

## MANAGING THE ENVIRONMENT-AN ENGINEERING CHALLENGE

BY

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One of the major problems today is the proper allocation and management of our resources: our natural resources, our human resources, and our material resources. Environmental quality is one area in which the lack of clear-cut objectives and methods of assessing relative priorities based on sound benefit cost analyses can lead to considerable misallocation of resources and thus less actual protection for the environment.

It is not uncommon today to hear otherwise rational people from many walks of life insisting on "zero" pollution. The economic law of diminishing returns applies directly to pollution abatement. Everyone is in favour of environmental quality. The question is what degree of environmental quality do we really want, and what fraction of our resources are we willing to commit to this objective. We face some terrible decisions.

If our objective is total preservation of the natural environment, we become poor because we cannot use our very rich natural resources. If our objective is maximum production with total disregard to environmental effects, we become poor when our quality of life degenerates to an undesirable level.

Because of the high level of public awareness and the pressure by certain interest groups, politicians and regulatory officials sometimes play the dangerous game of "can you top this" in matters of environmental requirements without concern for the economic impact. Optimal solutions to the problems can be found only in a rational systems analysis, not by striking out indiscriminately at polluters.

Here is the challenge. Effective control of wastes must be devised on a multi-disciplinary basis. Engineers need a broader understanding of natural eco-systems and a more humanistic approach to their problem solving. Scientific

professionals need a systems interpretation of their work and an introduction to engineering processes that make our world inhabitable for people. Social scientists need a more quantitative basis for placing society's problems into the focus of the decision process.

If governments and industry had unlimited funds, most environmental problems would be simple to solve. But since funds are limited, it is necessary to develop a basis for determining the priorities upon which the available funds are to be spent. In approaching the problem as a system, it is necessary to account for all its aspects. Economic, political, moral and even selfish or seemingly irrational elements must eventually be considered.

In order to develop a rational plan to manage our environment, all stakeholders, including the public, must understand that all environmental impacts must be evaluated quantitatively. To do this requires acceptance of four basic principles as follows:

1. There is no such thing as zero risk. Therefore, risks must be evaluated on a comparative basis.
2. There is no such thing as zero pollution. Therefore, the impact of any pollutant must be evaluated on a quantitative basis and a benefit-cost analysis prepared for each alternative pollution control scheme.
3. Resources that can be applied to pollution control are not unlimited. Therefore, it is essential that whatever resources (both public and private) are utilized to protect the environment must be allocated in a manner to assure the maximum benefit for the cost incurred.
4. We can't know all the answers before decisions are made. Proposals should be assessed on the basis of the best

scientific information available at the time, and decisions should be based on thorough cost-benefit and risk analysis.

Cost effective measures which vary with regional conditions have often been rejected by pressure groups. Some argue for fixed, stringent abatement and some object to variable standards that do not fall equally on all polluters. Some also claim that cost benefit evaluations are too difficult to make, too complex to enforce and too sophisticated for our legal system. These are all valid concerns; however, the potential benefits of a rigorous benefit-cost analysis are so great that even a partial application of this principle would result in greater improvements to the environment.

We have much to accomplish before reaching a satisfactory compromise with our overburdened environment. Sheer economic necessity will force a cost-benefit optimization at some point short of zero emissions. In the long term, compromise will only be achieved by a mixed strategy of optimal abatement, adequate monitoring and preventative episode control based on accurate forecasting. We must organize appropriate research for such forecasting and we must use the research available in a rational systems approach.

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#### PRIORITY ISSUES

The Academy asked its members to list the engineering issues which are, in their view, the most important for 1992. Here are their answers in order of priority.

- 1 Industrial productivity and efficiency.
- 2 Innovation and global competitiveness.
- 3 Engineering education and manpower.
- 4 Environmental pollution control.
- 5 Waste management.
- 6 Renewable resource development.
- 7 Urban and transportation infrastructure.
- 8 Energy efficiency and conservation.
- 9 Non-renewable resource conservation.
- 10 Sustainable electric energy supply.

Some of these matters will be addressed in future mailings of **ENGINEERING ISSUES**.

#### From the President:

This is the first edition of **ENGINEERING ISSUES**, an important public initiative of the Canadian Academy of Engineering.

The expression of public concern over such technical and environmental matters as energy, water, waste and pollution frequently fails to include consideration of the many factors which must be balanced in arriving at a sound judgement of appropriate action. The underlying objective of **ENGINEERING ISSUES** is to inform the public, providing facts and considerations that need to be woven into public decision-making in these matters.

Media articles and public statements frequently speak of science and technology with no reference to the central bridging role of engineering. It is hoped that, through this publication, the insight, experience and the judgment of leading professional engineers may be made more readily available to the public in addressing some of the difficult issues which we face.

Concerned individuals and the media are invited to contact the authors, editors and other persons identified in these **ISSUES** for further information.

Camille Dagenais, President

This is a publication of the Canadian Academy of Engineering whose Fellows volunteer to provide reliable and timely information to the Canadian public on issues which are important to safety, health and public policy. Each issue is reviewed by a panel consisting of Earl H. Dudgeon, (613)733-8054, Gerald G. Hatch and Gerald R. Heffernan, (416)925-9270.

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