Using the Precautionary Principle: A Citizen's Guide

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Abstract.

The Precautionary Principle (PP) has come into play in Europe because it has been found in the case of the use of a number of harmful substances or practices that by the time it takes to get definitive scientific proof that a chemical or a practice has caused harm, sufficient to withstand the assault of invested interests, it is too late for the millions of people whose health has been damaged irreversibly. This was the case with lead, benzene, asbestos and smoking. The PP acknowledges this problem and posits the notion that when there is reasonable doubt of the safety of substance or practice, we should err on the side of caution, and not insist on absolute evidence of harm before rejecting a project. However, there have been a number of critiques of the use of the PP in practice. That is why it is important that citizens be equipped with a precise way of determining when the PP should be applied. This can be done by examining a carefully chosen list of criteria. This paper provides those trigger criteria and illustrates their use in two case studies: 1) the incineration of domestic waste and 2) the fluoridation of drinking water.

Introduction

There are a number of statements of the Precautionary Principle but the simplest is the one used in the Wingspread Statement of 1998:

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

A slightly more explicit statement comes from Ticker and Coffin, 2006:

"If there is uncertainty, yet credible scientific evidence or concern of threats to health, precautionary measures should be taken. In other words, preventive action should be taken on early warnings even though the nature and magnitude of the risk are not fully understood."

For more on the Precautionary Principle please see the book edited by Raffensperger and Tickner, *Protecting Public Health and the Environment: Implementing the Precautionary Principle* (Raffensperger and Tickner, 1999).

Use of the Precautionary Principle is not without its critics, especially from members of the right wing of the political spectrum, who see the possibility that blanket use of this principle will block any form of industrial or economic development (Bailey, 1999, 2009; Graham 2004).

Thus for citizens to use the principle successfully it is necessary to carefully define a set of criteria which might justify and trigger its application in any particular case.

The proposed set of trigger criteria

The following is a set of criteria developed by Paul Connett, which if met, would justify the citation

of the Precautionary Principle as a reason for rejecting a proposed activity:

1. Is the evidence of harm plausible?
2. Is the evidence supported by a number of peer-reviewed published studies?
3. If the harm is real is it serious?
4. Are the effects reversible?
5. How good is the evidence that the benefit being sought is real and significant?
6. How significant are the consequences if the practice is halted?
7. Are there cost effective alternatives to the practice?

We will examine two case studies for which the responses to each of the trigger criteria will be considered. These are:

1) The Incineration of domestic waste
2) The fluoridation of drinking water

CASE 1. The Incineration of Domestic Waste.

Introduction

Since the late nineteenth century incineration has been used to get rid of domestic waste, as well as generating heat and electricity. Advocates of this technology claim today that the technology is safe, contributes to fighting global warming, and should be included as an alternative to generating electricity that decreases our dependence on the burning of fossil fuels and the use of nuclear energy.

Opponents of incineration argue that the technology is not safe, that both the claims of the production of energy, and the reduction in global warming, have been exaggerated and that there is a far better alternative strategy for handling waste than either landfilling or incineration: otherwise known as the Zero Waste strategy (See Paul Connett's power point presentation at http://www.americanhealthstudies.org/projects.html#zw).

Here I will subject the safety of this practice to the trigger criteria listed above.

1. Incineration: Is the evidence of harm plausible?

A number of safety issues have been raised by citizens and independent scientists. These include air emissions and ash disposal. A relatively small number of health studies have been conducted in the vicinity of incinerators (and even fewer near ash landfills). While some have shown an increase in cancer and birth defects near incinerators, the issue is complicated by two facts: a) it is extremely difficult to tease out the health effects caused by incinerators and the other sources of pollution in the area, and b) cancer has a long latency period so that proponents can always claim that the results pertain to old incinerators and not the new more advanced incinerators proposed today. Thus proponents are able to shift the focus from examining the track record of old incinerators to theoretical health risk assessments based on projected air emissions of toxic substances.

However, there is clearly plausible evidence of harm from old incinerators, and this may alone be offered if it is felt that the proposed incinerator will not be operated or monitored in a way assumed by the risk assessors. In this regard, citizens need reminding that there are three things needed to justify the assumption that a modern incinerator will not threaten public health: 1) Tough emission standards are in place; 2) Adequate and scientific monitoring to demonstrate that those standards are being met 24 hours a day and 365 days a year and 3) aggressive governmental action if they are not. More often than not, risk assessments are carried out assuming the emissions standards are

being met 100% of the time.

Moreover, there is plausible evidence that even the most sophisticated risk assessments for modern incinerators have either not included certain risks that are plausible or others that have not been fully quantified. These plausible risks include:

a) the risks posed by the thousands of chemicals emitted which have not been identified but are plausibly in the mix of emissions. Please note that in risk assessments if a risk is not quantifiable then it is assumed to be zero.

b) the risks posed by the chemicals which have been identified, but not quantified. Again, such risks are assumed to be zero for risk assessment purposes.

c) the synergistic reactions between identified pollutants which have only be assessed individually. The assumption is made that the risks are simply additive. It cannot be assumed that synergistic interactions will be cancelled out by the antagonistic reactions. Synergistic interactions are not considered in risk assessments.

d) the exquisite health risks posed by nanoparticles. These particles are less than one micron in diameter. These emissions are neither monitored nor regulated. In most countries the particulates monitored and regulated are those with a diameter of 10 microns or more. These nanoparticles have the potential to contain chemicals in all three categories a), b) and c) above. Risks posed by nanoparticles are not considered in risk assessments for incinerators.

In some countries the particulate emission standard for incinerators is going to be lowered to 2.5 microns, but even these particles are very large compared to nanoparticles.

There is plausible evidence that these particles pose serious health effects.

In a nutshell the problem of nanoparticles is that they are so small that a) they are very difficult to capture and b) they easily cross the membranes of the lung and enter the bloodstream. From here they get delivered to every tissue in the body where they can again across the cell membranes. They can even cross the extra protection given to the brain called the "blood brain barrier."

There is nothing new about nanoparticles. What is new is the study of nanotoxicology, which has developed in the last few years because of the advent of nanotechnology. Nanoparticles are produced by all high-temperature processes, including fossil fueled power stations, motor vehicles, incineration and gasification. The difference between domestic waste incinerators and these other high temperature processes is the "fuel" used contains all the toxic elements used in commerce. Thus each of these toxic elements has the potential to end up in the nanoparticles released - as well as the highly toxic byproducts generated in the burning process like chlorinated and brominated dioxins and furans – and thence the potential of entering every tissue in the body including the brain.

Meanwhile, it has been well established that there is a strong relationship between particulate levels and both mortality and morbidity in urban areas. Moreover, this relationship gets stronger the smaller the size of the particle. Thus it is highly plausible that the introduction of another source of nanoparticles in the form of incineration will make a bad situation even worse. But this situation is not being addressed in risk assessments proposed for new incinerators

2. Is the evidence supported by a number of peer-reviewed published studies?

Yes. An outline of the problem is given by Cormier et al. in an article published in the journal *Environmental Health Perspectives* in June 2006. In addition, Dr, Vyvyan Howard, a well known

and highly regarded infant and fetal pathologist, has given an excellent summary of the nanoparticle issue in testimony he gave in a recent public consultation for an incinerator proposed for the UK (reference). Both Cormier and Howard provide peer-reviewed published studies to support their arguments.

3. If the harm is real is it serious?

Yes. We are talking about a plausible increase in lung disease and heart disease that can lead to increase to higher death rates in urban areas. As far as dioxin emissions are concerned, either emitted on the surface of nanoparticles or in the gas phase, the major concern is their accumulation in the human foodchain. The author showed in 1986 that one quart of cows milk would deliver the same amount of dioxin contained in air breathed in by a human in eight months, if that person breathed the same air as falling on the grass consumed by the cow (Connett and Webster, 1987). In one day a grazing cow puts into its body the equivalent dioxin to a human breathing the air for 14 years (McLaughlin, 1995). This problem is compounded for humans by virtue of the fact that once dioxin has been consumed it remains in our bodies for a very long length of time. However, a woman has a way of getting rid of dioxin that a man doesn't have: it is called having a baby! So in the 9 months of pregnancy the mother can shift much of the dioxin to the fetus she has stored in her body fat for 20-30 years. This is serious because dioxins can interfere with fetal development by interfering with hormonal signals. Today, in industrialized countries we have far too much dioxin in our food, in our bodies and in our babies. That is why the US Institute of Medicine (IOM) in 2003 recommended that parents encourage young girls to limit the animal fat content of the food they eat, long before they reach pregnancy (IOM, 2003). Knowing that all incinerators put dioxin into the environment, the PP would suggest that we should not be building any more if there are any viable alternatives or strategies available. We will see below that there are. For a discussion of dioxins and incineration see Paul Connett's power point presentation at www.AmericanHealthStudies.org

4. Are the effects reversible?

No. Many of the risks are irreversible. As long as the source of the pollution in the form of nanoparticles, death rates in lung disease, heart disease and other degenerative diseases can be anticipated to increase. Reversibility can only be achieved via relocation or shutting down the existing sources, or avoiding the building of new sources. Once dioxins, and related compounds, have reached the foodchains it is difficult to control human consumption without draconian measures like the IOM (2003) recommendations to encourage young girls to limit their fat consumption, and the equally draconian advice to mothers to limit the breast-feeding that they give to their babies.

5. How good is the evidence that the benefit being sought is real and significant?

Not good. The benefits of incineration are largely illusory. The illusion is achieved by a) the single focus of seeing the task as "getting rid of waste"; b) trapping the debate between a self-serving choice between landfilling or incineration, instead of expanding the discussion to include a zero waste strategy (discussed below). When the discussion is broadened in this way, incineration can be seen as a waste of energy, a poor economic choice for the local and national economy, a wasted opportunity to fight global warming, and a failure to move closer to sustainability.

6. How significant are the consequences if the practice is halted?

One is forced to give a mixed answer to this. Stopping the building of an incinerator is the easier task before citizens. The more difficult task is moving their community towards a zero waste strategy. If they fail here then it is highly likely that their community will continue to landfill their waste that practice poses many serious environmental and public health consequences. If we

assume that the community replaces the incinerator with a commitment to a zero waste strategy then halting the incinerator will have many beneficial consequences as discussed below.

7. Are there cost effective alternatives to the practice?

Yes. This is the zero waste strategy (ZW). The modern incinerator is trying to perfect a bad idea. Our task in the 21st Century is not to find better ways of destroying discarded material but to stop making products and packaging that have to be destroyed. ZW sees waste as an industrial design problem. We need to find ways of moving from the back end of waste disposal to the front end of industrial production and our over-consumptive lifestyles. Thus to achieve ZW we need three responsibilities: 1) community responsibility at the back end; 2) industrial responsibility at the back end and 3) political responsibility to bring 1) and 2) together.

Community responsibility involves source separation of discarded materials into at least three categories (compostables, recyclables and residuals); door-to-door collection; composting facilities; recycling facilities; reuse and repair facilities; waste reduction initiatives; economic incentives (like the pay-by-bag system for residuals); a residual separation and research facility (if we can't reuse, recycle it or compost it, industry shouldn't be making it); a biological system to stabilize the dirty organic fraction and an interim landfill for the currently poorly deigned products and packaging which cannot currently be recycled.

Industrial responsibility involves three things: 1) design for sustainability from the very outset of production; 2) clean production, halting the use of toxics such as lead, cadmium, mercury, organochlorine and organobromine and organofluorine compunds, for all but very small and crucial uses and 3) extended producer responsibility (EPR). In future companies must expect that if they manufacture an object or package that unless the community can reuse the product or easily recycle the material in he package, that they will be required to take it back.

Political responsibility. We need political leaders with the vision to push for both community and industrial responsibility. The place where they can bring these two together is the residual screening and research facility built in front of the residual landfill described above. This is where the money spent on discard management can be integrated with the educational system, thus involving some of our bright minds in a "laboratory" for sustainability.

This alternative is better than incineration on every front: it saves money; it creates far more jobs and local businesses; it save more energy (four more times energy is saved by recycling materials than burning them); it reduces global warming far more than either landfilling or incineration; it helps to fight overconsumption; integrates with education and moves society in a genuinely sustainable direction. Also the zero waste strategy by combing with advanced education, can be integrated into other aspects of society that need to move in a sustainable direction, e.g. agriculture, architecture, energy, industrial design, economic development and community development.

An elaboration of these ideas, can be found in an essay by Paul Connett on the home page of the American Environmental Health Studies Project (AEHSP), "Zero Waste: A Key Move Towards a Sustainable Society" see www.AmericanHealthStudies.org/zerowaste/pdf . Also at the website can be found a series of videotapes accessible online on Zero Waste, entitled "On the Road To Zero Waste" also produced by Paul Connett.

Conclusion: Thus at least 6 of the 7 criteria would trigger the Precautionary Principle in support of opposition to an incinerator proposal. Only one criteria (6. How significant are the consequences if the practice is halted?) does not yield a clear cut answer. That issue is resolved in favor of triggering the Precautionary Principle, if rejection of the incinerator leads to a genuine commitment to a Zero Waste Strategy and not simply relying on landfills to solve the waste

problem.

CASE 2. The Fluoridation of Drinking Water.

Introduction.

Fluoridation is the addition of a compound to the drinking water that either contains the fluoride ion (e.g. sodium fluoride) or generates it on dilution (sodium fluorosilicate), in an effort to reduce tooth decay. Unlike the other chemicals added to water thigned to make the water safe to drink (e.g. chlorination to destroy disease carrying bacteria etc.) but to treat people. The public water supply is being used as a delivery system for medication. The practice began in the United States in 1945, at a time when people believed that chemicals could do anything – and do it without harming humans. At this time we had lead in gasoline, PCBs in transformers, asbestos lining our pipes and kids were being sprayed with DDT at picnics. All these uses have been abandoned but fluoridation clings on because it has the support of the US government and many professional bodies, including the World Health Organization.

Only a few countries in the world practice water fluoridation. Of these eight countries have more than 50% of their population drinking fluoridated water (Australia, Columbia, Ireland, Israel, Malaysia, New Zealand, Singapore and the United States). Another eleven countries have more than a million people drinking artificially fluoridated water. Some countries have high natural background levels of fluoride in their drinking water, including India and China, and have to remove the fluoride. The vast majority of European countries have either, never started fluoridation, or if they started it have since stopped. Some countries fluoridate their salt and topical fluoride treatment in the form of fluoridated toothpaste is universally available.

According to Brian Martin (1991) here is the situation with respect to the Philippines.

Philippines

1. About 8,300 or 0.014 percent of the population drink water with added fluoride.
Only the United States military bases have fluoridation.
2. About 4.5 million or 7.72 percent drink water naturally containing fluoride at or
above the level considered optimal for reducing tooth decay, which, in the Philippines, is 0.4 to 0.6 ppm.
3. The Fluoridation Law of 1963 authorized the fluoridation of public water supplies. In 1980, an installation to fluoridate metropolitan Manila was initiated, but it has not been completed due to political and financial difficulties. Small pilot projects were started in Limay, Bataan, and San Jose City, but were stopped for the same reasons.
4. The government promotes fluoride mouth rinsing every two weeks. Fluoride toothpastes are widely sold. The government has not yet promoted fluoride tablets or fluoridated table salt. Topical fluoride treatments at rural dental clinics were too expensive in terms of staff and so were phased out.

Source Letter from Guillermo F. Juliano, Chief, Dental Health Service, Ministry of Health, Manila, Republic of the Philippines, dated 14 July 1987. (Martin, 1991, p. 208-9)

Despite the unpopularity of this practice in most countries of the world, in recent years there has been a renewed push by the international dental lobby to get fluoridation into more countries,

particularly large developing economics where they are predicting a massive increase in tooth decay with the incursion of western style diets, including refined sugar and flour and soft drinks like Coca Cola. At a meeting held in Geneva in 2006, organized by the World Dental Federation (FDI), the World Health Organization (WHO) and the International Association for Dental Research (IADR) the delegates declared that access to fluoride should be considered a "basic human right." It is quite likely that in the near future the Philippines will be targeted for another push to fluoridate its water.

We will now address the 7 criteria to see if this practice would trigger the Precautionary Principle of opposition to the practice.

1. Is the evidence of harm plausible?

YES. A number of health effects have been observed at moderate to high doses (as occurs in countries with high natural levels of fluoride in their drinking water). The adverse effects observed are dental fluorosis (mottling and discoloration of the tooth enamel), skeletal fluorosis (for which the first symptoms observed are like arthritis), increased bone fractures in both children and adults, including hip fractures among the elderly, lowered thyroid function, and lowered IQ. An excellent summary of these effects has been published by the US National Research Council in a 507-page report *Fluoride in Drinking Water: A Scientific Review of EPA's Standards* (NRC, 2006). Proponents argue that none of these effects have been demonstrated in communities drinking fluoridated water at 1 ppm. Opponents counter-argue that that is largely because countries that practice and promote fluoridation are not doing the studies that would demonstrate this one way or the other. Meanwhile, there is a considerable amount of anecdotal evidence, as well as few published case studies, that some individuals are highly sensitive to fluoride. These individuals complain of a number of symptoms like gastrointestinal disturbances, aching bones and joints, rashes, headaches and tiredness not relieved by sleep, which are reversed when the source of the fluoride is removed. No fluoridating country has attempted to subject such observations to thorough scientific testing. There is also plausible evidence of an association between young boys drinking fluoridated water in their 6th, 7th and 8th years and succumbing to a bone cancer, osteosarcoma, by the age of 20 (Bassin et al., 2006).

2. Is the evidence supported by a number of peer-reviewed published studies?

YES. Many peer-reviewed studies discussed in 1) above are reviewed in the massive NRC (2006) report, also identified in 1).

3. If the harm is real is it serious?

YES. Arthritis affects about 68 million Americans. Hip fractures are very serious for the elderly. Over 25% are dead within a year of a hip operation and 50% never regain an independent existence. Hypothyroidism brings with it a litany of problems: lethargy, depression and obesity. Lowering IQ in children has serious consequences both for the individual - robbing them of their full potential – and for society, a lowering of IQ across the whole population will reduce the number of geniuses in society and increase the number of mentally handicapped.

4. Are the effects reversible?

MANY ARE NOT. If you cause a change in the intellectual development of a child in its early days that reduction cannot be erased. If you make a hip bone more vulnerable to fracture for the elderly (please note 50% of all the fluoride taken in each day accumulates in the bone, and lifelong accumulation may make the bones more brittle) treatment is possible but because the operation requires immobilizing the patient for an extended period of time it is very difficult for the patient to regain full use of their bodies.

5. How good is the evidence that the benefit being sort is real and significant?

VERY WEAK. The evidence that swallowing fluoride actually reduces tooth decay is very weak. There have been no randomized clinical trials (RCT) demonstrating effectiveness. There is little difference today between tooth decay between fluoridated and non-fluoridated countries and states (check out the decline in tooth decay - based on WHO data, published online - in 12-year olds in 18 different countries over the period 1960's to the present, plotted graphically at www.Fluoridealert.org/who-dmft.htm)

At best, the largest survey ever done in America only found a difference of 0.6 tooth surfaces in the permanent teeth of children (Brunelle and Carlos, 1990). Other surveys have found even less or none at all (Spencer et al., 1996; Armfield and Spencer, 2004 and Komarek, 2005).

6. How significant are the consequences if the practice is halted?

NOT VERY SIGNIFICANT AT ALL. At least four modern studies conducted in Finland, former East Germany, Cuba and British Columbia found that in communities that stopped fluoridation, tooth decay did not go up as feared by promoters of fluoridation (Maupome 2001; Kunzel and Fischer, 1997, 2000; Kunzel 2000 and Seppa 2000).

7. Are there cost-effective alternatives to the practice?

YES. If, and that is a big if, it could demonstrated that swallowing fluoride in drinking water actually worked, a far more rational approach would be to make fluoridated water available in supermarkets, free if necessary. This would mean that one could use pharmaceutical grade fluoride, instead of the industrial grade chemicals used in water fluoridation. The dose could be controlled. People could be told to drink just one liter of 1 ppm a day and no more. It would also be cheaper than current fluoridation programs because over 99% of the fluoride would not be flushed down the toilet or dissipated in other ways, as occurs with water fluoridation.

Using fluoridated toothpaste would be a more appropriate delivery system if fluoride were desired, because it delivers the fluoride topically, where promoters feel fluoride achieves its greatest benefit (CDC, 1999, 2001). This is a more appropriate delivery system but some opponents of fluoridation do not advocate this because of the toxicity of fluoride.

We believe that the alternative that provides the best long-term solution to children today and in the future, is to target low-income families with better education and better diet – especially during pregnancy. This should be coupled with dental health clinics in low-income areas staffed by professional dentists working pro bono (one morning or afternoon a week), as well as with dental students. The way this overall program would be made cost effective is to couple fighting tooth decay with fighting obesity in children – a situation that is destined to overwhelm the health care system, with the lifelong treatment of diabetes and other complications.

This is the only real long-term answer: free dental care for children (at least for children from low-income families), with the profits coming from treating adults.

Conclusion. Careful answers to each of these 7 criteria reveal very clearly that a simple application of Precautionary Principle should force an end to water fluoridation, without further delay. More information and documentation on this issue can be accessed from the home page of the Fluoride Action Network, for which Paul Connett is the executive director, http://www.FluorideAlert.org

In the March 2006 issue of the *Journal of Evidence Based Dental Practice*, Joel Tickner and

Melissa Coffin, examined the water fluoridation controversy in the context of the *Precautionary Principle*. The authors noted that:

* there are other ways of delivering fluoride besides the water supply;

* fluoride does not need to be swallowed to prevent tooth decay;

* tooth decay has dropped at the same rate in countries with, and without, water fluoridation;

* people are now receiving fluoride from many other sources besides the water supply;

* studies indicate fluoride's potential to cause a range of adverse, systemic effects;

* since fluoridation affects so many people, "one might accept a lower level of proof before taking preventive actions."

While the authors never state their personal position on water fluoridation, the observations that they make above should indicate that an application of the Precautionary Principle would sound the death knell for fluoridation (Ticker and Coffin, 2006).

Overall Conclusion. We believe that the introduction of the seven triggering criteria will enable citizens to introduce the notion of the Precautionary Principle in a more disciplined way and thus avoid the criticisms leveled at the principle by those who support all technological and industrial mindless of the costs to human health and the environment.

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