waterford	Taft, LA	OT	Mississippi River
MARYLAND			
Calvert Cliffs 1	Lusby, MD	OT	Chesapeake Bay
Calvert Cliffs 2		OT	
MASSACHUSETTS			
Pilgrim	Plymouth, MA	OT	Cape Cod Bay
MICHIGAN			
Donald C. Cook 1	Bridgeman, MI	OT	Lake Michigan
Donald C. Cook 2		OT	
Fermi 2	Newport, MI	NDCT	Lake Erie
Palisades	Covert, MI	MDCT	Lake Michigan
MINNESOTA			
Monticello	Monticello, MN	OT w/ tower	Mississippi River
Prairie Island 1	Red Wing, MN	OT or MDCT	Mississippi River
Prairie Island 2		OT or MDCT	

Reactors	Site	Cooling system	Water source
MISSISSIPPI			
Grand Gulf	Port Gibson, MS	NDCT	Mississippi River
MISSOURI			
Callaway	Fulton, MO	MDCT	Missouri River
NEBRASKA			
Cooper	Brownville, NB	OT	Missouri River
Fort Calhoun	Ft. Calhoun, NB	OT	Missouri River
NEW HAMPSHIRE			
Seabrook	Seabrook, NH	OT	Atlantic Ocean
NEW JERSEY			
Hope Creek	Salem, NJ	NDCT	Delaware River
Oyster Creek	Forked River, NJ	OT	Barnegat Bay
Salem 1	Salem, NJ	OT	Delaware River
Salem 2		OT	
NEW YORK			
FitzPatrick	Scriba, NY	OT	Lake Ontario
Ginna	Ontario, NY	OT	Lake Ontario
Indian Point 2	Buchanan, NY	OT	Hudson River
Indian Point 3	Buchanan, NY	OT	Hudson River
Nine Mile Point 1	Scriba, NY	OT	Lake Ontario
Nine Mile Point 2		NDCT	
NORTH CAROLINA			
Brunswick1	Southport, NC	OT	Cape Fear River
Brunswick 2		OT	
McGuire 1	Cornelius, NC	OT	Lake Norman
McGuire 2		OT	
Shearon Harris	New Hill, NC	MDCT	Altamaha River
OHIO			
Davis-Besse	Oak Harbor, OH	NDCT	Lake Erie
Perry 1	North Perry, OH	NDCT	Lake Erie

Reactors	Site	Cooling system	Water source
PENNSYLVANIA			
Beaver Valley 1	Shippingport, PA	NDCT	Ohio River
Beaver Valley 2		NDCT	
Limerick 1	Pottstown, PA	NDCT	Schyulkill River
Limerick 2		NDCT	
Peach Bottom 2	Delta, PA	OT w/ tower	Conowingo Pond
Peach Bottom 3		OT w/ tower	
Susquehanna 1	Berwick, PA	NDCT	Susquehanna River
Susquehanna 2		NDCT	
Three Mile Island 1	Londonderry, PA	NDCT	Susquehanna River
SOUTH CAROLINA			
Catawba 1	Clover, SC	MDCT	Lake Wylie
Catawba 2		MDCT	
Oconee 1	Seneca, SC	OT	Lake Keowee
Oconee 2		OT	
Oconee 3		OT	
Robinson 2	Hartsville, SC	OT	Lake Robinson
Virgil Summer	Parr, SC	OT	Lake Monticello
TENNESSEE			
Sequoyah 1	Soddy-Daisey, TN	OT and/or NDCT	Chickamauga River
Sequoyah 2		OT and/or NDCT	
Watts Bar 1	Spring City, TN	OT and NDCT	Tennessee River
TEXAS			
Comanche Peak 1	Glen Rose, TX	OT	Squaw Creek Reservoir
Comanche Peak 2		OT	
South Texas 1	Palacios, TX	CP	Colorado River
South Texas 2		CP	
VERMONT			
Vermont Yankee	Vernon, VT	OT w/ tower	Connecticut River
VIRGINIA			
North Anna 1	Mineral, VA	OT	Lake Anna
North Anna 2		OT	
Surry 1	Gravel Neck, VA	OT	James River
Surry 2		OT	
WASHINGTON			
WNP-2	Richland, VA	MDCT	Columbia River
WISCONSIN			
Kewanee	Carlton, WS	OT	Lake Michigan
Point Beach 1	Two Rivers, WS	OT	Lake Michigan
Point Beach 2		OT	

SUMMARY, BY COOLING SYSTEM	No. of units
Reactors relying upon once-through cooling systems	48
Reactors with once-through shared with tower or pond	11
Reactors relying upon cooling towers	33
Reactors relying upon cooling ponds, canals or reservoirs	11

Appendix B

Sample Letter Requesting Disclosure Under Freedom of Information Act

November 12, 1999

Chief
FOIA-LPDR Branch
Division of Freedom of Information and Publication Services
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, DC 20555

BY FAX: (301) 415-5130

To Whom It May Concern:

On behalf of Nuclear Information and Resource Service (NIRS), and pursuant to the Freedom of Information Act, 5 U.S.C. 552(b), et. seq., I hereby request that you make available copies of all documents in the U.S. Nuclear Regulatory Commission's possession that describe or discuss the takings of endangered and threatened sea turtles, as described more fully below. This request covers but is not limited to all draft and final reports, correspondence, memoranda, notes, records of telephone contacts, all types of camera images, electronic communications including fax transmissions and e-mail, or other written records, whether in paper or computer files, preserved via the use of any medium (e.g., paper documents, final notes or word processors or computer disks, diskettes, hard drives or network systems.) In addition, this request includes studies, analyses, work papers, internal or external communications of any sort, testimony, press releases, reports, memoranda of the like concerning, recording or in any way related to:

1) All communications between Florida Power & Light's St. Lucie nuclear power station and the Nuclear Regulatory Commission pertaining to reports of "incidental capture" of threatened and endangered sea turtles (Kemp's ridley, loggerhead, leatherback, hawksbill and green) for the years 1996, 1997, 1998 and 1999. These documents would not only include actual reports not publicly filed, but also documents referencing reports and reporting requirements for both live and dead sea turtle captures. "Incidental captures" shall include, but not be limited to incidental captures, unintentional or intentional captures, detainment, maiming, injuries, killing, and/or explained or unexplained death.

2) All camera documentation (video, 16 mm, slides, disc images and photographs) of live and dead captures of threatened and endangered sea turtles (Kemp's ridley, loggerhead, leatherback, hawksbill and green) beginning with the commercial operation of the St. Lucie units in 1977 to present in 1999.

3) All correspondence between FP&L and NRC staff pertaining to proposed limits for incidental taking, capturing and/or killing of endangered and threatened sea turtles (Kemp's ridley, loggerhead, leatherback, hawksbill and green) for the years 1996, 1997, 1998, 1999.

4) All documents between FP&L and any state representative or employee of any state agency pertaining to the reports or communications of incidental captures of threatened or endangered sea turtles for the years from and including 1996 to and including 1999 that are in the possession of any employee of the NRC.

5) All documents between the NRC and the United States Fish and Wildlife Service (USFWS) pertaining to the reports or communications of incidental captures of threatened or endangered sea turtles for the years from and including 1996 to and including 1999 pertaining to St. Lucie.

6) All documents and correspondence between the NRC and the USFWS concerning the number of permitted takes under any federal law or statute allocated to FP&L.

7) All documents between the NRC and the United States National Marine Fisheries Service (NMFS) pertaining to reports or communications of incidental captures of threatened or endangered sea turtles for the years from and including 1996 to and including 1999 at St. Lucie.

8) All documents and correspondence between the NRC and NMFS concerning the number of permitted takes under any federal law or statute allocated to FP&L.

9) All documents and correspondence exchanged within the NRC between the Office of General Counsel, the various NRC Project Managers for St. Lucie and Nuclear Reactor Regulation staff pertaining to the kill or capture of endangered or threatened species of turtles at St. Lucie station.

Pursuant to this request, please provide all documents and communications prepared or utilized by, in the possession of or routed through the NRC related to items 1-9.

For any portion of the request that you deem appropriate to deny, NIRS requests that you describe the information that is denied, identify the exception to the FOIA on which you rely and explain how that exception applies to the withheld information.

Pursuant to NRC regulations at 10 CFR 9.41, NIRS requests that any searching and copying fees incurred as a result of this search be waived, and provides the following information in response to the eight criteria listed in Section 9.41(b):

[Note: In order to waive government search and copying fees applicants must provide the federal agency with information that satisfies eight criteria as specified under the Freedom of Information Act. The following NIRS responses are provided only as examples of responses that satisfy these conditions. The FOIA applicant will need to provide their own responses to obtain the fee and search waiver.]

1) Purpose of request:
The purpose of the request is to gather information on the protection from capture of endangered and threatened species and regulatory compliance at nuclear power stations. The requested information is currently not available in the NRC's Public Document Room.

2) Extent to which NIRS will extract and analyze the substantive content of the records:
NIRS is qualified to make use of the requested information. The staff has demonstrated the ability to interpret information and communicate that information in a form comprehensible to the general public. Members of the NIRS staff have published articles in such national journals as *The Progressive, Nuclear Times,* and *The Bulletin of the Atomic Scientists*. NIRS is quoted as a reliable source of information on nuclear issues and environmental protection in newspapers across the country, including *The New York Times, The Washington Post, Newsday* and *The San Francisco Chronicle.*

NIRS has a working relationship with attorneys, physicists, nuclear engineers, medical doctors, biologists and other respected professionals who contribute to the full understanding of nuclear regulatory compliance and endangered or threatened species.

3) **Nature of the specific activity or research in which the records will be used and NIRS's qualifications to utilize the information for the intended use in such a way that it will contribute to public understanding:**
NIRS seeks the requested information solely to contribute to and help shape the public debate on regulatory compliance and the protection of endangered or threatened species. NIRS intends to use the information in order to advance the concerns for public understanding of nuclear regulatory compliance and protection of endangered and threatened species.

4) **Likely impact on the public's understanding of the subject as compared to the level of understanding of the subject prior to disclosure:**
The public understanding of the issues of nuclear regulatory compliance and environmental protection will be enhanced by the contribution of this information.

5) **Size and nature of the public to whose understanding a contribution will be made:**
NIRS has an active subscribing membership of over 1,500 throughout the United States. Several thousand additional members periodically receive mailings from NIRS. NIRS provides resource material to electronic and print media outlets with very broad outreach to a safety conscious audience. Additionally, NIRS has a web site (www.nirs.org) which receives an average of 700 visitors per day where postings on this issue will be made available.

6) **Means of distribution of the requested information:**
NIRS will use its own newsletter publication *The Nuclear Monitor* and our media contacts in both the electronic and print media outlets to provide very broad outreach to the safety conscious public. NIRS will also share information with other interested parties concerned with regulatory compliance and endangered or threatened species. Additionally, NIRS will post information on its web site (www.nirs.org) which receives an average of 700 visitors per day.

7) **Whether free access to information will be provided:**
NIRS will provide the information without charge to all members of the public. Information prepared from the FOIA requested will be posted on the web site for downloading free of charge. NIRS will also provide a copy of information to all interested parties without charge.

8) **No commercial interest by NIRS or any other party:**
NIRS has no commercial interest in obtaining the requested information. This information is provided to all public requests without charge. The sole interest of NIRS is to promote a policy debate on nuclear regulatory compliance and the protection of endangered and threatened species.

Sincerely,

Appendix C

An Index of Resources on Renewable Energy and Energy Efficiency

ALLIANCE TO SAVE ENERGY

The Alliance to Save Energy promotes the efficient use of energy resources in the United States and throughout the world. The Alliance works in the following areas: energy efficiency in buildings, industrial energy efficiency and competitiveness, consumer energy education, trade and investment, energy policy reform, and international energy issues. The Alliance also conducts technical and policy research, policy advocacy work, and other activities designed to promote energy efficiency.

Contact: Alliance to Save Energy
1200 18th Street, NW, Suite 900, Washington, DC 20036
Telephone: (202) 857-0666 • Fax: (202) 331–9588
www.ase.org

AMERICAN BIOENERGY ASOCIATION

The mission of the American Bioenergy Association (ABA) is to advocate for the increased use of biomass to produce power, transportation fuels, and chemicals. ABA works to build federal support for the biomass industry through tax incentives, increased research and development, and regulatory and policy initiatives.

Contact: American Bioenergy Association
314 Massachusetts Ave., NE Suite 200, Washington, DC 20002
Telephone: (202) 467–6541 • Fax: (202) 467–6541
www.biomass.org

AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

The American Council for an Energy-Efficient Economy (ACEEE) is a dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection. ACEEE fulfills its mission by conducting technical and policy analysis; advising government and utilities; working collaboratively with businesses and other organizations; publishing books, conference proceedings, and reports; organizing conferences and workshops; and informing consumers. ACEEE works closely with the U.S. Department of Energy, the U.S. Environmental Protection Agency, and other federal agencies as well as states, utilities, and international organizations.

Contact: American Council for an Energy-Efficient Economy
1001 Connecticut Avenue, NW, Suite 801,Washington, DC 20036
Telephone: (202) 429-8873 • Fax: (202) 429–2248
www.aceee.org

AMERICAN WIND ENERGY ASSOCIATION

The American Wind Energy Association (AWEA) is the wind energy industry's national trade association, representing wind power plant developers, wind turbine manufacturers, utilities, researchers, and others involved in the wind energy industry. AWEA provides information on current wind energy projects operating worldwide, new projects in development, companies involved in the wind energy field, technology development, and policy issues.

Contact: American Wind Energy Association
122 C St., NW Suite 380, Washington, DC 20001
Telephone: (202) 383–250 • Fax: (202) 383–25005
www.awea.org

CENTER FOR RENEWABLE ENERGY AND SUSTAINABLE TECHNOLOGY

The Center for Renewable Energy and Sustainable Technology (CREST) is an excellent Internet site that offers a wide range of information from a variety of organizations working to promote energy efficiency, renewable energy and environmentally sustainable technologies.

Contact: Center for Renewable Energy and Sustainable Technology
www.solstice.crest.org

Renewable Energy Policy Project

The Renewable Energy Policy Project's (REPP) mission is to accelerate the use of renewable energy technologies by providing information, analysis, and innovative strategies in the context of changing energy markets and increasing environmental needs. REPP conducts research and publishes reports addressing a wide range of renewable energy and energy policy issues.

Contact: Renewable Energy Policy Project
1612 K St., NW Suite 202, Washington, DC 20006
Telephone: (202) 293–2898 • Fax: (202) 293–5857
www.repp.org

ROCKY MOUNTAIN INSTITUTE (RMI)

The Rocky Mountain Institute is an independent, nonprofit research and education foundation whose goal is to foster the efficient and sustainable use of energy and natural resources. RMI has several program areas: energy, water, transportation (hybrid vehicle development), green development, global security, economic renewal, corporate sustainability, and climate change. RMI offers energy consulting and related services to businesses and governments and has an extensive list of helpful publications.

Contact: Rocky Mountain Institute
1739 Snowmass Creek Road, Snowmass, CO 81654-9199
Telephone: (970) 927-3851 • Fax: (970) 927-3420
www. rmi .org

SOLAR ENERGY INDUSTRIES ASSOCIATION

The Solar Energy Industries Association represents the interests of manufacturers of photovoltaics and solar thermal technologies through business development, utility education and outreach, policy and technical analysis, and support for adequate federal funding for technology development and R&D.

Contact: Solar Energy Industries Association
1616 H St., NW, 8th Floor, Washington, DC 20006
Telephone: (202) 628–7979 • Fax: (202) 628–7979
www.seia.org

U.S. DEPARTMENT OF ENERGY OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) develops and deploys cost-effective energy-efficient, and renewable energy technologies that help meet our nation's energy needs, protect our natural environment, and strengthen U.S. economic competitiveness. EERE achieves these goals through a strong and balanced program of research, development and market deployment.

Contact: Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy
1000 Independence Avenue, SW, Washington, DC 20585
Telephone: (800) 363–3732
www.eren.gov

ENERGY EFFICIENCY AND RENEWABLE ENERGY CLEARINGHOUSE

The Energy Efficiency and Renewable Energy Clearinghouse (EREC) provides an information line with information on all U.S. Department of Energy programs dealing with energy efficiency and renewable energy. The EREC is a source for fact sheets, publications, brochures, resource lists, referrals, and business assistance.

Contact: Energy Efficiency and Renewable Energy Clearinghouse
PO Box 3048, Merrifield, VA 22116 [no walk-in address available]
Telephone: (800) DOE-EREC [363-3732]

NATIONAL RENEWABLE ENERGY LABORATORY

As the nation's leading center for renewable energy research, NREL is developing new energy technologies to benefit both the environment and the economy. NREL conducts ongoing research in almost fifty technology areas, including solar photovoltaics, solar thermal energy systems, wind energy, geothermal energy, biomass-derived fuels and chemicals, waste-to-energy technologies, energy-efficient buildings, advanced vehicles, fuel cells, and superconductivity.

Contact: National Renewable Energy Laboratory
1617 Cole Blvd. , Golden, CO 80401-3393
Telephone: (303) 275-3000
www.nrel.gov/buildings/highperformance/

Contact Information

Licensed to Kill is a collaboration between **Project Partners** Safe Energy Communication Council (SECC), Nuclear Information and Resource Service (NIRS), Standing for Truth About Radiation (STAR) and the Humane Society of the United States (HSUS).

Safe Energy Communication Council
1717 Massachusetts Avenue, NW, Suite 106
Washington, DC 20036
Tel: (202) 483-8491
Fax: (202) 234-9194
www.safeenergy.org

Nuclear Information and Resource Service
1424 16th St,. NW, Suite 404
Washington, DC 20036
Tel: (202) 328-0002
Fax: (202) 462-2183
www.nirs.org

Standing for Truth About Radiation
66 Newtown Lane, Suite 3
East Hampton, NY 11937
Tel: (631) 324-0655
Fax: (631) 324-2203
www.noradiation.org

Humane Society of the United States
2100 L St., NW
Washington, DC 20037
Tel: (202) 452-1100
Fax: (301) 258 3080
www.hsus.org

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