megawatts to 60 megawatts. As for the restart, however, no one disagrees that the EIS was to be completed before the reactor can be brought back on line. Energy Secretary Frederico Peña maintained until December that he would decide this month whether or not to restart the reactor after the EIS is complete. His delay, our sources said and continue to say, has more to do with the November elections than with the EIS completion.

Andrew Lawler

■

Methylmercury Risks

Grace M. Egeland and John P. Middaugh (Policy Forum, 12 Dec., p. 1904) suggest that the benefits from essential nutrients in fish may counterbalance neurotoxicity caused by prenatal methylmercury exposure. Although this question deserves renewed attention, it should be noted that the risk balance is not static. While methylmercury toxicity is expected to follow a dose-response relationship, it is not clear whether an increased benefit can be derived during pregnancy from eating seafood beyond a certain minimal level (*1*). Mercury toxicity may therefore outweigh the benefits, especially when consumption of contaminated seafood is high. We have studied 900 children prenatally exposed to methylmercury (*2*). Although selenium averaged a 10-fold molar excess above mercury, selenium concentrations in cord blood did not confer protection against mercury-associated deficits in intellectual function. However, as mentioned by Egeland and Middaugh, the visual system seems not to have been affected by mercury toxicity in Faroese children (*2*), perhaps because of protective effects of essential fatty acids from seafood. Nonetheless, other brain functions of the children were not similarly protected (*2*).

Neurotoxicity caused by prenatal exposures is of special concern, because it is likely to be irreversible. Egeland and Middaugh quote only the beginning of a sentence from our paper (*2*), and the literature reference given (no. 27) appears to be incorrect. The quotation from our paper should have continued as follows: "regression coefficients suggest that a doubling in mercury exposure may cause a developmental delay of approximately 2 months for several functions."

Tertiary prevention should not stand alone. We strongly recommend other measures, whenever possible. Although the Policy Forum was published 1 week before the scheduled release of the U.S. Environmental Protection Agency's (EPA's) report on mercury (*3*), a draft of this report was mentioned in relation to the reference dose for mercury. We applaud EPA for this study (available at www.epa.gov/airlinks) and for identifying the most important potential effects of limiting the anthropogenic mercury releases to the environment. Mercury pollution from the United States and other countries causes increased exposures to this toxic metal, particularly in northern populations, like the Faroese. Egeland and Middaugh indicate their affiliation with the Alaska Department of Health and Social Services, but Alaskans would be ill advised if they abandoned their demand for safe food.

Pál Weihe
Medical Director, Faroese Hospital System, FR-100 Torshavn, Faroe Island
E-mail: palweihe@sleipnir.fo
Philippe Grandjean
Institute of Community Health, Odense University, DK-5000 Odense, Denmark
E-mail: p.grandjean@winsloew.ou.dk

References

1. S. F. Olsen, P. Grandjean, P. Weihe, T. Videro., *J. Epidemiol. Comm. Health* **47**, 436 (1993).
2. P. Grandjean *et al., Neurotox. Teratol.* **19**, 417 (1997).
3. *Mercury Study Report to Congress* (U.S. Environmental Protection Agency, Washington, DC, 1997).

We are writing in response to the Policy Forum by Egeland and Middaugh. We believe that the authors' critique of EPA's guidance for advisories for mercury contamination is based on erroneous assumptions and misinterpretations of the toxicological literature. For instance, it is not true that EPA developed the new reference dose (RfD) for mercury (Hg) "[i]n an effort to reduce industrial emissions of Hg," as stated by the authors. Rather, EPA's guidances are developed as part of a scientific assessment of the potential health impacts of mercury exposure.

The authors suggest that EPA has overestimated the risk of prolonged, low-level mercury exposure by basing its analysis on data from a 1971–72 mercury poisoning episode in Iraq. It should be noted, however, that the same data are used to support the 1990 guidance issued by the World Health Organization (*1*) in its 1995 (not 1996) guidance (*2*). EPA went a step further, focusing on the effects of mercury on the developing fetus. The guidance is, therefore, meant to be a safe consumption level for all members of the population, including pregnant women, and not a threshold for toxicity for individuals.

EPA modeled the Iraqi data using a number of mathematical constructs. It derived a "benchmark dose" [lower bound on 10% effect level for all effects reported by Marsh *et al.* (*3*)] which is equal to 11 parts per million (ppm) of Hg in maternal hair. Uncertainty in the data and models were accounted for by the use of a 10-fold factor, which then allowed derivation of a safe level for the more heterogeneous U.S. population. Although EPA selected a single study as a basis for the RfD, the entire literature was reviewed. Similarly derived benchmark doses from other recent epidemiological studies, including two prospective studies carried out in the Faroe and Seychelles islands, are close to this value (11 to 17 ppm). A recent review of the animal toxicological data supports benchmark doses in this range as well. The independent EPA Science Advisory Board (SAB) reviewed the RfD, along with EPA's more comprehensive draft Report to Congress (*4*). In August 1997, the SAB urged use of this RfD as derived and supported by other human and aninial studies. They suggested that this estimate "should be retained until the ongoing Faroe and Seychelles Islands studies have progressed much further and have been subjected to the same scrutiny as has the Iraqi data," particularly with regard to application of statistical methods and the use of subtle indicators of impacts on neurodevelopment.

Fish advisories fulfill the public's right to

know which fish are contaminated and how to limit their exposure. Advisories identify areas where elevated or unsafe levels of pollutants have been detected in certain species or fish, and provide guidance on the species and/or size of fish to be consumed in limited quantities or to be avoided. EPA also advises that there are health benefits associated with fish consumption and does not recommend reducing overall consumption of fish. Using this information, anglers are able to take prudent steps to protect their health. There is no evidence that advisories informing about locally contaminated fish diminish the consumption of commercially caught fish.

Contamination of fish by methylmercury will continue to be a challenging issue for government at all levels. Fortunately, the health benefits of fish in the diet can be attained by buying commercially caught fish or fishing in safe waters. Ultimately, underlying environmental contamination problems must be addressed.

Lynn R. Goldman
Assistant Administrator,
Office of Prevention, Pesticides,
and Toxic Substances,
U.S. Environmental Protection Agency,
Washington, DC 20460, USA
E-mail:goldman.lynn@epamail.epa.gov
William H. Farland
Director,
National Center for Environmental
Assessment,
U.S. Environmental Protection Agency,
Washington, DC 20460, USA
E-mail: farland.william@epamiail.epa.gov

References

1. "Environmental Health Criteria 101: Methylmercury" (World Health Organization, Geneva, Switzerland, 1990).
2. Environmental Protection Agency, *Integrated Risk Information System (IRIS)—Revised RfD for Mercury* (National Center for Environmental Assessment, Washington, DC, 1997).
3. D. O. Marsh *et al., Arch. Neurol.* **44**,1017 (1987).
4. "Mercury study report to Congress: Characterization of human health and wildlife risk from anthropogenic mercury emissions in the United States" (Safety Advisory Review Draft EPA-452/R-96-00lf, Environmental Protection Agency, Washington, DC, 1996).

Response: Mercury is a regulatory challenge in that current-day policies need to be formulated not only to improve existing conditions but also to ensure a safe environment for future generations. Thus, we agree with the statement by Goldman and Farland that underlying environmental contamination problems must be addressed, and we support efforts in this regard. We also agree that most people are not at risk from eating fish. Fish provide many health benefits, local fish consumption advisories are often needed, and underlying problems of anthropogenic pollution have to be dealt with in the United States and globally.

Reference doses are an integral component in the establishment of environmental regulatory cleanup and emission standards, and it is prudent that conservative risk estimates be made in efforts to err on the side of safety in regulatory policies. However, we question the scientific merits of sole reliance on EPA's RfD in the development of fish consumption advisories. Attempts to eliminate the potential risks of low-level methylmercury exposures through overlying restrictive advisories could introduce other risks. The new EPA RfD, if uniformly applied, would result in advisories for many species of routinely consumed commercially caught fish. From a risk-management perspective, a broad multidisciplinary public health approach is needed to determine the extent to which the new RfD should be applied.

It is unfortunate that our Policy Forum calling for a broad public health approach in the risk-management process, a recommendation of the Presidential/Congressional Commission on Risk Assessment and Risk Management (*1*), is interpreted as abandoning the demand for a safe environment. We believe that most, if not all, public health officials would agree with policies that encourage fish consumption and stringent mercury emission standards.

We thank Weihe and Grandjean for correcting our reference error (*2*).

Grace M. Egeland
John P. Middaugh
Section of Epidemiology,
Division of Public Health,
Alaska Department of Health and
Social Services,
Anchorage, AK 99524–0249, USA
E-mail:johnm@health.state.ak.us

References

1. *Framework for Environmental Health Risk Management. Final Report,* vol. 1 (Presidential/Congressional Commission on Risk Assessment and Risk Management, Washington, DC, 1997).
2. P. Grandjean *et al., Neurotox. Teratol.* **19**, 417 (1997).

Letters to the Editors

Letters may be submitted by e-mail (at science_letters@aaas.org), fax (202-789-4669), or regular mail (Science, 1200 New York Avenue, NW, Washington, DC 20005, USA). Letters are not routinely acknowledged. Full addresses, signatures, and daytime phone numbers should be included. Letters should be brief (300 words or less) and may be edited for reasons of clarity or space. They may appear in print and/or on the World Wide Web. Letter writers are not consulted before publication.