



CHICAGO JOURNALS



History
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Science
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Reviewed work(s):

Source: *Osiris*, Vol. 21, No. 1, Global Power Knowledge: Science and Technology in International Affairs (2006), pp. 209-228

Published by: [The University of Chicago Press](#) on behalf of [The History of Science Society](#)

Stable URL: <http://www.jstor.org/stable/10.1086/507142>

Accessed: 19/01/2012 05:02

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Hallowed Lords of the Sea: Scientific Authority and Radioactive Waste in the United States, Britain, and France

*By Jacob Darwin Hamblin**

ABSTRACT

In 1959, oceanographers and atomic energy officials met at an international conference in Monaco to discuss the scientific aspects of dumping radioactive waste into the ocean. The result was a broad consensus among oceanographers that there was not enough scientific knowledge of the oceans to merit large-scale dumping. Because nuclear nations already had been dumping for years, the new consensus challenged existing practices. This paper focuses on the conflicts between oceanographers and the atomic energy establishments of the United States, Britain, and France. It reveals the perception, shared by atomic energy officials in all three countries, that oceanographers manipulated public and international opinion to seize authority, influence, and potential patronage for research on oceanography. While historians often debate the consequences of government (usually military) funding on scientists' agendas and practices, few address the impacts that international consensus and scientists' patronage strategies have had upon the policies and status of patrons. This paper reveals a siege mentality within governments and shows the birth of international collaboration between atomic energy establishments as a means of combating the negative publicity caused, in their view, by oceanographers seeking influence and financial support. The international debates about radioactive waste disposal, seen as a contest for scientific authority, highlight the reciprocal influences of patronage practices during the cold war era.

INTRODUCTION

The Wise Man says
That only those who bear the nation's shame
Are fit to be its hallowed lords

—John Isaacs (1959), quoting Lao Tzu¹

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Special thanks to Odile Frossard for her help in the archives of the Commissariat à l'Énergie Atomique and to Janice Goldblum for her help in the National Academies Archives. This article is based on archival research financially supported by the American Philosophical Society through its Franklin Research Grant. Unless otherwise noted, translations into English from French are the author's.

¹ John D. Isaacs to Pacific Coast Committee, Dec. 21, 1959, Folder "ES: Com on Ocean: Subc on Disposal of Low-Level Rad Waste into Pacific Coastal Waters: Report: Review, 1959," National Academies Archives, Washington, D.C. (hereafter cited as NAS Archives).

Perhaps sensing a heavy burden of responsibility, U.S. oceanographer John Isaacs reached deep into the cultural past for inspiration, drawing on ancient Chinese philosophy to conjure images of wise men, national shame, and hallowed lords. At the time, he chaired a National Academy of Sciences (NAS) panel to report on the biological effects of dumping radioactive waste into the Pacific. He knew that his panel's conclusions, warning about the dangers of existing practices in radioactive waste disposal, would be at odds with the statements of atomic energy establishments in the United States, Britain, and France. They also would cast doubt on what leading oceanographers themselves had been saying for most of the decade—that the sea could be considered a giant sewer.² The Lao Tzu passage itself, only one of several such quotations Isaacs sent to his fellow panelists, stands as a provocative encapsulation of a political attitude: those who acknowledge a nation's past sins have a moral claim to authority and leadership. In the present essay, we can extend this lordship to the sea, to examine the international issue of contested scientific authority between oceanographers and atomic energy establishments.

Isaacs's panel had its roots in a conflict about ocean dumping between the federal government and the state of California, but its conclusions spoke to questions of worldwide importance: Was it safe to dump radioactive waste at sea? If so, where and how much? By the mid-1950s, the nuclear powers had been dumping radioactive waste into sewers, rivers, and oceans for years without much international conflict. But the 1958 United Nations Conference on the Law of the Sea had declared itself against ocean pollution. It charged the newly created International Atomic Energy Agency with the task of developing appropriate regulations for radioactive waste, and international scientific bodies seemed poised to play a leading role in authoring them.³ In late 1959, delegations made up of oceanographers and atomic energy officials met in Monaco to discuss the important scientific problems related to radioactive waste disposal. Although it was not supposed to be a diplomatic meeting, it resulted in a broad acceptance of many of the same conclusions being made by Isaacs and his committee, with a consensus among the oceanographers that more research was needed before nuclear powers could dump radioactive waste at sea on a large scale. Because such dumping policies were already in effect, the Monaco meeting implicitly challenged existing practices. Scientists, apparently, had become diplomats.

Historians of science have taken up the story of scientists engaged in international affairs, revealing some of the ways in which they tried to balance the professional demands of science with their need to act as part of the cold war national security state.⁴ At the international level, scientific communities advised diplomats, helped to negotiate regulations, and established scientific problems requiring international cooperation. Certainly, historians agree that many international activities could, in fact, be

² *Disposal of Low-Level Radioactive Waste into Pacific Coastal Waters* (Washington, D.C., 1962).

³ For overviews of the IAEA, see David Fisher, *History of the International Atomic Energy Agency: The First Forty Years* (Vienna, 1997); and Lawrence Scheinman, *The International Atomic Energy Agency and World Nuclear Order* (Baltimore, 1987).

⁴ Ronald Doel and Allan Needell have written extensively about these connections, exploring the ways in which scientists were incorporated into diplomacy and national security. Ronald E. Doel, "Scientists as Policymakers, Advisors, and Intelligence Agents: Linking Contemporary Diplomatic History with the History of Contemporary Science," in *The Historiography of Contemporary Science and Technology*, ed. Thomas Söderqvist (Amsterdam, 1993), 215–44; Allan A. Needell, *Science, Cold War, and the American State: Lloyd V. Berkner and the Balance of Professional Ideals* (Amsterdam, 2000).

construed as scientists acting in the service of their respective states.⁵ However, scientists were not always simply co-opted into state goals, so we must also examine the array of other motivations at the international level. Like any other group tied to governmental politics during the cold war era, scientists might have had entirely separate interests to pursue.⁶

One of these interests undoubtedly was patronage, especially given the power of international scientific consensus to justify or even compel it. An ongoing dispute among historians is the question of how military patronage altered the practice of science and the research agendas of scientists.⁷ With our focus on the consequences of military funding, however, we risk seeing the patron as the sole source of pressure; it is easy to forget that scientists often courted their patrons, and they did so vigorously. Oceanographers, in particular, were hugely successful in convincing a variety of patrons that research on the oceans was worth a large grant or two.⁸ In many ways, their pursuit of funding fits our conception of science in the service of the cold war state; for the military, it often was a relatively simple relationship in which one side wanted science and technology, and the other provided the necessary expertise.⁹ But once we look at the variety of other situations, in which expertise was claimed by both the patron and the potential recipient of funds, a more complex portrait of national and international science emerges. In the case of radioactive waste, the international consensus

⁵ See, e.g., the growing literature on the International Geophysical Year (1957–1958), in which historians increasingly are pointing out the diplomatic, national, and strategic motivations behind cooperative activities. Aant Elzinga, “Antarctica: The Construction of a Continent by and for Science,” in *Denationalizing Science: The Contexts of International Scientific Practice*, ed. Elisabeth Crawford, Terry Shinn, and Sverker Sörlin (Dordrecht, 1992), 73–106; Ronald E. Doel, “Constituting the Post-war Earth Sciences: The Military’s Influence on the Environmental Sciences in the USA after 1945,” *Social Studies of Science* 33 (2003): 635–66; Jacob Darwin Hamblin, “Mastery of Landscapes and Seascapes: Science at the Strategic Poles during the International Geophysical Year,” in *Extremes: Oceanography’s Adventures at the Poles*, ed. Helen M. Rozwadowski (Cambridge, forthcoming).

⁶ Kristine Harper has pointed this out in her discussion of the competing national and international goals in meteorology. Kristine C. Harper, “Research from the Boundary Layer: Civilian Leadership, Military Funding, and the Development of Numerical Weather Prediction (1946–55),” *Soc. Stud. Sci.* 33 (2003): 667–96.

⁷ For representative publications taking different sides on this issues, see Paul Forman, “Behind Quantum Electronics: National Security as Basis for Physical Research in the United States, 1940–1960,” *Historical Studies in the Physical and Biological Sciences* 18 (1987): 149–229; Daniel J. Kevles, “Cold War and Hot Physics: Science, Security, and the American State, 1945–1956,” *Hist. Stud. Phys. Biol. Sci.* 20 (1990): 239–64.

⁸ Oceanographers’ changing patronage strategies are discussed in Jacob Darwin Hamblin, *Oceanographers and the Cold War: Disciples of Marine Science* (Seattle, 2005). The military (naval) patronage for oceanography in the United States is discussed at length in Gary E. Weir, *An Ocean in Common: American Naval Officers, Scientists, and the Ocean Environment* (College Station, Texas, 2001). Efforts to court naval patronage at the Scripps Institution of Oceanography are discussed in Ronald Rainger, “Patronage and Science: Roger Revelle, the U.S. Navy, and Oceanography at the Scripps Institution,” *Earth Sciences History* 19 (2000): 58–89. Naomi Oreskes has pointed out that some ostensibly nonmilitary projects have had their military origins erased or forgotten, as in the case of the *Alvin* submersible craft; rather than painting their projects blue, that is, making basic research seem like applied military research to attract funding, oceanographers often painted their projects white, obscuring the military origins of their research. See Naomi Oreskes, “A Context for Motivation: U.S. Navy Oceanographic Research and the Discovery of Sea-Floor Hydrothermal Vents,” *Soc. Stud. Sci.* 33 (2003): 697–742.

⁹ Much of the discussion about naval patronage of oceanography has centered on the use of scientists as experts. Chandra Mukerji, for example, went so far as to call oceanographers a reserve labor force, ready to provide the military with much-needed expertise at any time. Mukerji, *A Fragile Power: Scientists and the State* (Princeton, 1990).

of oceanographers at Monaco went *against* the wishes of the authorities in their own countries. Emphasizing the need for research (certainly a typical patronage strategy) called into question existing policies. It also implied that oceanographers were better suited as authoritative experts on marine radioactivity than the scientists already working for atomic energy establishments.

Because we often see the problem of scientific authority as a way of understanding the combative relationship between environmentalists and bureaucracies such as the AEC, we might overlook other turf wars played out on an international scale.¹⁰ One of these was waged between established scientists in government and (what they perceived as) the opportunistic nongovernmental scientists using public opinion to grasp power and money by asserting scientific authority. The relationship between these groups was often collaborative, to be sure, but it could be confrontational as well—perhaps surprisingly so, given the desire of one to solicit funding from the other. The present chapter centers on the dilemmas of three of the four major atomic energy establishments of the late 1950s: the U.S. Atomic Energy Commission (AEC), the UK Atomic Energy Authority (AEA), and the French Commissariat à l'Énergie Atomique (CEA). Leaving out the Soviet Union (except in passing) allows us to focus on the crucial link, or battleground, between oceanographers and the atomic energy establishments: democratically elected public officials and the lay public at large. It also helps to reveal the emergence of an international community separate from the one created by academic oceanographers, in the form of interagency liaison between major figures in all three establishments, across national lines. They created such links, formally or informally, to contest oceanographers' claims to authority and to find ways of bringing oceanographers back into line with established assumptions about the role of the ocean in waste disposal. Even when the three establishments were not acting in concert, their concerns were strikingly homogeneous, centered on the perception of oceanographers not as accomplices but as opportunistic adversaries. Were the oceanographers acting in the interests of the state? Certainly, atomic energy officials did not think so; instead, they saw the oceanographers as acting in their own, self-aggrandizing interest. Atomic energy officials perceived a struggle: for scientific authority about how the ocean could or could not be used—or, to continue with Isaacs's imagery, for hallowed lordship of the sea.

THE SEARCH FOR WASTE SITES

The first serious assessments by oceanographers of radioactive waste disposal at sea came about because of the fallout debates in the mid-1950s. To address public concern, the National Academy of Sciences conducted a major study of the biological effects of atomic radiation (the BEAR study) in 1956. One of the panels, chaired by Scripps Institution of Oceanography director Roger Revelle, was devoted to the oceans. Although it acknowledged the uncertainty of knowledge of the seas, this group confidently agreed with existing policies that the ocean could be used to some degree as a repository for nuclear waste.¹¹ The United Nations made a similar assess-

¹⁰ Stephen Bocking recently has emphasized the importance to environmentalists of the uncertainty of environmental effects, because it allows them to call into question the scientific authority of those who have already made policies. See Bocking, *Nature's Experts: Science, Politics, and the Environment* (New Brunswick, N.J., 2004).

¹¹ See *The Effects of Atomic Radiation on Oceanography and Fisheries* (Washington, D.C., 1957).

ment through its Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). The UNSCEAR report was more cautious than the American report, but it echoed the findings of American and British oceanographers who supported their countries' decisions to dump at sea. The search for atomic graveyards in the deep sea became a major goal of international cooperation in the late 1950s, particularly the International Geophysical Year (IGY), an eighteen-month cooperative project beginning in the summer of 1957.¹²

The IGY proved disappointing to those hoping to use the sea for the disposal of high-level wastes, because most of the scientific work cast doubt on widely held assumptions about the existence of deep stagnant water. Early IGY evidence of deep circulation came from Japanese and French scientists, who used the French-made bathyscaphe, a recently invented manned submersible craft, in their joint study. About 120 miles off the coast of Japan, descending to a depth of more than 9,000 feet, the two-man *FNRS III* measured slow currents. A Japanese scientist who went down with the bathyscaphe, Tadayoshi Sasaki of the Tokyo Fishery College, reported water movement at less than an inch per second. He concluded that the movement was probably caused by ice melting at the poles. To Sasaki, the implications were crystal clear. "Considering the length of half-life of radioactive waste," he said, "this sluggish flow of deep sea water would make the sea unsafe as a dumping place for atomic reactor waste."¹³

Soviet scientists came to similar conclusions. "Huge canyons in the oceans, far deeper than the Grand Canyon, are not good ash cans for the nuclear age, a Soviet scientist said today." Thus the *New York Times* heralded the Soviet findings of the IGY in August 1958. Quoting Lev Zenkevich, a marine biologist, the newspaper noted that the water was not stagnant in the deepest parts of the ocean, as some oceanographers had hoped. Instead, the water circulated, meaning that radioactive wastes could poison sea life and, ultimately, man.¹⁴ The Soviet newspaper *Tass* reiterated this point in November 1958, when pointing out that the Soviet oceanographic vessel *Vityaz* had measured the deepest parts of the ocean during the IGY. Even in these deep areas, there were no stagnant waters, in direct contradiction to what American oceanographers had suggested.¹⁵

National delegates met for the United Nations Conference on the Law of the Sea (UNCLOS) from February through April 1958. Meeting while the IGY was in progress added a renewed urgency to the problem. Scientists needed to find answers quickly in order to inform future agreements. International law now stated that United Nations signatories would have to regulate against pollution of the seas from the exploitation of offshore oil and other resources. The law also required states to regulate the dumping of radioactive waste at sea, according to principles to be set forth by a competent international organization. Because that organization would be the International Atomic Energy Agency, officially created just months before, the handwriting was on the wall: oceanographers and other scientists would have a limited amount of time to gather data and bolster their professional judgments about international regulation of

¹² An overview of the IGY can be found in Walter Sullivan, *Assault on the Unknown: The International Geophysical Year* (New York, 1961).

¹³ "Current is Found Far Down in Sea," *New York Times*, June 29, 1958, 45.

¹⁴ "Sea Canyons Held Poor Atom Ash Cans," *New York Times*, Aug. 3, 1958, 8.

¹⁵ "Oceanographers Split," *New York Times*, Nov. 22, 1958, 11. The *Tass* story is reported here. See also Walter Sullivan, "Sea Depths Yield Secrets in IGY," *New York Times*, Jan. 5, 1959, 4.

dumping because the IAEA would see the formulation of specific regulations as one of its principal mandates.¹⁶

While physical oceanographers were studying the deep sea, biological oceanographers were studying the concentration of isotopes in organisms. Perhaps, the biological argument went, radioactive materials could reach humans through the food chain, despite the physical mixing and chemical dilution of radioactivity in the sea. If true, this might limit even the amount of low-level wastes put into the sea. In the United States, the National Academy of Sciences established the Committee on Oceanography (NASCO) to formulate recommendations to the government on areas needing policy recommendations, including these biological implications of radioactive waste disposal.¹⁷ The new status acquired by oceanographers in the United States raised some hackles in the AEC because it opened a possible avenue for oceanographers to appropriate a large chunk of the AEC's policy authority. Moreover, as historian Ronald Rainger has argued, NASCO scientific assessments of risk became more than policy statements; they became moral pronouncements on what risks were acceptable.¹⁸ As we shall see, this was happening on an international scale, and it irritated scientists in atomic energy establishments enormously. Oceanographers' efforts to claim such policy territory presumed to second-guess the decisions already made by experts within the AEC, the AEA, and the CEA.

While the IGY studies were in progress, the AEC sought the NAS's advice about using the Atlantic coast as a major dumping area. The AEC wanted to allow the dumping of low-level radioactive waste closer to shore than usual—that is, closer than 100 miles out. Actually, the AEC *already* had been allowing a commercial firm to dump its low-level radioactive wastes in shallow water (fifty fathoms) less than 15 miles from shore.¹⁹ The AEC had made the decision: AEC sanitary engineer Arnold Joseph mentioned to the Academy that “the Atomic Energy Commission feels that as many as 4 or 5 disposal areas can be established along the Atlantic Seaboard,” all conveniently located near ports but not the most densely populated ones. As its own experts had arrived at this conclusion already, asking the oceanographers to study the problem can only be interpreted as the AEC's effort to consolidate the legitimacy of its decision. Certainly, it would have expected no dissent: the panel's chairman, Dayton Carritt of the Chesapeake Bay Institute, was handpicked by the AEC.²⁰

Although the Carritt panel did precisely what the AEC wanted, the experience soured Academy oceanographers on toeing the AEC line. After mulling over the possibility of dumping off the Atlantic seaboard, Carritt's panel chose twenty-eight sites

¹⁶ For a contemporary discussion of UNCLOS, see Charles Swan and James Ueberhorst, “The Conference on the Law of the Sea: A Report,” *Michigan Law Review* 56 (1958): 1132–41.

¹⁷ Harrison Brown to Detlev Bronk, Jan. 8, 1958; Detlev Bronk to Harrison Brown, Feb. 3, 1958, Folder “ADM: ORG: NAS: Coms on BEAR: Oceanography and Fisheries: Cooperation with NRC Com on Oceanography,” NAS Archives.

¹⁸ Ronald Rainger, “A Wonderful Oceanographic Tool: The Atomic Bomb, Radioactivity, and the Development of American Oceanography,” in *The Machine in Neptune's Garden: Historical Perspectives on Technology and the Marine Environment*, ed. Helen M. Rozwadowski and David K. van Keuren (Sagamore Beach, Mass., 2004), 93–131, 115.

¹⁹ Arnold Joseph to Richard C. Vetter, memo, Jan. 10, 1958, Folder “ES: Com on Ocean: Subcommittee on Radioactive Waste Disposal into Atlantic and Gulf Coastal Waters, General, 1958,” NAS Archives.

²⁰ *Ibid.*

that might be suitable. When the locations were revealed to the public, in a map on the pages of the *New York Times*, city and state officials all along the coast were horrified. Virginia congressman Thomas N. Downing was shocked to discover that three of the sites were off Virginia, and he wrote to AEC chairman John A. McCone to register a firm protest. While he had great confidence in NASCO's scientific abilities, he wrote, "I cannot see where it is either necessary or practical to dispose of this radioactive material in waters so close to our shore." Aside from the possible physical harm, such disposal would be bad for business. The sites, it seemed, were very close to resort areas, so "there would also arise a psychological factor which could possibly be harmful to the economy of this area."²¹

The outcry by public officials embarrassed the National Academy of Sciences, which terminated Carritt's working group immediately. The experience helped to drive a wedge between academy scientists and the AEC. With its foregone conclusions dictated by the AEC, the report threatened the Academy's status as a reliable, independent, authoritative voice. Academy president Detlev Bronk was very annoyed at all of the negative publicity "because of Carritt." He wondered if the NAS ought to make a formal statement to rectify Carritt's missteps, adding, "I was never impressed by his scientific quality as are some."²²

In the United States, the Carritt study marked a point of departure for oceanographers and the AEC, with the former trying to assert a separate scientific authority and to attune themselves to the needs of public officials and the lay public. This would be interpreted by the AEC as opportunism. The best example of this was the committee under Scripps Institution of Oceanography scientist John Isaacs, which tried to do (or not to do) for the Pacific what Carritt had done for the Atlantic. Because depth dramatically increased much closer to shore in the Pacific than it did in the Atlantic, the AEC did not anticipate the kinds of commercial gripes that plagued them on the East Coast. Taking ships out to deep water would not be as costly or time consuming. Nonetheless, the California State Legislature formally objected to the AEC's methods of dumping radioactive waste offshore. It petitioned the federal government and the armed forces to extend the depth requirement to 2,000 fathoms and to ensure that dumping areas were at least sixty miles away from known seamounts. Moreover, California politicians seemed to want to make a statement: as Joseph summarized it—"to go on record that they are opposed to the philosophy of unsafe bulk disposal of radioactive wastes."²³

It was in the decidedly unpleasant aftermath of the Atlantic report that Isaacs's working group made its own report on the Pacific. The crucial difference was that the Pacific group knew beforehand that public officials represented potential adversaries. Should the group make an effort to placate the Californians or simply to back up the AEC's position? Here was where Isaacs hoped a quote from Lao Tzu would aid his fellow scientists in shaping the final report:

²¹ Thomas N. Downing to John A. McCone, June 25, 1959, Folder "ES: Com on Ocean: Subc On Rad Waste Disposal into Atlantic and Gulf Coastal Waters, 1959," NAS Archives.

²² Harrison Brown to Dayton Carritt, July 25, 1959; Detlev Bronk to S. Douglas Cornell, July 31, 1959, Folder "ES: Com on Ocean: Subc On Rad Waste Disposal into Atlantic and Gulf Coastal Waters, 1959," NAS Archives.

²³ Arnold B. Joseph to Richard C. Vetter, June 19, 1956, Folder "ES: Com on Ocean: Subc on Rad Waste Disposal into Atlantic and Gulf Coastal Waters, General, 1958," NAS Archives.

The Wise Man says
 That only those who bear the nation's shame
 Are fit to be its hallowed lords;
 That only one who takes upon himself
 The evils of the world may be its king.

In his reflective way, Isaacs appeared to be committed to doing good science, possibly suggesting that the sea should be used for dumping—while asserting that oceanographers should shoulder more responsibility for such decisions.²⁴

Isaacs attempted to avoid the problems that plagued Carritt's Atlantic report by talking to local organizations about the issues. He later told the *Houston Post* that he consulted more than thirty bodies, including sportsman's clubs, commercial fishermen's groups, and antipollution leagues. The report targeted not scientists but rather the lay person, because Isaacs recognized that the biggest difficulties would come not from scientists or government, but from the public at large. "Thus there are no vital steps of erudition that an audience must take on faith, but, rather, each step in our picture can be considered and criticized by any intelligent 'natural naturalist,' such as a crab fisherman, as well as by the formal scientist."²⁵

When Isaacs handed over his committee's draft, AEC scientists were taken aback. The draft emphasized the biological uncertainties connected to isotope concentration and implied that continued radioactive waste disposal was going to limit man's other uses of the sea. "If true," Arnold Joseph complained, "AEC perhaps should have curtailed sea disposal some time ago." The biological argument was made in such a way that "it appears to be a fact, whereas in reality this is still largely hypothesis."²⁶ What really surprised Joseph, however, was the implication that the oceanographers had more of a right to speak for the public than the AEC did. "We, too, are very sensitive to reactions by public, civic, political and business interest groups." The report was poised, he believed, to paint a negative portrait of atomic energy establishments everywhere. Isaacs's group seemed to suggest widespread complacency and an unwarranted confidence that problems would solve themselves. Joseph countered: "Has AEC exhibited 'complacent confidence'? Does not the fact that this study was requested mean anything?"²⁷

Joseph understood the international stakes. After all, sea disposal already was routine, especially by Britain. Joseph thought that the British would be offended by the report. "As worded," Joseph criticized, "this is a real slap at the British in their pipeline disposal only a few miles off shore." The oceanographers, he claimed, were giving the impression that atomic energy establishments everywhere could not be trusted. The report "calls the AEC, collectively from the Commissioners to the janitors, a bunch of untrustworthy people."²⁸

Because Isaacs's group called for more research, AEC officials sensed opportunism.

²⁴ Isaacs to Pacific Coast Committee, Dec. 21, 1959 letter (cit. n. 1).

²⁵ John D. Isaacs to Ralph S. O'Leary, March 15, 1961, Folder "ES: Com on Ocean: Subc on Disposal of Low-Level Rad Waste into Pacific Coastal Waters: Rept: Review: 1961," NAS Archives.

²⁶ Arnold B. Joseph to John D. Isaacs, Sept. 22, 1960, Folder "ES: Com on Ocean: Subc on Disposal of Low-Level Rad Waste into Pacific Coastal Waters: Rept: Review: General: 1960," NAS Archives.

²⁷ Arnold B. Joseph to Roger Revelle, July 20, 1961, Folder "ES: Com on Ocean: Subc on Disposal of Low-Level Rad Waste into Pacific Coastal Waters: Rept: Review: 1961," NAS Archives.

²⁸ Arnold B. Joseph, "Comments on Report of Pacific Coast Subcommittee on Sea Disposal of Low Level Radioactive Waste," revised April 1961, Folder "ES: Com on Ocean: Subc on Disposal of Low-Level Rad Waste into Pacific Coastal Waters: Rept: Review: 1961," NAS Archives.

“Contrary to the opinions held by some,” Joseph complained, “AEC is limited in the funds it can spend for research.” The oceanographers had not spent much time asking the AEC for its expertise, but they had spent a disproportionately high amount of time gauging the views of the public. The oceanographers were making their own conclusions about what the public could or could not handle, while clamoring for more research money. What did they mean when they used terms like “unacceptable levels”? This was not a scientific viewpoint, Joseph held. “There will always be ‘unacceptable’ levels of radioactive substances to some people.”²⁹ In his view, the oceanographers were pandering to public perceptions to augment their own authority by second-guessing experts who had been studying these issues for years.

The sense of outrage within the AEC was perhaps best captured by a comparison, used by Joseph himself, to racial integration. After World War II, President Harry Truman had ordered the armed forces to integrate their units, and in 1954, the U.S. Supreme Court ruled that racial segregation in public schools was unconstitutional. But there was widespread, often violent, resistance to government-mandated integration. Surely this was a clear case, Joseph argued, of experts needing to stay their course and do what was right, rather than accommodating public opinion. The widespread fear and visceral opposition to racial integration had to be overcome for the common good. The same was true of radioactive waste. Joseph challenged the oceanographers to resist equating majority views with right ones, and more importantly, to avoid appealing to the emotions of laypersons. Issues leading to feelings of “‘[r]epugnance or apprehension’ like race integration problems will probably be with us for a long time,” Joseph argued. “Is it proper for a scientific community to sway in its scientific judgment because these states of mind ‘might cause’ rejection?” The only way to quiet people’s fears was to inform and to educate, not to finesse the findings and present them according to what the public might find palatable. Joseph’s allusion to racial conflict helps to highlight AEC officials’ indignation at oceanographers who not only second-guessed their scientific decisions but also did so by exploiting negative public attitudes.³⁰

AN ATOMIC TWIST: INTERNATIONAL SCIENCE AND THE MONACO CONFERENCE

Joseph was right that Isaacs’s report would rattle the UK Atomic Energy Authority (AEA), which had worked hard over the years to convince other British government offices to authorize ocean dumping.³¹ Although the report was not officially published until 1962, largely because of repeated draft criticisms by the AEC, its conclusions were known to oceanographers in 1959 and would inform the Monaco conference. When finally released, the report would indicate that packaged waste should only be dumped into very deep water, on the order of 1,200 fathoms.³² If accepted, the British would have to abandon their most convenient dumping ground, the Hurd Deep (in the English Channel). AEA health physicist H. J. Dunster wrote to Roger Revelle, Isaacs’s boss at the Scripps Institution of Oceanography, that the report ignored the physical

²⁹ Ibid.

³⁰ Ibid.

³¹ The “authorization” process in Britain is discussed, along with other pertinent waste disposal issues, in Frans Berkhout, *Radioactive Waste: Politics and Technology* (London, 1991).

³² *Disposal of Low-Level Radioactive Waste into Pacific Coastal Waters* (cit. n. 2).

and chemical properties of the ocean—the power of dilution—in favor of a biological approach. This led to some pretty restrictive recommendations, ones the British were not prepared to accept.³³

British atomic energy officials shared the opinion of their American counterparts that leading scientists were exploiting public opinion to bolster their own positions and to ask for money. They expected questions of uncertainty to arise at the IAEA's international scientific conference, held in November 1959 in Monaco, and they saw the main international problem as one involving Western scientists, not cold war diplomacy. Although the Soviet Union's increasingly shrill outcries against ocean disposal loomed as a sticky political issue, the AEA was far more concerned about the effects of an international group of oceanographers entering into atomic matters.³⁴ AEA officials assumed an authoritative stance to ward off any impression that a scientific negotiation was taking place between them and nongovernmental scientists. Two of the British representatives, health physicists H. J. Dunster and A. H. K. Slater, agreed that their main object would be "to give oceanographers and geologists an idea of what was involved in waste disposal problems" and to discuss the general difficulties, "but not their detailed solution." In other words, the AEA was to instruct the oceanographers, not vice versa. They saw the nongovernmental scientists as special interests, and it would be crucial "to make sure that these other interests did not seek to divert money from atomic energy projects for their own particular problems." The British delegates to Monaco were thoroughly warned to beware of oceanographers and geologists who wanted to give their research "an atomic twist merely in order to divert funds to them for their purposes."³⁵ Dunster, the head of the delegation, belittled the "marked tendency" of oceanographers to "batten on to waste disposal" as a way to obtain funds, without any genuine interest in solving the waste disposal problem.³⁶

With such attitudes in mind, the absence of an oceanographer on the British delegation to this scientific conference should come as no surprise. AEA scientists and officials went to the conference to defend their policies, and the last thing they wanted was an elaborate research program (for which they would have to pay) that might question those policies. Instead, the AEA sent people knowledgeable about disposal practices near the coast and the deep sea, people whose primary purpose would be to speak about the "evidence that these are non-hazardous."³⁷ Still, in the interest of a balanced delegation, Dunster suggested asking someone from Britain's National Institute of Oceanography to come to Monaco, too. But the AEA offered no travel funds, and the institute politely declined.³⁸

Few oceanographers saw the Monaco conference in quite the same way the British AEA did. They were there not to be instructed but to discuss the science and, in doing so, to help the IAEA develop international regulations. The IAEA's director-general,

³³ H. J. Dunster to Roger Revelle, July 17, 1961, AB 54/16, United Kingdom National Archives, Kew, U.K. (hereafter cited as British National Archives).

³⁴ For more detailed discussion of the Soviet Union's opposition to nuclear waste disposal at sea, see Jacob Darwin Hamblin, "Environmental Diplomacy in the Cold War: The Disposal of Radioactive Waste at Sea during the 1960s," *International History Review* 24 (2002): 348–75.

³⁵ A. H. K. Slater, Note for Record, June 5, 1959, AB 16/3000, British National Archives.

³⁶ H. J. Dunster to J. M. Hartog, "International Agency Conference on Disposal of Nuclear Waste," April 20, 1959, AB 16/3000, British National Archives.

³⁷ W. G. Marley to J. F. Jackson, "International Atomic Energy Conference on Disposal of Radioactive Wastes," April 27, 1959, AB 16/3000, British National Archives.

³⁸ Dunster to Hartog, "International Agency Conference on Disposal of Nuclear Waste" (cit. n. 36).

Sterling Cole, had written that the conference was to be a discussion between atomic energy officials and oceanographers and geologists. In his letter to the British Foreign Office (and other nations' diplomatic offices), Cole explicitly suggested that the oceanographers and geologists might contribute to the solution of the waste disposal problem.³⁹ When they tried to do so, atomic energy officials resisted, exacerbating divisions that were more institutional and disciplinary than national. As one British official later chastised his own delegation's attitude, it was likely that most countries saw the Monaco conference as a step toward consensus about standards and procedures, and that the representatives of the AEA should not have been so indifferent to what others had to say.⁴⁰

The Monaco conference turned out to be as much a failure for atomic energy officials as it was a successful meeting of minds for oceanographers. Sir John Cockcroft, director of the AEA's research establishment at Harwell, openly declared it a victory for the exchange of ideas but privately lamented that the result was much sharper distinctions between positions.⁴¹ Two separate camps had emerged, the oceanographers and the atomic energy officials, and each had arrived at its own consensus. For example, French and Italian oceanographers believed that there was not sufficient knowledge of oceanographic conditions to justify dumping, especially not in nearby shallow seas such as the Mediterranean. By contrast, the representatives of the atomic energy establishments of three major dumping powers (the United States, Britain, and France) found common ground in their view that they already knew enough to make conservative estimates of what could be dumped and could make such estimates about any part of the sea. The leader of the British delegation, Dunster, dismissed the oceanographers' view as being "based more on prejudice than knowledge."⁴² As Cockcroft acknowledged, few skeptics from other countries were convinced by the atomic energy officials' position, largely because of the influence of the oceanographers.⁴³

The British saw Monaco as a failure because it publicly raised more questions about the validity of radioactive waste than it resolved, and it drew attention to the oceanographers' view that more study was needed. The *Sunday Times* summed it up nicely with a headline: "All at Sea on Atomic Waste."⁴⁴ The conference not only opened British practices to scrutiny but also left wide avenues for scientists to ask for more money and to assert a role in decision-making. British officials felt they had been outmaneuvered by oceanographers on the diplomatic front. In the aftermath of the meeting, one disappointed Ministry of Science official predicted that the discharge of waste into the sea was destined to become a "hobby-horse for the mischievous, the ignorant and the timid alike."⁴⁵ Another wrote that in the future, conferences on technical matters should be recognized as having wide political repercussions. As such, the government ought to ensure that the delegates "had a sufficiently high level of political competence."⁴⁶ And it ought to ensure that an oceanographer of international standing was

³⁹ Sterling Cole to Secretary of State for Foreign Affairs, Foreign Office, March 24, 1959, AB 16/3000, British National Archives.

⁴⁰ P. W. Ridley to F. J. Ward, Aug. 28, 1959, AB 16/3000, British National Archives.

⁴¹ "Note by Sir John Cockcroft," Dec. 7, 1959, AB 16/3001, British National Archives.

⁴² H. J. Dunster to John Cockcroft, Dec. 8, 1959, AB 16/3001, British National Archives.

⁴³ "Note by Sir John Cockcroft" (cit. n. 41).

⁴⁴ Stephen Coulter, "All at Sea on Atomic Waste," *Sunday Times*, Nov. 22, 1959, press clipping, AB 16/3001, British National Archives.

⁴⁵ P. W. Ridley to H. J. Dunster, Dec. 9, 1959, AB 16/3001, British National Archives.

⁴⁶ A. H. K. Slater to A. S. McLean, Jan. 15, 1960, AB 16/3001, British National Archives.

included, if only for show, to beef up the scientific credibility of the delegation—it was probably worth the cost of an airline ticket and hotel.⁴⁷ The message was clear: the AEA alone did not carry sufficient political or scientific authority, certainly not beyond Britain's shores.

MER FERMÉE! THE MEDITERRANEAN DEBACLE

By this time, France also had devoted major resources and political commitment to becoming a nuclear nation.⁴⁸ Like its American and British counterparts, the French Commissariat à l'Énergie Atomique (CEA) knew of the difficulties associated with nuclear safety and saw radioactive waste as a potential political problem.⁴⁹ The commissariat envisioned two possible solutions: land burial in "radioactive cemeteries" in the environs of its reprocessing plant in Marcoule, or sea disposal. The former's main drawback would be the disquietude of neighboring populations. CEA officials hoped that sea disposal would help them avoid public outcry. Thus in May 1960, the CEA decided to plan an experimental dump of about 2,000 tons of liquid and solid waste—contaminated work clothes, with assortments of plastic, wood, metal, glass, and other materials. These would be packed into 200-liter drums and dumped into the Mediterranean, at a site between the towns of Antibes (near Nice) and Calvi (in Corsica), in water about 2,500 meters deep, fifty miles from the coast of France and sixty miles from the coast of Italy.⁵⁰

The CEA's official description of the plan observed that there were no currents at the sea's surface in the specified region. "One could hope," it added, "that the currents would be equally nonexistent at the bottom." Some measurements had been taken in 1959 that indicated that such might be the case. Thus the site seemed ideal: it was in relatively deep water, away from the coast, with no discernable current, and not near known fishing waters. There would be no notable risks, the CEA stated; even if all of the drums burst, which was unlikely, the surrounding water would dilute the material so much that the danger to human health would be "completely negligible."⁵¹

French newspapers picked up the story in October 1960, and the negative response from oceanographers was immediate. Jean Furnestin, director of the Institut Scientifique et Technique des Pêches Maritimes, pointed out that all of the physical oceanographers and biologists at the recent IAEA meeting in Monaco, without exception, had underlined the formidable dangers that confronted humanity from ocean dumping of radioactive waste. No one had been able to demonstrate that there were in fact "dead zones" in the ocean. The Soviet work aboard the *Vityaz* during the IGY,

⁴⁷ H. J. Dunster to A. H. K. Slater, Dec. 4, 1959, AB 16/3001, British National Archives.

⁴⁸ On the importance of nuclear power in French politics and culture, see Gabrielle Hecht, *The Radiance of France: Nuclear Power and National Identity after World War II* (Cambridge, Mass., 1988). For a French insider's view on the political and diplomatic issues related to nuclear programs, see Bertrand Goldschmidt, *Le Complexe atomique* (Paris, 1980). The origins of the CEA are discussed in Spencer R. Weart, *Scientists in Power* (Cambridge, Mass., 1979).

⁴⁹ On the history of nuclear safety in France, see M. Cyrille Foasso, "Histoire de la Sûreté de l'Énergie Nucléaire Civile en France, 1945–2000" (Ph.D. diss., Univ. Lumière, Lyon II, 2003).

⁵⁰ Most of the elements would have been Ce-144 and Pr-144 (about 350 curies), Sr-90 (about 40 curies), and Pu (about 14 curies). "Projet de Rejet en Mer en Méditerranée de Déchets Radioactifs," May 12, 1960, Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), Archives, Commissariat à l'Énergie Atomique, Fontenoy aux Roses, France (hereafter cited as CEA Archives).

⁵¹ *Ibid.*

Furnestin pointed out, had proven that even the deepest Pacific waters moved to the surface much faster than previously believed. In the Mediterranean site, there were no instruments sufficiently sensitive to tell whether there were currents at that depth or not. Moreover, there was plenty of evidence to suggest that such currents might exist on a seasonal basis, and that the region was unstable. Besides, biologists were unanimous in pointing out the perils of radioactive concentration in deep flora and fauna that could be passed to other creatures at shallower depths. Furnestin argued that approval should not be given without first consulting oceanographers and fisheries specialists.⁵²

Back in Paris, oceanographers at the Centre de Recherches et d'Études Océanographiques also criticized the CEA's action because the commissariat had planned it without any consultation. Vsevolod Romanovsky, the director, learned of the plans from the newspapers and was appalled to discover that the CEA had suggested to the press that oceanographers—including Romanovsky specifically—approved of the idea. Romanovsky had conducted the 1959 studies cited by the CEA, but he believed they had been inconclusive, and some were still ongoing. True, he had recommended an experimental dumping, but he had in mind something on the order of 10 drums. The CEA was planning to dump 6,500.⁵³

Closer to the (proposed) action, scientists at the Institut Océanographique in Monaco seethed with anger at the CEA. In a widely circulated letter, the institute's director, Louis Fage, wrote that he had been stupefied to read the news that the CEA was planning to dump 2,000 tons of waste into the Mediterranean. He described the Mediterranean in two words, exclaimed on the page: *mer fermée* (closed sea)! Aside from directing the institute, Fage also was the president of the Committee for the Exploitation of the Sea, a quasi-international body consisting of scientists from France and Monaco. In that capacity, he registered strong protest against the CEA's decision, giving several rebuttals to its scientific assumptions.⁵⁴

In reading the protests of Furnestin, Romanovsky, Fage, and others, one is left with the indelible impression that if their rage came partly from the scientific foolishness of the dumping experiment, it came also from the fact that they had been left out of the decision-making process. They were reading about the experiments from the newspapers like everyone else. Fage wrote that he could not vouch for the veracity of the newspapers' claims, since no specialists in *marine biology* (Fage underlined this also in his letter) seemed to have been consulted. These scientists, not atomic energy officials, had already established the crucial questions on the issue, namely the ecological connections between marine life and human beings. Rather than look purely at circulation, Fage insisted, one should look at plankton, "for they are at the base of the chain in which we occupy the summit." He quoted the findings of American oceanographer Bostwick Ketchum, who had shown that the concentration of radioactive substances in plankton could be up to 500 times that of sea water. This was a living environment (*milieu vivant*) for which the introduction of radioactive waste

⁵² Jean Furnestin to Secrétaire Général de la Marine Marchande, Oct. 6, 1960, Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), CEA Archives.

⁵³ V. Romanovsky to Haut Commissaire, CEA, Oct. 8, 1960, Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), CEA Archives.

⁵⁴ Louis Fage to Le Délégué Général à la Recherche Scientifique et Technique, Oct. 13, 1960, Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), CEA Archives.

could be destructive. Fage insisted that it would have been better to hear the marine biologists prior to the decision.⁵⁵

The most formidable opponent was Jacques-Yves Cousteau, a member of Fage's committee and director of the Musée Océanographique de Monaco. According to Fage and Cousteau, undersea photographs had revealed that the deep water in the dumping area did indeed move. With underwater breathing gear, and with manned and unmanned submersibles, Cousteau and his colleagues took photographs of the depths and published them internationally. In the years ahead, Cousteau's books and films about undersea life would make him an international household name. By 1960, he already had established his fame with his book *Le Monde du Silence*, translated into several languages in the 1950s, and a 1955 documentary film of the same name that won the Palme d'Or at the 1956 Cannes Film Festival.⁵⁶

On the pages of French newspapers, Cousteau blasted the CEA. He proclaimed that scientists had not been consulted. He made it clear that neither the Musée Océanographique nor his ships were involved in any way. He accused the CEA of having acted behind the backs of scientists after the Monaco conference, when it had become clear that profound differences of judgment existed between atomic scientists (*atomistes*) and an international group of oceanographers. The latter, he claimed, had categorically condemned sea disposal, on the grounds that sufficient studies had not yet been made. He then included a list of the important scientific bodies that had not been consulted, such as the International Commission for the Scientific Exploration of the Mediterranean, the (French) Academy of Sciences, and the Centre National de la Recherche Scientifique (CNRS). It was, he claimed, a bit like announcing that tomorrow morning there would be an experiment to dispose of allegedly inoffensive nuclear waste at the Place de l'Opéra, without first consulting with the mayor of Paris.⁵⁷ With such complaints, Cousteau appealed to local officials (who also had not been consulted) and implied that oceanographers, not atomic energy officials, were the true custodians of the seas and the protectors of local interest.

Meanwhile, mayors and city councils of towns all along the French Riviera sent protests to the CEA's high commissioner, Francis Perrin. Of course, the CEA sent reassuring replies to them, pointing out that the experiment rested on the firmest scientific grounds. However, the mayor of Nice, Jean Médecin, sent back a telegram that cut right to the heart of the issue, underscoring the power of international scientific consensus. He baldly stated that whatever the CEA's scientific competence might be, it would certainly not prevail over the numerous French and foreign scientists of contrary opinion. Whoever marked this telegram (in the CEA's archives), Perrin or a subordinate, underlined that statement in red and penciled two exclamation marks in the margin. The marks must have signified an array of frustrations. If Nice was any indication, clearly the battle for scientific authority was being lost to the oceanographers. The people of Nice, as Médecin said, stood ready to oppose the CEA and to stop the dumping "by all possible means." Other nearby towns voiced similar sentiments. One

⁵⁵ Ibid.

⁵⁶ A brief biography of Cousteau is Axel Madsen, *Cousteau: An Unauthorized Biography* (New York, 1986).

⁵⁷ The CEA's records include various newspaper clippings reprinting Cousteau's remarks. Quoted here is an unpaginated excerpt from *Le Patriote*, a newspaper in Nice, dated Oct. 11, 1960. Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), CEA Archives.

anonymous letter writer suggested to Perrin that if the waste was so inoffensive, perhaps he should put it in his own breakfast.⁵⁸

The CEA's plans became worldwide news. Prince Rainier of Monaco urged the government of Charles de Gaulle to put off the experiment until scientists knew more about the dangers. The leading French newspaper, *Le Monde*, quoted Cousteau's statements that the CEA did not understand anything about the problems of the sea.⁵⁹ Cousteau tried to make it an international issue, saying that it involved all of the countries bordering the Mediterranean, not just France. The *New York Times* called Cousteau the "unofficial leader of the anti-dumping campaign." In the face of the publicity assault, less than a week after making the announcement of the experiment, the CEA backed down and decided to put the project off for a while.⁶⁰ In the weeks that followed, Cousteau gave more interviews, stressing that the issue was really an international one, one that could be resolved only by oceanographers. It might end up as a choice for all humanity, he said, between using the sea as a waste dump or preserving the riches within it.⁶¹

For its problems regarding ocean dumping, the CEA did not blame the press, or the general public's irrationality, or local mayors. It laid the blame entirely at the feet of oceanographers, particularly Cousteau. In an internal note, CEA officials dismissed the idea that the press could have mounted such an offensive or that the population could have spontaneously reacted so negatively. Instead, the escalation of the issue's importance "is a direct function of the declarations, acts, and positions taken by M. J.-Y. Cousteau, director of the Musée Océanographique du Monaco." Quoting American newspapers, they lamented the fact that Cousteau suddenly seemed to be internationally recognized as the leading figure against ocean dumping. The department outlined specifically the steps Cousteau had taken to undermine them. He began to critique the experiment "violently"; he then sent telegrams to all the mayors in the area; he attended all the important local meetings to discuss the issue; he attacked Perrin in the press; he acted as a "scientific expert" at a major regional meeting; he then acted indirectly at other local political meetings to oppose the project. In addition, he had given "innumerable interviews" to reporters for newspapers, radio, and television. For the CEA, the Cousteau nightmare brought into question their ability to speak for the sea. Cousteau focused on the CEA's incompetence, calling it childish; its scientists were incapable of understanding the sea, he claimed, making mathematical calculations that would not even measure up to the standards of first-year oceanography students.⁶²

From the CEA's point of view, the task ahead was not to change plans to dump radioactive waste but to repair relationships with oceanographers by ceding to them

⁵⁸ The letters of protest from towns on the coast are all collected in the same folder, near Jean Médecin to Francis Perrin, Oct. 12, 1960, Folder: Effluents/Protestations, Box F2/23-18 80-1217 (HC), CEA Archives.

⁵⁹ The statements about Rainier and Cousteau in *Le Monde* are from clippings saved by the CEA dated Oct. 11, 1960. Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), CEA Archives.

⁶⁰ "France to Delay Atomic Disposal," *New York Times*, Oct. 13, 1960, 20.

⁶¹ Extract from interview of Cousteau by Pierre Ichac, Oct. 26, 1960, Fonds M. A. Gauvet, Folder "Déchets dans la Mer," Box 156/256, CEA Archives.

⁶² "Éléments d'Appréciation de l'Importance de l'Action de M. J.-Y. Cousteau dans la Campagne d'Opposition au Projet de Rejet Expérimental en Méditerranée," Department of External Relations, CEA, Nov. 1960, Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), CEA Archives.

some scientific authority and possible financial support. Perrin left for a three-week visit to the United States and promised Fage that they would meet upon his return.⁶³ In the meantime, Henri Baïssas (of the Department of External Affairs) asked leading French geophysicist Jean Coulomb to help facilitate a rapprochement with oceanographers. Coulomb felt that it would be easy to bring physical oceanographers into the CEA's camp but more difficult with biological oceanographers. He tried to arrange a meeting with Cousteau, but was ignored. A leading CEA physicist, Bertrand Goldschmidt, did finally meet with Cousteau and informally promised to support more scientific work under the IAEA. Baïssas and a colleague met with Furnestin and had an informal conversation about the importance of supporting research. Baïssas followed up with a formal letter stating that the CEA would not proceed with a dump without proper studies by, guidance from, and agreement with, oceanographers.⁶⁴

Perrin met with Fage upon his return from the United States, taking other CEA officials with him. According to a CEA internal memorandum, the meeting was very pleasant. In fact, Fage declared himself in support of the commissariat's activities, being convinced that they were harmless. In return, the CEA promised to lower the number of drums dramatically to keep it in line with biologists' views.⁶⁵ Baïssas went with a colleague to Monaco to reenlist the scientists there and soon reported his "mission to Monaco" as a success. His strategy was to admit candidly to the oceanographers that the CEA, despite being convinced that its plans were harmless, had committed the error of not sufficiently consulting the scientific community. He promised much closer collaboration in the future, declaring the Mediterranean as a place for experiments (on the order of ten to twenty tons), not for massive dumping. As a result, Furnestin "incontestably" wanted to help them, as did other scientists present. Even Cousteau, cornered by Baïssas during a pre-lunch cocktail, privately assented to the CEA's plans.⁶⁶ In the coming months, Baïssas worked hard to cajole Cousteau and others, careful not to ruffle any scientific feathers, to create an experiment that helped the CEA but also drew on outside scientists' expertise. Such conciliatory maneuvers were necessary, Baïssas wrote, to rupture "the mystical charm that paralyzes us."⁶⁷

ATOMIC ESTABLISHMENTS FIND COMMON GROUND

One of the suggestions at the Monaco conference was the creation of a permanent international laboratory to study ocean disposal of radioactive waste. Publicly, Sir John Cockcroft grandly stated to the IAEA that Britain supported future scientific work at Monaco. But in reality the British did so only grudgingly. Leading health physicist H. J. Dunster acknowledged that more research could be done, "if only to demonstrate that current practice by Great Britain in this connection is safe." The value of international research, he wrote to a colleague, was principally to allay the fears of people swayed more by political arguments than scientific ones. At the national level, they

⁶³ Francis Perrin to Louis Fage, Oct. 14, 1960, Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), CEA Archives.

⁶⁴ "Déchets Radioactifs," no author, Nov. 15, 1960; Henri Baïssas to Jean Furnestin, n.d., Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), CEA Archives.

⁶⁵ "Déchets Radioactifs" (cit. n. 64).

⁶⁶ Henri Baïssas, "Compte Rendu de Ma Mission à Monaco," Dec. 15, 1960, Folder "Effluents/Protestations," Box F2/23-18 80-1217 (HC), CEA Archives.

⁶⁷ Henri Baïssas, note, Feb. 6, 1961, Folder "Effluents/Rejets en Méditerranée," Box F2/23-18 80-1217 (HC), CEA Archives.

should start to monitor their principal dumping grounds, such as the Hurd Deep in the English Channel, not because they expected to find significant levels of radioactivity but because they did not wish to face the criticism that they had no data. From the AEA's point of view, such environmental surveys were superfluous, costly, and purely political.⁶⁸

After the Monaco conference, American, British, and French atomic energy establishments tried to find common ground. To ensure that they could do so, the AEA and the AEC helped each other by sharing copies of their national delegations' secret instruction briefs for meetings at the IAEA. The Americans discovered that the British bristled at the thought of more mushrooming scientific projects, but for political reasons they did not want to be seen as the only nation to oppose the new laboratory. Cockcroft's instructions were to "do what he can to curb the [International Atomic Energy] Agency's natural proclivities in this matter" without blatantly taking too strong a stand against international scientific studies. One official urged the British delegation to show a "conspicuous lack of enthusiasm," but admitted that it had become politically impossible not to support such studies.⁶⁹

The British learned through this cooperation that the United States, by contrast, strongly supported the international laboratory. According to the U.S. delegation briefing (shared with the British by physicist Isidor Rabi), its primary reason for doing so was to counter Soviet propaganda. The Soviet Union opposed dumping in principle, and the United States feared that the environmental effects of waste disposal would form the basis of a major propaganda campaign against the West. The Americans certainly were correct on this score, and the Soviets spent much of the 1960s reproaching the United States and the United Kingdom for poisoning the seas.⁷⁰ In 1960, however, the Americans hoped that their support for international scientific work could give more credibility to their policies, particularly if scientists could identify problems and be seen to be researching them. The draft trading between the AEC and the AEA allowed officials to see that their apparent disagreement was more of a difference in tactics and immediate diplomatic necessity, rather than a genuine divergence of views. Neither side believed that a new international laboratory was necessary to solve real problems of waste disposal.⁷¹

In fact, the AEA and AEC had done more than trade briefings. For the AEA, physicist Sir William Penney and two colleagues went to the United States in October 1960 and met with General Alvin Luedecke, the general manager of the AEC, along with several of his staff. They appeared to have agreed that an IAEA laboratory in Monaco, with a mandate to study radioactive waste, might become a source of scientific criticisms, not solutions. But Luedecke pointed out that the problem was manageable, because the laboratory would be staffed with plenty of American scientists whose paychecks would come from the AEC. They also agreed that it was a very good idea for

⁶⁸ H. J. Dunster to F. A. Vick, "Radioactive Waste Disposal at Sea," July 27, 1960, AB 6/2087, British National Archives.

⁶⁹ D. E. H. Peirson to John Cockcroft, Nov. 4, 1960, AB 16/3002, British National Archives. Quotation taken from I. G. K. Williams to J. C. Walker, "Collaboration between the IAEA and the Government of Monaco," Nov. 7, 1960, AB 16/3585, British National Archives.

⁷⁰ For more on the diplomatic aspects of radioactive waste in the 1960s, see Hamblin, "Environmental Diplomacy in the Cold War" (cit. n. 34).

⁷¹ The brief for the United States delegation is titled "Scientific Collaboration with the Government of Monaco on Research on Disposal of Radioactive Waste into the Sea," n.d., AB 16/3002, British National Archives.

the two establishments to continue collaborating in this way, prior to meeting with scientists and certainly prior to any international meeting. They felt that they needed to see if there was any way to do the same with the French, to understand fully their position before coming to the IAEA. Although the French had not been close partners on atomic energy matters in the past, the Mediterranean fiasco gave them, the Americans, and the British reason to believe that the CEA was confronting similar issues and might want to collaborate.⁷²

The French were more than willing to compare notes on how to deal with troublesome oceanographers. Francis Perrin met with American atomic energy colleagues in November, after being forced by public opinion to shelve the Mediterranean experiment. By the next month, the French were collaborating directly with the British. The French and British atomic commissions met to deal specifically with their mutual public relations problems. It turned out to be a productive meeting of minds. They felt they had to do something to establish common practices that they could defend against critics, even scientists. The British gave talks on subjects ranging from the technical details of disposal to relations with local authorities. In fact, each side specified two people to liaise directly with their foreign opposite on public relations and technical issues in the future, to avoid any semblance of disagreement that could be exploited in international meetings.⁷³

The existing notes of these meetings between the CEA and the AEA, held in the British National Archives, reveal an atmosphere of mutual understanding, not of diplomatic negotiation. Their common problem was public relations, and their common headache was the oceanographic community. Geopolitical difficulties seemed nearly trivial by comparison. In the course of one meeting, for example, the British found that their French counterparts felt the same as they did about the Soviets—that they discharged quite a bit into rivers and oceans, despite their public pronouncements, and were not to be taken seriously. More important were the oceanographers who (they believed) made mountains out of molehills to serve themselves. Cousteau, French public relations official Jean Renou told his British counterparts, might be well known for his literary work, but he was not much of an oceanographer. What was needed, he and others agreed, was a push for education about atomic energy so that officials and the general public would not be so easily swayed by prejudiced scientists such as Cousteau.⁷⁴

The solidarity among atomic energy establishments would continue into the 1960s, particularly between the British and the French, who soon began to coordinate their dumping operations with each other and with other European countries.⁷⁵ But the antagonism with oceanographers at the international level also would continue. Oceanographers' scientific claims had little direct effect on dumping practices, but their claims about the dearth of knowledge on the effects of radioactivity in the oceans exerted enormous political pressure, contributing to a series of international agreements

⁷² "Record of Discussion of Anglo-US Collaboration on Waste Disposal Problems Prior to November Meeting of IAEA Committee," Oct. 14, 1960, AB 16/3002, British National Archives.

⁷³ Public relations liaison was to be handled by Jean Renou (France) and Eric Underwood (the United Kingdom), while technical aspects would be handled by André Gauvenet (France) and Ian Williams (the United Kingdom). See Bertrand Goldschmidt to D. E. H. Peirson, Dec. 20, 1960, AB 16/3588, British National Archives.

⁷⁴ "Notes of Talks with CEA 14th–15th December: Public Relations Aspects of Waste Disposal," n.d., AB 16/3588, British National Archives.

⁷⁵ See Hamblin, "Environmental Diplomacy in the Cold War" (cit. n. 34).

beginning in the 1970s that limited the disposal of radioactive waste.⁷⁶ For the time being, the victory went to the oceanographers, who won both scientific authority and the promise of patronage. All three establishments (U.S., British, French) publicly claimed that they needed to support more research in oceanography, to ensure that their practices were indeed safe. Moreover, they agreed to the creation of a permanent laboratory financed by national governments through the International Atomic Energy Agency. When it was founded in 1961, the Monaco laboratory looked exactly as oceanographers had hoped and as the atomic energy officials cynically had expected. Its first director, oceanographer Ilmo Hela, was the former director of Finland's Institute of Marine Research and definitely an academic scientist, and there were close institutional ties to Cousteau's Musée Océanographique. According to an IAEA press release, the laboratory's first goal was to understand the movement of water and marine organisms and the deposition of organic and inorganic matter, a pretty broad agenda that made no specific reference to radioactive waste. Second was the study of the distribution of radioactive materials in organisms, and last of all was the study of the effects of radioactive materials on marine ecology.⁷⁷ If the AEC, AEA, and CEA saw oceanographers as interested in power and patronage rather than solving the waste disposal problem, the establishment of the Monaco laboratory only strengthened this view.

CONCLUSION

Environmental controversy is familiar territory when examining cases of contested authority. Given the breadth of uncertainty, even the most incorruptible and irreproachable of "nature's experts," as Stephen Bocking calls them, would walk on tenuous political ground because scientific authority is constantly questioned.⁷⁸ It may be that contested scientific authority is inextricably tied to democratic values. Sociologist Dorothy Nelkin wrote on such themes during much of her academic career; when she published *Technological Decisions and Democracy* in 1978, claiming that political struggles are inherent to technological decisions,⁷⁹ longtime British science policy advisor Sir Solly Zuckerman agreed, recalling the story of British nuclear power. One consequence of democracy, he wrote, was that anything claiming to be scientific would appeal to the segment of the population wanting to believe it, resulting in political pressure.⁸⁰ On the national level, individuals or institutions had to play the role of experts in mediating such political questions; it was not an easy job, nor was it an easy role to assert, because scientific authority was fiercely contested terrain.⁸¹

⁷⁶ These agreements are part of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, the initial version of which was signed in 1972. Details are available at <http://www.londonconvention.org>.

⁷⁷ International Atomic Energy Agency, press release, "Finnish Scientist to Direct Major Research Program in Monaco," June 8, 1961, AB 16/3585, British National Archives.

⁷⁸ Bocking, *Nature's Experts* (cit. n. 10).

⁷⁹ Dorothy Nelkin, *Technological Decisions and Democracy* (London, 1978).

⁸⁰ Lord Zuckerman, "Science Advisers and Scientific Advisers," *Proceedings of the American Philosophical Society* 124 (1980): 241–55.

⁸¹ On science advising, see *ibid.*; Gregg Herken, *Cardinal Choices: Presidential Science Advising from the Atomic Bomb to SDI* (Stanford, 2000); Sheila Jasanoff, *The Fifth Branch: Science Advisers as Policymakers* (Cambridge, Mass., 1990); Zuoyue Wang, "Responding to *Silent Spring*: Scientists, Popular Science Communication, and Environmental Policy in the Kennedy Years," *Science Communication* 19 (1997): 141–63.

Furthermore, the same battles for authority could replay on the international scale with entirely different results, especially if one side could lay claim to international consensus.

Were oceanographers the robber barons of the sea that many atomic energy officials thought they were, capitalizing on international opinion to assert their authority and sap money from reluctant patrons? Or had they become the new “hallowed lords,” taking on responsibility for high-stakes policy decisions of international importance that previously had been the province of atomic energy establishments? We cannot ignore the fact that oceanographers did succeed in gaining money from a variety of patrons during the cold war, from military, atomic energy, foreign policy, and fisheries sources, to name a few, and that international consensus among scientists strengthened their ability to assert power at home.⁸² As this essay has shown, oceanographers’ scientific claims often were interpreted as opportunistic appeals for political influence and research money. Such efforts to secure patronage were not always welcome, particularly when they implied neglect or ignorance on the part of those scientists and officials already dealing with the related problems.

When taking part in international affairs, oceanographers did not necessarily serve the interests of the state. Quite to the contrary, by contesting scientific authority about the oceans, oceanographers became national liabilities for the state interests of the United States, Britain, and France. Their activities provoked no small amount of antipathy from government scientists and officials, who saw those activities as veiled grasps for money. The undeniable existence of such attitudes turns the conventional question of patronage upside down, provoking questions about the direction of pressure. Instead of generous patrons hampering science through undue influence, scientists in the pursuit of funding wrought havoc on existing policies by insisting, publicly, upon the need for more research. With international agreements resting on their advice, oceanographers wielded considerable power. As a remarkable response to the apparent international consensus among oceanographers, atomic energy establishments forged their own bonds of collaboration across borders, to help each other deal with the potential diplomatic and public relations problems brought on—in their view—by oceanographers’ opportunism. Such perspectives reinforce the need to look carefully at the importance of international affairs in understanding some of the major questions in the historiography of science. Certainly they highlight the reciprocal effects of patronage, at national and international levels, during the postwar era. The siege mentality within atomic energy establishments is telling evidence that the pressures sometimes went in the opposite direction than we might expect and that the historiographic question that often consumes us—the effects of patrons’ priorities upon the practice of science—can rob scientists of much of the power and influence they undoubtedly possessed.

⁸² These efforts are discussed in greater detail in Hamblin, *Oceanographers and the Cold War* (cit. n. 8).