This paper was peer-reviewed for scientific content.
Pages 106-111. In: D.E. Stott, R.H. Mohtar and G.C. Steinhardt (eds). 2001. Sustaining the Global Farm. Selected papers from the 10th International Soil Conservation Organization Meeting held May 24-29, 1999 at Purdue University and the USDA-ARS National Soil Erosion Research Laboratory.

Environmental McCarthyism and the Precautionary Principle - Learning from the Past while Addressing Current Dilemmas

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ABSTRACT

Throughout history, mankind has been quick to suspend rules of reason when the public good was perceived as unduly threatened. This has often been to devastating effect, such as during the McCarthy Era of the mid 20th century. One had simply to be accused of being a communist, and the onus was on the accused to prove otherwise—a virtually impossible task. In more recent times such sentiments have shifted to environmental topics, with agrochemicals as the suspect in a water quality relationship it is said might negatively affect humankind and the entire ecosystem. Under the Null Hypothesis of classical science, unless a change can be documented, nothing beyond reasonable chance is assumed to have occurred. Some feel that modern science has failed to identify real agro-environmental hazards, hence the need to invoke the Precautionary Principle. They say that action is needed now and warn that to wait for absolute proof is to invite disaster. Others believe this philosophy is simply a veiled form of 'Environmental McCarthyism.' They caution that such steps are unduly alarmist, aimed at bypassing rigorous scientific technique while imposing personal agendas. The stakes are higher than ever, but the basic issue remains the same—at what point is there sufficient evidence to warrant action, and when is it imprudent to do so? We can learn much from the past while seeking new solutions to current water quality dilemmas. A more open, active dialogue of affected stakeholders is needed, to better define problems and collectively find answers.

HISTORICAL EXAMPLES

Examples abound of non-rational behavior against perceived threats to society. During the period of the Inquisition (11th to 15th centuries), the safety of civilized society was considered to be under such extreme threat, that 'trial by accusation' of individual heretics was seen as being too cumbersome to address the crisis. Hence, the public was encouraged to seek out and denounce those suspected, and the testimony of two witnesses was sufficient to commit the accused to prison. Because the nature of offences was so ill defined, the ability to accuse under the Inquisitor's power gradually increased, until in some instances the purpose of the Inquisition almost seemed geared "to achieve uniformity and conformity, regardless of the cost" (Rowe, 1970).

Near the end of the French Revolution (18th century), Robespierre 'the Incorruptible' was given increasing authority to prosecute perceived enemies of the state (Encyclopaedia Americana, 1970). He instituted the 'Terror', which eventually freed the revolutionary tribunal from all restrictions of legal procedure. During the final six-week period of the Terror, nearly 1300 persons —including Robespierre himself - were sent to the guillotine.

Our own century has not been immune to such sentiments. In 1950 Senator Joseph McCarthy gained prominence in the United States, charging that his list of "card-carrying communists" threatened the security of the nation (Encyclopedia Americana, 1970). One simply had to be accused of being a communist and the onus was on the accused to prove otherwise - a virtually impossible task. McCarthy said that his detractors were "disloyal Americans, or stupid", yet his inquiries "failed to unearth any case of provable subversive activity or disloyalty." In the process, reputations were ruined and lives destroyed.

The Agro-Environmental Dilemma

These examples serve to illustrate that disastrous, unintended consequences can result when—under the perceived need to radically address imminent danger—systematic, methodical procedures for truth-finding are superceded. In such cases there was surely cause for concern, but in hindsight the steps taken and the methods followed allowed events to escalate far beyond reasonable control.

Society faces a similar dilemma today—with particular reference to the interface between agriculture and water quality matters. On the one hand, there are those who claim that agricultural practices are deteriorating soil and water quality to such an extent that all humankind and the world ecosystem are at risk. They say that action must be taken now, that society can't afford to wait for documented evidence of suspected conditions. Yet others contend that such statements are poorly founded, and urge continuation of a systematic approach towards documenting and verifying the existence of cause/effect relationships—this, before action is taken. The fundamental question remains: At what point is there sufficient evidence to warrant action on agro-environmental issues—and when is it imprudent to do so to avoid embroilment in what may well be defined as 'Environmental McCarthyism'?

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UNDERSTANDING RISK

A central reason for differences of opinion on water quality, is that individual attitudes toward acceptable risk greatly affect how we interpret water quality information (Harker et al., 1998). Some are prepared to accept a 'guidelines' approach to water quality—the concept that there are contaminant levels below which our lives and the health of the ecosystem are at reasonable risk. Others take a 'zero tolerance' position and hold that no amount of unnatural substance or elevated agro-nutrient in the environment is acceptable. All of us may adhere somewhat to each of these schools of thought, with most leaning one way or the other.

Some people believe that public demand for zero risk is unreasonable, and call for experts and policy makers to provide a better understanding of why such an objective may be unattainable. Black (1995) points out that all of nature uses water to absorb waste products and to transport nutrients and says that, "Policies advocating the zero discharge of pollutants are contrary to the role of water as a natural resource buffer and aim for a fundamentally unnatural goal."

Hrudey and Krewski (1995) question the validity of a zero tolerance point of view. Using conservative USEPA estimates, they calculated the hazard of life-time exposure to one molecule a day of the most potent known carcinogen (TCDD). Their calculations indicate that exposing the entire world population to this smallest conceivable dose would not yield a single case of cancer. Hence, "Within a realistic concept of safety, there is a safe level of exposure…" to even the most toxic of carcinogens -- and the concept of zero tolerance is rendered invalid.

But it is argued that "the long-term health implications of exposure even to minute quantities of these chemicals, particularly their combined effects, are not well understood" (Linton, 1997). Until such relationships are better known, we can never be sure.

Evaluating Risk

Risk assessment is at best an imprecise science, severely constrained by what Adam Finkel (1996) of the US Occupational Health and Safety Administration (OHSA) calls "a dearth of qualified practitioners." He cautions that we must be careful not to ask more of risk assessment than it can deliver. Scherer (1990) points out that traditional approaches to risk assessment involving probabilities, statistics, and risk analysis, are not sufficient in the public mind. He says that technical and scientific problems are ultimately social problems, and that public reaction to risk assessment is based on a set of criteria that requires both technical and social solutions.

Sandman (1987) says the public is more likely to focus on a dimension of 'outrage,' a combination of more than 20 factors that include:

- •**Fairness of risk** - accounts for proximity to a hazard, like a nuclear reactor
- •**Degree of control** - access to a private well versus relying on public water supply
- •**Familiarity** - exposure to automobile accidents versus pesticide contamination

Add to these outrage factors, a notion of trespass—the concept that individuals don't like others arbitrarily dumping substances into public water sources, regardless of whether or not harm can be shown to arise therefrom.

In the end, risk analysis generally comes down to a matter of probabilities. Probabilities are usually based on historical data, assume average conditions, and project that past trends will continue. However, there is often little historical data from which to extrapolate the probable effects of trace amounts of water-borne agrochemicals on human and ecosystem life, and toxicology findings from laboratory rats and other tests may be far removed from reality.

CLASSICAL SCIENTIFIC APPROACH

In today's classical science, the Null Hypothesis is the general principle of evaluation—that is, unless the probability of change is documented to be greater than that due to a specified likelihood from chance alone, no change is assumed to have taken place. The process of evaluation incorporated in the Null Hypothesis is similar to the 'innocent until proven guilty' dictum of criminal law. This systematic, conservative methodology is used because we are often fooled by apparent relationships. A set of coincident circumstances (e.g., trace levels of pesticides in the Great Lakes drinking water of mothers experiencing birth defects) by no means confirms that potential cause/effect relationships are in force. There are often too many other variables that might be responsible, and we must be cautious of reaching conclusions that cannot be substantiated by the data at hand.

The strength of the scientific method is that it demands proof. An important weakness is that it requires a way to separate effects, in order to identify statistical cause-effect relationships. This can be problematic for constituents that are widely distributed in water. For example, at a recent conference on Children's Health and Environment (1998), the question arose as to how researchers might expect to find abnormal effects within a statistically normally distributed population, if the entire population was somehow uniformly subject to the same adverse effect (e.g., trace pesticides in drinking water) (Bertel, 1998)? A further weakness is that there is often an implicit conservatism in favor of the status quo, since, typically, the probability of detecting a real change is less than the probability of accepting the Null Hypothesis that there is no change (Cox, 1958).

THE PRECAUTIONARY PRINCIPLE

There are those who think that when it comes to environmental matters, the Null Hypothesis should be abandoned in favor of the Precautionary Principle. This principle holds that the environment is too hard to understand and too difficult to fix, to justify assuming there is no negative effect until society has irrefutable evidence to the contrary. As recently reiterated, the precautionary principle states that:

"When an activity raises threats to the environment or human health, precautionary measures should be taken, even if some cause-and-effect relationships are not fully established scientifically" (SEHN, 1998).

There exists a wide range of interpretation as to the stringency with which the precautionary principle ought to be applied. Proponents of a moderate interpretation hold that instead of asking questions like: "How safe is safe?", or "What level of risk is acceptable,." society ought to be asking: "How much contamination can be avoided?", or "What are the alternatives to this product?", and "Is this activity really necessary?" This approach places much less emphasis on the traditional risk assessment and cost/benefit analysis of individual chemicals or products, while still allowing such techniques to be used to effectively compare alternatives. What, for example, might have happened had society taken a harder look at the long-term implications of DDT, before incorporating it into routine use?

Others argue that the precautionary principle is dangerous, that it is antagonistic towards sound science, having its roots largely founded on instinct and feeling (Mongoven, 1998). They warn that it threatens the entire chemical industry, wherein hundreds of new chemicals are marketed annually. At present, the release of a new chemical may not require environmental testing for specific scenarios, because negative environmental effects are not known to exist. In its harshest interpretation, the precautionary principle could require any new product to prove it has no negative effect on any aspect of the environment—a virtually impossible task, akin to Environmental McCarthyism.

The strength of the precautionary principle is that it emphasizes environmental assessment on the basis of whole system analysis—an understanding of the parts by looking at the whole (Ashford and Miller, 1998). Its weakness is that once cause/effect relationships have been 'linked' (however tenuously) to apparent factors, there is a tendency towards the wholesale condemnation of any and all of the constituents of the suspected 'chemical soup.'

ADDRESSING CURRENT DILEMMAS

Clear Criteria

As illustrated in the historical examples cited earlier, without a set of clear criteria by which to judge when action is warranted, things can rapidly get out of hand.

State of Idaho: It has only been a few years since the State of Idaho came head-to-head with the Clean Water Act—in a classical example of Environmental McCarthyism (Idaho DEQ, 1999a). The US Clean Water Act requires that states identify water bodies (lakes and streams) known to require remediation, and propose a plan for doing so. The evidence for so selecting waters in Idaho were skimpy, but based on available information, Idaho's Division of Environmental Quality (DEQ) declared that some 60 bodies of water fell into this category. They may have strongly suspected there were more degraded waters (perhaps 2-4 times as many), but did not have the hard data to say so with confidence. Therefore, the state went with a proven, albeit likely undervalued number.

Two environmental groups (The Idaho Sporting Congress, and Idaho Conservation League) thought the state-selected number was ludicrously small, and took the federal Environmental Protection Agency (EPA) to court for approving the state's plan. A federal judge found EPA's approval of the list to be 'arbitrary and capricious' and required EPA to develop its own list of suspect waters within 30 days. EPA did this in consultation with the complainants. As a result, the State of Idaho is now required to use tax dollars to verify that some 950 water bodies *do not* require a water quality action plan.

It was a simple matter for others to compile a list of waters accused of not meeting state water quality standards, but will require an incredible amount of work on the part of the state to prove whether or not they belong there (Idaho DEQ, 1999b). It will take years for limited state resources to even begin to tackle such a job, and in the meanwhile neither the State nor the environmental groups will get what they both really want—the timely identification and addressing of critical water quality concerns. Perhaps Idaho should have initially pursued a more vigorous course of identifying suspected waters. However, in the end, it's a classical case of Environmental McCarthyism—I accuse you, now you have to prove otherwise.

In Canada we've been relatively immune to such excesses, but perhaps it's only a matter of time.

Applying Standards

Contaminants in drinking water are under increasing scrutiny—as they should be. The pervasive tendency in applying standards is to continually lower the level at which natural and unnatural substances may be detected in water. However, the reasons for doing so often have less to do with specific toxicities than they do with a fundamental uncertainty and distrust of the rationale behind the standards.

Aquatic Guidelines: Take, for example, the blanket application of aquatic guidelines—the standard increasingly recommended to protect water quality overall. One reason for using aquatic guidelines is that people are uncomfortable with the prospect that significantly higher levels of contaminant are generally allowed in drinking water standards. Another, is the belief that aquatic organisms represent the 'lowest common denominator' on the ecological scale, hence all waters ought to be protected to that level of sensitivity—even ground waters because they might discharge into surface waters.

The underlying issues hearken back to whether drinking water standards are adequate in the first place; and whether different standards (aquatic vs. drinking) ought to be separately applied to surface and ground waters. Until this dilemma is resolved, the merit behind systematically applying aquatic-use guidelines to all water quality will be muddied (Harker et al., 1998).

The Nitrate Standard: The necessity of clearly understanding the rationale behind a guideline in order to properly interpret its significance is amply illustrated in the nitrate-nitrogen (NO_3-N) standard for drinking water—10 mg L^{-1}. If, for example, 10 mg L^{-1} of NO_3-N is judged to be 'bad', does that mean that 5 mg L^{-1} is half way to bad, or that 20 mg L^{-1} is cause for alarm?

Early research in the 1940's (Comly, 1945) indicated that high nitr***ate*** in drinking water was associated with the nitr***ite*** that causes blue baby syndrome, an occasionally fatal condition. The conservative standard of 10 mg L^{-1} NO_3-N was set for all drinking water—based on results showing apparent toxicity in some infants at >60 mg L^{-1}. However, well waters contaminated with nitrate may also be contaminated with bacteria, and subsequent research has repeatedly raised the possibility that blue baby syndrome may be principally due to bacteria alone (Cornblath and Hartmann, 1948; Hanukoglu and Danon, 1996). Still, nitrate might be involved to some extent (Tanase et al., 1998) and the debate continues.

Understanding the origin of the nitrate standard and the debate surrounding it, helps us to keep the standard in perspective. What then is the significance to child health of finding nitrate concentrations of 5, 10 or even 20 mg L^{-1} in groundwater? Perhaps very little—unless there's a well-documented trend to steadily increasing levels, and levels are likely to persist at concentrations well above the standard.

Phosphorus Levels: Phosphorus is undoubtedly the greatest water quality concern on the great plains (prairies) of western Canada. Concentrations as little as 0.01 to 0.05 mg L^{-1} of *dissolved* inorganic phosphorus can represent eutrophic conditions (promoting excessive growth of aquatic vegetation) (Sosiak, 1997). To illustrate the extent of excessive nutrients already existing in surface water in this region, typical concentrations of dissolved inorganic phosphorus in farm dugouts (surface ponds used primarily for farmstead water) are 0.1 to 0.5 mg L^{-1} – about 10 times the concentration associated with eutrophic conditions (Corkal and Peterson, 1994).

In response to problems of excessive P in surface water, the prairie province of Alberta has adopted an interim water quality objective of 0.05 mg L^{-1} of *total* P for surface waters (CAESA, 1998). However, most *total* P is unavailable for biological growth, so this objective is highly conservative. In fact, the guideline is so conservative that very few streams in that province have total P below that concentration, including those almost devoid of agricultural activity and human habitation (Anderson et al., 1998). If the interim water quality objective where applied indiscriminately, it would be not only unachievable, but, as in the State of Idaho example, take scarce resources from activities that might reduce dissolved P from other causes, such as stopping direct runoff from concentrated livestock holding facilities. Fortunately, Alberta has taken the approach of concentrating on specific problems first (Sosiak, 1997).

The origin of excessive P in surface water on the Prairies is easily understood. The naturally fertile prairie soils contain in the order of 1000 kg total P ha^{-1} in the 10 cm tillage layer (Sadler and Stewart, 1974), although most of that P is biologically unavailable or only very slowly available (Selles et al., 1999). Typical runoff from prairie cropland would be less than 100 mm per year, and the driest 2/3 of cropland would have less than 25 mm of annual runoff (Environment Canada, 1978). So losses of as little as 50 g of total P per ha—or less than 0.01 percent of the total P near the land surface—would bring the concentration of total P in runoff above the 0.05 mg L^{-1} guideline. To make matters worse, evaporation almost invariably exceeds precipitation on the prairies. As water evaporates from lakes and reservoirs, the concentration of P increases. Not surprisingly, there is evidence many shallow prairie lakes and ponds were eutrophic long before European settlement (Mitchell and Trew, 1992).

Cost/Benefit

Implicit to any discussion of water quality control is the concept of cost vs. benefit. In an extreme interpretation of the precautionary principle (for example), the potential cost of environmental hazards to society is so high that no benefit can counteract them. A moderate interpretation of cost/benefit considerations allows that costs might well be higher than originally estimated; therefore, benefits must clearly be sufficiently great to compensate for hidden costs.

Social Cost: There is a social (public) cost to pollution; and a 'socially optimal' level of pollution control requires balancing the benefits of reduced levels of pollution with the costs of achieving them (Weersink and Livernois, 1996). Benefits include: reduced environmental and human health damages; while costs may encompass the lost value of goods and services required for pollution control.

The on-farm effects of agricultural pollution might be reflected in reduced productivity, increased production costs (specialized irrigation techniques required due to poor soil or water quality), and on-farm health. Off-farm damages such as air and water pollution must, however, be borne by the public. Some view concern over deteriorating water quality as an indication that agricultural pollution is already greater than some socially optimal level.

Current Hazards, Future Costs**:** We live longer, healthier lives today than ever before, and when it comes to predicting many hazards, we have excellent long-term records of many relationships. We can say with confidence, for example, that the probability of a North American adult over 35 years of age dying from a heart attack in any given year is 1:77 (Kluger, 1996). Similarly, the odds of a young adult (14-25 yrs) dying in a car crash are 1:3500. These represent significant odds when compared with the uncertainty of death or long-term consequences from trace amounts of agrochemical in drinking water.

We are quickly becoming a society preoccupied with the possibility that products of our own making may be harming us - causing cancer for example. Yet a multi-disciplinary task force representing the National Academy of Sciences has concluded, "there is no clear difference between the potency of known naturally occurring and synthetic carcinogens. . . in the human diet." The investigators go on to say that, "Current evidence suggests that the contribution of excess macro-nutrients and excess calories to cancer causation . . . outweighs that of individual food micro-chemicals, both natural and synthetic" (NAS, 1996). In short, eating too much is far more likely to cause cancer than the micro-chemicals in the food we eat.

In matters analytical, we've become so smart that perhaps we're foolish - wherein "The scientific community's ability to detect chemicals is much more advanced than the understanding of the toxicology associated with such discoveries" (CAST, 1992). Compared with the reality of other hazards, one has to wonder if future generations will not look back on us as a society preoccupied with chasing electrons, while ignoring the very real prospect of being hit by a bus.

Prudence or Paranoia?

In a recent book titled "But Is It True?" (c1995), author Aaron Wildavsky challenges conventional wisdom about some of the environmental perils that surround us. He presents an overview of the data used to support such conclusions, then asks—"But Is it true?" According to Wildavsky, it is often possible to draw multiple conclusions from the same information, and claimed trends and cause/effect relationships may well be uncertain.

In another book, "The Argument Culture - Moving from debate to dialogue", sociologist Deborah Tannen (1998) warns there is a prevalent 'argument culture' in our language that tends to cast even the most complex problems as clear polar opposites. She says that fitting ideas into a particular camp requires a simplification that doesn't work for all topics. The author cautions that dialogue, not debate, is often required to address difficult issues effectively—until, as she puts it, "the boundaries between disciplines have been eliminated and the problems and questions are seen as a seamless whole."

That would seem to be the case with issues of water quality. We need more active, open dialogue and less debate on such a subjective issue. The involvement of all parties in a watershed is required to define the problem and seek solutions. Through such a process we can surely better determine when and what action is warranted, and learn from past experiences while addressing current dilemmas.

SUMMARY

Historical examples abound of the hazard of suspending conventional wisdom when the good of society is deemed unduly threatened. Not the least of these occurrences is the McCarthy Era, during which unproven accusations ruined reputations and lives. A similar condition exists today, wherein the concerns and claims are environmental, and the interests of society must be carefully weighed against the threats perceived. Some say we ought to suspend rigorous scientific proof in favour of applying a less stringent Precautionary Principle, in order to avert possible disaster. Others see this philosophy as little more than Environmental McCarthyism, wherein the onus is on the accused to prove there is no environmental impact.

Individual attitudes about acceptable risk greatly influence our interpretation of water quality. Risk assessment is at best an imprecise science, encompassing many uncertainties. The classical scientific approach using the Null Hypothesis, assumes that unless cause/effect can be shown to be greater than random chance, a relationship does not exist. But by its very nature, thisapproach is extremely conservative and documenting change can be difficult. On the other hand, advocates of the Precautionary Principle feel that the environment is too difficult to fix, to wait for classical science to establish iron-clad relationships. However, this principle is subject to such a wide range of interpretation, that the vigour with which it is applied can be highly arbitrary.

In addressing current water quality dilemmas, it is important that we learn from the past while seeking to: establish and follow a clear set of evaluation criteria; understand how the derivation of standards affects their prudent application; comprehend the relative cost/benefit of specific preventions and cures; and know the difference between prudence or paranoia. Many issues are neither black nor white, and water quality is clearly one of these. As we seek to enter into a more open and accepting dialogue of water quality discussion, we can better determine when action is warranted, while effectively addressing current dilemmas.

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