Alar: The Numbers Game

The dispute over the cancer danger from Alar highlights just how uncertain risk assessment is

LAST WEEK New York and Los Angeles schools pulled apples from cafeteria lines. The reason: concern about exposure to cancer-causing pesticides. Two days later the International Apple Institute took out full-page ads in newspapers around the country touting the health benefits of apples.

Both actions are a direct response to a report by the Natural Resources Defense Council, released 2 weeks ago, alleging that pesticide residues in foods pose an intolerable risk to children and blasting the Environmental Protection Agency for ignoring the problem (*Science,* 10 March, p. 1280).

After a week spent reviewing the NRDC report, EPA came out swinging. Calling the study misleading, John Moore, EPA's acting deputy administrator, said last week that NRDC's risk estimates are too high and are based on poor data and inappropriate techniques.

What's lost in all the charges and countercharges is a sense of just how squishy the numbers are, on either side. Risk estimates are often taken as gospel when they really represent a best guess, built on myriad assumptions, some of which are invariably value laden.

Much of the controversy revolves around the pesticide daminozide, better known as Alar, which EPA and the environmental group have been battling over for years. Alar, a growth regulator, has been widely used on apples since the late 1960s to promote a uniform red color and prolong shelf life. It penetrates the apple skin and cannot be washed off. Since 1985 Alar use has dropped substantially.

NRDC calculates that some 4700 to 6000 preschool children, out of a population of 22 million, will eventually get cancer from exposure to Alar in just the first 6 years of life. That translates into a risk of 240 cancers in a population of 1 million. EPA calculates a risk to infants, from exposure for just 18 months, of 9 in 1 million, which is 25 times lower than the NRDC estimate.

Both groups agree the risk from either estimate is too high, though they say there is no reason to stop eating apples. EPA announced on 1 February that it will propose banning Alar in May, a process that could take 18 months.

Some of the difference in the two risk estimates—a factor of four—can be traced to the different exposure periods used: 18 months versus 6 years. The rest stems primarily from different assumptions about the potency of Alar as a carcinogen and about exposure.

■ **Potency factor.** The biggest difference between the two risk assessments, according to Moore, stems from the cancer potency factor, an estimate of the number of cancers likely to arise from a given dose. Moore accuses NRDC of using a cancer potency factor that has been rejected by scientific peer review. EPA, in fact, used this same potency factor for evaluating the pesticide and on those grounds proposed in 1985 to expedite cancellation of Alar. A scientific advisory panel to the agency concluded at that time that the potency data were "fundamentally flawed."

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NRDC, on the other hand, challenges EPA's new potency factor, which the agency derived from interim data from an ongoing 2-year toxicity study of Alar. The concern, explains Robin Whyatt of NRDC, is that just 1 year into the study only some of the effects will have shown up; thus, this potency factor is likely to underestimate the real risk.

Bill Jordan, policy chief in EPA's pesticides office, maintains that EPA has made statistical adjustments to take that into account. Nonetheless, he concedes that the new potency factor is far from definitive and is "likely to change when the final results are in. It could be lower or higher."

Both groups maintain that they used the best available data at the time.

■ **Exposure.** NRDC and EPA are also at odds over exposure to Alar. The difference comes from their estimates of how many apples kids eat. EPA used a 1977–78 food consumption survey of some 30,000 persons conducted by the U.S. Department of Agriculture (USDA). NRDC, on the other hand, used a 1985–86 USDA survey of just 2,000 persons. From 1977 to 1985, fruit consumption jumped 30%, according to USDA figures.

EPA discounts the 1985 data because the sample was small and the response rate—65%—was poor. NRDC, for its part, criticizes EPA for using outdated data when a new survey, albeit a small one, suggests that fruit consumption has changed. USDA's 1986–87 survey, from a much larger data base, will be out shortly and should settle the dispute.

"It sounds like a case where no one is right or wrong," says Paul Portney, director of the Center for Risk Management at Resources for the Future. "It sounds like there are plausible reasons for both side's estimates." In cases like this, adds Stephen Brown of Environ Corp., neither estimate is "provably wrong. It is literally impossible to say what the true risk value is."

Portney guesses that "both estimates overestimate the real risk, which we will probably never know. I suspect that the actual risk is several orders of magnitude below EPA's number, just because of the conservatism built into their procedures. But there is also a chance that it could be higher." The problem, he adds, is that once a risk assessment is done, people tend to forget all the assumptions they made along the way and attach too much certainty to the final number. But, Portney says, there are few alternatives: "If we don't try to make quantitative risk assessments, how do we decide what to regulate—by rolling dice?"

For all the rhetoric spewing forth from both sides, the two risk estimates are actually not that far apart. A factor of 25 difference is well within the range of what two reasonable people, using similar data and reasonable assumptions, might come up with. "For these kinds of games, it is pretty doggone close," says Portney.

The bottom line is that both EPA and NRDC want Alar off the market, though they differ on the urgency of the problem. NRDC calls the risk intolerable and is pushing for an immediate ban, while EPA defends its decision to allow Alar to remain on the market for another 18 months. Because of "serious questions" about the interim data, the agency wants to see the final toxicity study, says Jordan, "but we are positioning ourselves to be ready to move as soon as the data are available. If the risk is anything like we are seeing now, we will cancel Alar."

"Until this action is complete, EPA considers [the] risks acceptable, since exposure is generally limited," says Moore. Meanwhile, EPA has recommended that farmers discontinue using Alar and has advised the public on which products are likely to contain Alar residues. ■ **LESLIE ROBERTS**