Keeping Society's Options Open

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Introduction

Environmental regulations are promulgated to protect public health, safety and the environment. Unfortunately, regulations can become an end in themselves or be used to foster unrelated policy objectives. When this happens, business activity frequently shifts to less regulated, hence artificially less expensive alternatives. Since all human activity – including every waste management practice – consumes energy, generates pollution, and involves risk, such a shift can result in unintended harm to the environment.

After practically minimizing a source's emissions, spending more resources to achieve small gains may cost more than they are worth. Also, emissions' reductions that do not measurably improve public health, safety and environmental quality waste society's limited resources. Good regulation, like good stewardship, treats all society's air, water, land, human and financial resources as limited and precious commodities. They all should be conserved.

Municipal Waste Combustor [MWC] Regulations

Before the Clean Air Act [CAA], municipal waste incinerators were frequently little more than open-burning-dumps-in-a-box. New Source Performance Standards regulating incinerator particulate emissions were among the first promulgated under the CAA. By the later 1970s, the oil embargo, sustained high energy prices under the Public Utilities Regulatory Policy Act [PURPA], and anticipated landfill capacity shortages combined to foster the development of the waste-to-energy {WTE] industry. As more facilities were built, state environmental review laws worked with federal requirements to apply Lowest Achievable Emissions Rate [LAER] technology, technology designed to absolutely minimize facility emissions in poor air quality (non-attainment) areas, to stimulate commercialization of advanced air pollution control systems. Then, plants built in clean-air areas met Best Available Control Technology [BACT] requirements by using this now commercially demonstrated technology. Thus, LAER air emissions control systems cascaded across the country. The process of initiating major technology improvements in poor air quality areas, proving performance and then spreading that technology everywhere steadily ratcheted the emission limitations for new plants down to ever lower levels.

Particulate emissions are an example of the ratcheting process. In the 1960s, burning a ton of municipal solid waste [MSW] emitted about 30 pounds of particulates. In 1971, the New Source Performance Standard [NSPS] for incinerators reduced particulate emissions to approximately 1.9 pounds of particulate per ton of MSW burned, a 94 percent reduction. In the 1980s, the focus changed to minimizing acid gas, trace metal, and dioxin/furan emissions. Advanced control technologies were developed and installed, first in non-attainment areas, then everywhere. New plant particulate emissions have been reduced to below 0.2 pounds per ton of MSW burned since the late 1980s – a 99 percent reduction (from 30 pounds) in about two decades. Each incremental improvement came from technology meeting more stringent emissions criteria. Each incremental improvement also used many more resources – energy, money and human talent – than the previous step.

Dioxin and furan emissions are another example of the ratcheting process. When first measured in the later-1970s, concentrations were 1,000 times greater than those routinely found 10 years later in state-of-the-art plants. The technology to control sulfur dioxide and hydrogen chloride emissions also reduced dioxin and furan emissions. Multipathway health risk assessments routinely show negligible risk from this level of dioxin and furan emissions. Even so, the 1995 Emissions Guidelines call for these low emitting systems to demonstrate dioxin emissions another 50 times lower. This reduction is the anticipated byproduct of using activated carbon to reduce mercury emissions.

The Maximum Achievable Control Technology [MACT] emission limitations required by 1990 Clean Air Act Amendments [CAAA] show the ultimate effect of the ratcheting process. The philosophical basis for MACT is that if 12 percent of similar facilities have achieved emissions control at a certain level, the rest should meet similar levels to protect citizens from pollution. The CAA recognized the inappropriateness of applying extraordinary measures everywhere by calling for LAER installations to be excluded from the pool of best performing plants when developing emission limitations. The LAER-to-BACT ratcheting process, however, had already spread stringent non-attainment area emissions controls across the entire country. Even though the resulting regulations simply formalize the *de facto* limitations most modern facilities already meet, this process has produced more restrictive regulations than would probably exist without the ratcheting process. They also ensure that any new facility, regardless of where it is built, meets non-attainment area requirements.

Fallacies in Current MWC Regulations

Municipal waste combustor emissions have been drastically reduced. With advances in technology, MWCs achieved progressively lower emission levels, triggering on-going reductions in allowable emissions under federal, state and local regulations for new plants. These reductions came, however, at the price of increasingly higher costs both per ton of pollutant removed and per ton of waste processed. After a little more that two decades of continuous ratcheting down of regulations, MWCs have become a comparatively minor source of combustion related air pollution. Other man-made and natural sources like automobiles, trucks, power plants, fireplaces, wood stoves, metal production furnaces, industrial manufacturing processes, volcanoes and forest fires are now the major known sources of combustion related pollutants.[1]

"Real world" engineering practices require that equipment designs provide an adequate margin between expected and required performance. Safety margins are needed to ensure permit compliance regardless of the input and operating condition variations encountered during testing. Thus, facility emission test results are normally well below permitted levels.

The fact that state-of-the-art MWCs achieve ever lower emissions levels, albeit at a high cost per ton of waste processed, has been used to ratchet down emission limits. When improved emissions control technology has been installed and demonstrated, then more money must be expended to develop new technology to recreate a suitable safety margin. However, the public and business men alike are risk averse. Somebody might be willing to accept the possibility of public castigation, fines and jail terms due to violations produced by normal variability when sufficiently better emissions control technology does not exist, but abandoning the development of new MWCs is the likely consequence of such reductions. The hiatus in new MWC construction reported in the Preamble to the 1995 Emissions Guidelines for existing MWCs[2] provides strong evidence that the point of uncontrollable risk has been passed. MWCs have been effectively priced out of the market when decision makers compare their cost to the cost of much less regulated solid waste management alternatives.

Society tends to purchase the least expensive alternative believed to meet its needs. For example, when a single waste management option is singled out for disproportionately stringent pollution control, while alternative management techniques are not so burdened, prices become distorted. Shifting disposal to comparatively less regulated, hence artificially lower priced, options is the natural consequence of regulating only one of several competing alternatives. The distortion may cause environmental quality to actually decrease. Well-regulated incinerators, for example, sterilize, stabilize and reduce the volume of material requiring final disposal while recovering energy from otherwise wasted resources. Competing disposal options also involve risk, pollute the environment and consume resources. However, these alternative disposal options are not subjected to the same rigorous environmental regulations as MWCs. The potential for doing more harm than good is particularly acute when the less regulated alternatives are not well studied or simply assumed to be environmentally benign.

In addition to price distortion caused by uneven regulations, excessive regulation can result in inordinate cost to control specific pollutants. For example, EPA's cost estimate for MWC NO_x reductions is \$4,275/megagram [Mg, about 1.1 tons].[3] The proposed utility boiler rule costs only \$230/Mg of NO_x removed.[4] Because MWCs began employing LAER-like NO_x controls across the United States in the late-1980s, today they have to spend much more than the utility industry to eliminate a megagram [Mg, about 1.1 tons] of NO_x. Since utility boilers make a much larger contribution to the national NO_x burden than MWCs, on either a per-unit or industry-wide basis, society would get 19 times as much environmental improvement if the money spent reducing MWC NO_x emissions was spent on reducing emissions from utility boilers instead.

When emissions reductions do not produce discernible improvements, the point of diminishing returns has been reached. Ambient air quality studies typically find no difference between upwind and downwind pollutant concentrations at state-of-the-art MWCs and hazardous waste incinerators.[5,6,7,8,9,10] Further regulation of these pollutants is an exercise in control-for-control's-sake rather than an effort likely to produce measurable environmental gains. Spending money on more controls that do not result in detectable improvements in environmental quality simply wastes our limited resources; it does not measurably improve public health and safety or the environment.

Figure 1, known in quality assurance engineering as the Pareto Principle,[11] illustrates the point that initial emission control costs are low and pollution reduction high, while each subsequent increment of pollution reduction is increasingly costly and progressively smaller. The cost analysis accompanying the December 19, 1995 Municipal Waste Combustor regulations also illustrates the point. For facilities without acid gas control, emissions reductions cost about \$1,400/Mg of HCl and SO_2 removed. Retrofitting existing dry scrubber and electrostatic precipitator equipped facilities with fabric filters to achieve a small incremental improvement in acid gas emissions costs more than \$11,000/Mg.[12]

Lessons That Should Have Been Learned

Public and private resources are limited. There are competing national priorities. Environmental expenditures that produce minimal improvements in public health or environmental quality reduce the funds and human resources available to address other major societal needs, such as health care, education, fire and police protection, to name a few. Therefore, it is very important that environmental policy focus our nation's resources where they will produce the greatest public health benefits and do the most environmental good.

Today's implicit regulatory approach – ratcheting emissions ever downwards and uneven regulation of competing alternatives – should be reconsidered based on thoughtful answers to the following questions:

- Will increasingly stringent emissions limitations for a specific source category (e.g., incinerators) make any discernible difference in ambient air quality?
- Do less stringently regulated, hence economically preferable, options either produce greater net risk to society or consume more resources than the more strictly regulated alternative?
- Will measurable overall gains in public health, safety and environmental quality occur if society continues to ratchet down emissions well past the point of diminishing returns?

In my opinion, thoughtful answers to the above questions will result in regulations based on sound scientific and engineering principle and valid total cost accounting which will, in turn, enhance mankind's total environment. Specific recommendations are:

- Systematically compare the environmental and health impacts of all major alternatives.
- Determine the level at which emissions limitations become reasonably protective of public health and the environment.
- Scrutinize further reductions for cost effectiveness and significantly correlated health benefits.
- Base policy on properly promulgated consensus risk assessment and risk management techniques.
- Implement policies that produce the maximum public health and environmental benefits by encouraging the use of the most practicable and cost-effective combination of alternatives.
- Simultaneously regulate competing alternatives to avoid unintended biasing of the market.

Conclusion

The history of municipal waste combustor regulation provides an instructive case history of what can happen when regulatory policy loses sight of the purpose of environmental regulation. The current MWC regulations in effect tend to encourage the use of alternative, less regulated, waste disposal options. The lessons learned need to be applied to how we regulate all pollution sources based on actual impact to the environment and in a cost effective manner. It is a factor to consider in the current regulatory reform and commonsense initiatives fostered by both the Administration and the Congress.

Once protective emissions levels have been achieved, society must concentrate its resources elsewhere to get the maximum benefit from each dollar expended. Emissions limitations that exceed adequate protective levels and are unevenly applied waste society's limited money and human resources and squanders our air, land and water resources.

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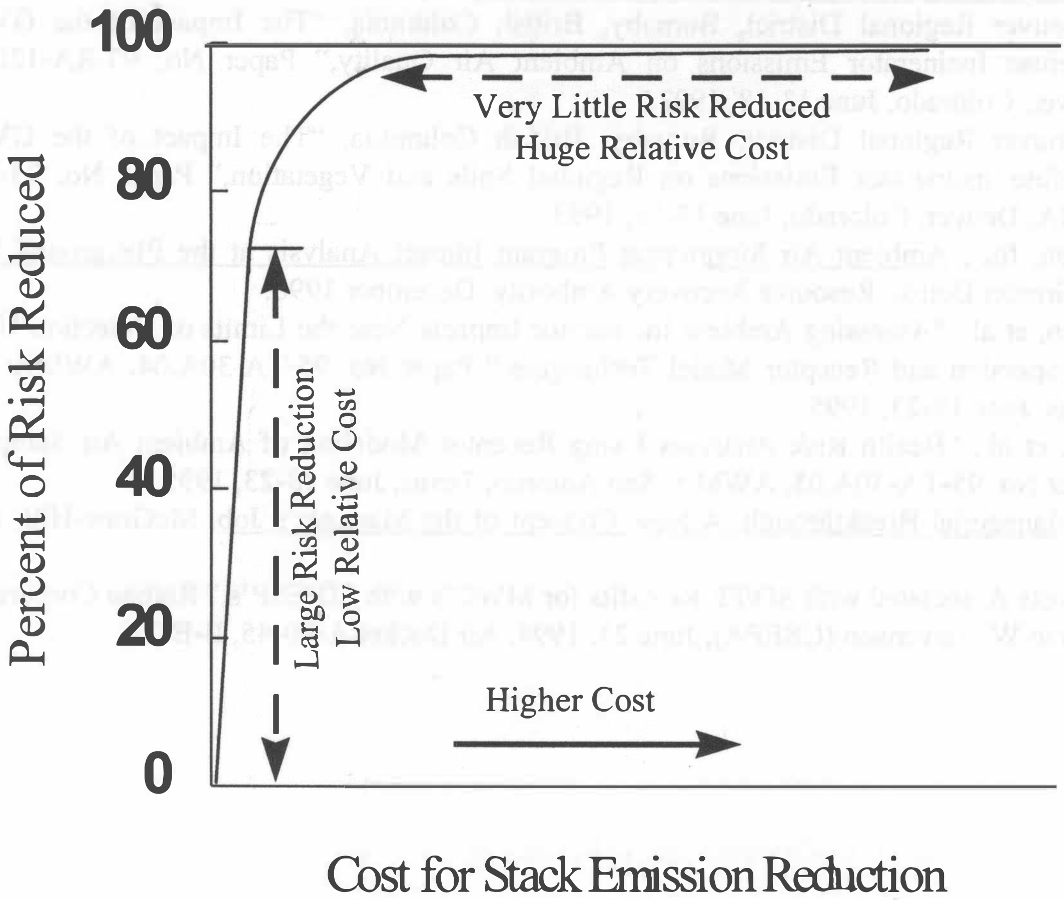
Figure 1



The Pareto Distribution
(Adapted from J. M. Juran, "Managerial Breakthrough, A New Concept of the Manager's Job") [11]