

Environmental Assessments and Trends: What You Should Know and How They Affect You!

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Introduction

Regulatory agencies use environmental assessments as the best available indicators of information on national conditions and trends in air, water, land, human health, and ecological systems. The results from these assessments are used in legislative discussions and proceedings to promulgate laws and regulations which have far reaching impacts and consequences on many industries and companies across the country.

To arrive at the health of the environment, United States Environmental Protection Agency (USEPA) uses risk assessment to characterize the nature and magnitude of health risks to humans (e.g., residents, workers, and recreational visitors) and ecological receptors (e.g., birds, fish, other wildlife) from chemical contaminants and other stressors that may be present in the environment. Similarly state agencies use risk assessment strategies to develop environmental standards.

While there are many definitions for “risk”, USEPA considers risk to be the chance of harmful effects to human health or to ecological systems resulting from exposure to an environmental stressor. Also, according to USEPA, a stressor is any physical, chemical, or biological entity that can induce an adverse response. Stressors may adversely affect specific natural resources or entire ecosystems, including plants and animals, as well as the environment with which they interact.

As per USEPA, those who are in a position to help and decide to protect humans and the environment from stressors or contaminants are called “risk managers” which include:

- Federal or state officials whose job it is to protect the environment,
- Business leaders who work at companies that can impact the environment, or
- Private citizens who are making decisions regarding risk.

Risk Assessment

Risk assessment is performed in two distinct areas: human health and ecological risk. A human health risk assessment is the process to estimate the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media, now

or in the future. On the other hand, an ecological risk assessment is the process of evaluating how likely it is that the environment may be impacted as a result of exposure to one or more environmental stressors such as chemicals, land change, disease, invasive species and climate change.

Risk assessment is a scientific process. There are some factors when considering risk:

- How much of a chemical is present in an environmental medium (e.g., soil, water, air),
- How much contact (exposure) a person or ecological receptor has with the contaminated environmental medium, and
- The inherent toxicity of the chemical.

Important factors such as variability, uncertainty and probabilistic modeling should be considered since any one of these factors can affect risk assessment outcomes and key indicators. These factors are briefly discussed below.

Variability - Refers to the range of toxic response or exposure. For example, the dose that might cause a toxic response can vary from one person to the next depending on factors such as genetic differences, preexisting medical conditions, etc. Exposure may vary from one person to the next depending on factors such as where one works, time spent indoors or out, where one lives, how much people eat or drink, etc.

Uncertainty - Refers to our inability to know for sure - it is often due to incomplete data. For example, when assessing the potential for risks to people, toxicology studies generally involve dosing of sexually mature test animals such as rats as a surrogate for humans. Since we don't really know how differently humans and rats respond, EPA often employs the use of an uncertainty factor to account for possible differences. Additional consideration may also be made if there is some reason to believe that the very young are more susceptible than adults, or if key toxicology studies are not available.

Probabilistic Modeling, a related term, is a technique that utilizes the entire range of input data to develop a probability distribution of exposure or risk rather than a single point value. The input data can be measured values and/or estimated distributions. Values for these input parameters are sampled thousands of times through a modeling or simulation process to develop a distribution of likely exposure or risk. Probabilistic models can be used to evaluate the impact of variability and uncertainty in the various input parameters, such as environmental exposure levels, fate and transport processes, etc.

Results from human health and ecological risk assessments are used not only to evaluate the health of the environment, but they offer how key indicators (pollutants, chemicals or toxins) are trending.

As per USEPA's 2008 Report on the Environment, brief discussions of some of key indicator trends are provided below.

Outdoor Air - Nationwide, emissions of criteria pollutants (or the pollutants that form them) due to human activities have decreased. Between 1990 and 2002, emissions of carbon monoxide, volatile organic compounds (which lead to the formation of ozone), particulate matter, sulfur dioxide, and nitrogen oxides (which lead to the formation of ozone and particulate matter) decreased by differing amounts, ranging from 17 to 44 percent. For lead, emissions have

decreased by 99 percent, but this reduction is based on data that span a longer time frame (1970 to 2002).

Outdoor air concentrations of carbon monoxide, lead, nitrogen dioxide, ozone, and particulate matter have decreased over the decades during which the current nationwide monitoring network has operated. These reductions are consistent with the observed decreases in emissions mentioned above. In most or all of the United States, outdoor air concentrations of carbon monoxide, lead, and nitrogen dioxide have decreased such that levels now meet EPA's standards to protect human health and the environment. Though outdoor air concentrations of ozone and particulate matter have decreased nationwide, concentrations still exceed EPA's standards for either or both pollutants in dozens of metropolitan areas.

For selected air toxics, emissions due to human activities and outdoor air concentrations have decreased. Nationwide, emissions summed across all 188 air toxics decreased between 1990 and 2002. This includes a 52-percent reduction in mercury emissions. Monitoring networks are extensive enough to determine corresponding national trends in outdoor air concentrations of benzene, which decreased 55 percent between 1994 and 2006.

National indicators are not available for other aspects of outdoor air quality. While indicators provide insights on emissions and outdoor air concentration trends for many pollutants, monitoring networks are not yet extensive enough to determine national trends in concentrations for all pollutants, including many air toxics. Further, the indicators are limited in quantifying how exposures to single pollutants and mixtures of air pollutants affect human health and the environment. Although strong evidence links outdoor air pollution to health effects at specific locations, few long-term studies at a national scale have measured the extent to which health effects are linked directly to outdoor air quality.

Acid Rain and Regional Haze - Nationwide, emissions of the main pollutants that form acid rain decreased between 1990 and 2002. Emissions of sulfur dioxide due to human activities decreased by 37 percent, and emissions of nitrogen oxides due to human activities declined by 17 percent. Acid rain, as measured by wet deposition of sulfates and nitrates, decreased across most of the country from 1989 to 2006. Consistent with emissions data, average regional decreases in wet deposition of sulfate during this time were 35 percent in the Northeast, 33 percent in the Midwest, 28 percent in the Mid-Atlantic, and 20 percent in the Southeast.

Wet deposition of nitrate also decreased in some parts of the country, but to a lesser extent than wet deposition of sulfate. Many surface waters in the Adirondack Mountains, New England, and the northern Appalachian regions became less acidic between the early 1990s and 2005. This change corresponds to a decrease in acid rain in these regions. While acidic surface waters are still found in these areas, some surface waters are showing signs of recovery.

National indicators are not available to track trends in other ways that acid rain has harmed the environment or human health. Regional haze in 38 National Parks and Wilderness Areas improved between 1992 and 2004, with the average annual visual range (or distance that one can see) gradually increasing. On average, the West has substantially better visibility than the East due to regional differences in air pollution and the greater humidity in the East. National indicators have not been developed to track visibility in cities or other populated areas.

Ozone Depletion - Stratospheric ozone over North America decreased through the 1980s and early 1990s, but has started to recover. Before the late 1970s, there was little change, beyond natural variations, in the thickness of the ozone layer over North America. Since then, the

thickness of the ozone layer decreased, reaching its lowest level in 1993, with no further decline occurring in more recent years. While the ozone layer has begun to recover, ozone levels over North America during 2002 to 2005 were still 3 percent lower, on average, than those observed 20 years earlier.

Tropospheric concentrations of total ozone depleting substances have been slowly declining. Between 1995 and 2006, total ozone-depleting substances in the troposphere have declined 12 percent, and this decline has contributed to the recent recovery in stratospheric ozone levels. The trends for individual ozone-depleting substances vary. Tropospheric concentrations of many ozone-depleting substances have declined since the early 1990s, but concentrations of halons (fire extinguishing agents) and hydrochlorofluorocarbons (HCFCs), a class of chemicals being used to replace CFCs, increased.

Greenhouse Gases - Global atmospheric concentrations of several important greenhouse gases have risen substantially over the past 100 years. Measurements of gases trapped historically in Antarctic ice confirm that the current global atmospheric concentrations of carbon dioxide and methane are unprecedented over the past 650,000 years, even after accounting for natural fluctuations. Concentrations of nitrous oxide are 18 percent higher than pre-industrial levels; and concentrations of certain synthetic chemicals were essentially zero a few decades ago, but increased rapidly between 1980 and 2006. Between 1990 and 2005, U.S. greenhouse gas emissions from human activities rose 16 percent; the primary source of these emissions was fossil fuel combustion. Carbon dioxide, widely reported as the most important greenhouse gas, makes up most of this increase. Energy use, primarily electricity generation and transportation, accounted for approximately 85 percent of the U.S. greenhouse gas emissions in 2005.

While trends in U.S. emissions and global atmospheric concentrations of greenhouse gases are based on robust data, gaps remain. For both emissions and concentrations, trends have been quantified for several of the most important greenhouse gases, but not for every greenhouse gas.

Water - Since 1960, more than half of the rivers and streams measured nationwide have shown major changes in the volume of high and low flows over time. In largely arid grasslands and shrub lands, the percentage of streams with no-flow periods decreased slightly between 1960 and 2006, along with the average length of no-flow periods.

Fresh surface waters show a mixed picture of chemical condition. Acidity has decreased since the early 1990s in lakes and streams in most regions sensitive to acid rain, although one region showed little change. Approximately 30 percent of the nation's wadeable stream miles contain high nitrogen and phosphorus concentrations. Over the last several decades, nitrate loads increased in the Mississippi River. Phosphorus loads decreased in the St. Lawrence and Susquehanna Rivers, but showed no clear trend in the Mississippi or Columbia rivers.

The extent of surface waters and many key stressors are not currently tracked by national indicators. Key stressors include pollution from various sources and toxic contaminants in sediments, which can impact water quality and potentially enter the aquatic food web.

Land - Forest cover and agriculture are the two most common types of land cover in the United States. In 2001, of the approximately 2.3 billion acres of land in the nation, 641 million acres were forest cover, 449 million acres were agriculture, 419 million acres were shrub, 291 million acres were grass, and 103 million acres were developed land. These estimates were derived from satellite data.

The total amount of forest in the United States declined over the last century, but has been increasing in recent years. Regional variations exist. Forest cover has increased in the Northeast, Mid-Atlantic, and Midwest, and decreased in the West and Southwest. Comparing and integrating land cover information is difficult. Different agencies collect data on land cover, often at varying times and for different purposes. These agencies also define and classify land cover differently and at varying levels of detail. The most recent comprehensive data available are from 2001.

Waste and the Environment - Since 1990, the per capita municipal solid waste generation rate has remained stable at four-and one-half pounds per person per day. As the U.S. population has increased, however, the nation has steadily generated more municipal solid waste. Generation increased from 88 million tons in 1960 to 251 million tons in 2006. Hazardous waste generation has declined. Hazardous waste generation dropped from roughly 36 million tons in 1999 to 28 million tons in 2005. Recycling or composting of municipal solid waste increased from 6 percent to 33 percent since 1960. Hazardous waste recycling rose only slightly between 1999 and 2005 and remains at less than 10 percent. Most waste is still disposed of on land. In 2006, 55 percent of municipal solid waste was disposed of in landfills, compared to 94 percent in 1960. Of the hazardous waste disposed of on land in 2005, 90 percent was injected deep into the ground in permitted wells, and the remaining 10 percent was treated and disposed of in a manner to minimize risk to human health and the environment.

Information about many types of waste is not currently available at the national level. Also, data are lacking about exposure and the effects of waste and management practices on human health and the environment. The potential effects associated with waste vary widely and are influenced by the substances or chemicals found in waste and how they are managed.

Chemical Applied and Released to Land - The amount of certain toxic chemicals in industrial waste materials decreased by more than 4 billion pounds (16 percent) between 1998 and 2005. In 2005, the United States handled 1.1 billion pounds of PBT chemicals in industrial waste, along with 24 billion pounds of other toxic chemicals that are subject to reporting to EPA under the Toxics Release Inventory (TRI) program. The metal mining industry has accounted for 35 percent of the total TRI chemicals in production-related wastes released to the environment since 1998.

Over the past 45 years, the use of fertilizers, including nitrogen, phosphate, and potash, has increased nearly three-fold. The combined use of these three chemicals rose from 46 pounds per acre per year in 1960 to 138 pounds per acre in 2005. Nitrogen accounted for the steepest increase. While fertilizers are not inherently harmful, they have the potential to contaminate ground and surface water when applied improperly or in excessive quantities. In annual surveys conducted since 1994, 42 to 71 percent of food samples have shown detectable amounts of pesticide residue. A small fraction of samples (approximately 1 out of every 500) had pesticides at concentrations that exceeded tolerance levels designed to protect human health. Foods tested include fruits, vegetables, grains, meat, and dairy products.

Data about chemicals used on land are limited. Some data are available on pesticide and fertilizer use on agricultural lands. Agencies collect national information on only a fraction of all chemicals used in the United States, however. Consistent national indicators are lacking regarding when, where, and how frequently chemicals are applied to land and the potential impact when they contain toxic ingredients.

Health Status - Overall, the health of the U.S. population has continued to improve. Mortality rates continue to decline, and life expectancy continues to increase, due to factors such as improved medical care over the past few decades.

Life expectancies in the United States are lower, however, than in many other countries. In 2004, the United States ranked 35th in life expectancy for men and women among the 192 nations and states that are members of the World Health Organization.

The three leading causes of death in the United States—heart disease, cancer, and stroke—remain unchanged since 1999. Measures of premature death show that injuries are the leading cause of death, followed by cancer and heart disease. Infant mortality in the United States shows a long-term decline, although it remains among the highest in the industrialized world at nearly seven deaths per every 1,000 live births in 2004. U.S. infant mortality rates were two to three times higher than the lowest rates reported worldwide.

Given that promulgated regulatory cleanup, discharge and health standards are derived from risk assessments and trends, companies are encouraged to participate in the regulatory deliberation processes. This can be done through industry association or as a company, an interested citizen or a community. Cost of regulatory compliance is expected to increase exponentially. Also, enforcement trends are not in favor of companies. Added fines, investigations, remedies and agency responses substantially erode company's valuable assets. This means that environmental, safety and health professionals should assume a greater role in ensuring that they:

- Are actively involved in reviewing proposed rules or amendments to existing rules because uncertainty and variability factors and particularly modeling assumptions can drive regulatory decisions that drive cost of doing business.
- Remain proactive on performing environmental assessments to establish environmental liabilities.
- Conduct remedies following prudent risk assessment processes.
- Proper structuring and implementation of new rules and regulations.

Regulations

According to The Hill's Congress Blog of February 11, 2013 "Since 2012 Election Day alone, Washington has issued over 800 new rules. Additionally, according to a recent George Washington University and Washington University analysis, in 2012 there were 283,615 full-time government employees dedicated to drafting and enforcing regulations, while fewer than 50 employees at the Office of Management and Budget were responsible for reviewing the new regulatory mandates to ensure they are justified and accurate prior to implementation."

According to a new study released in November 2012 by the National Association of Manufacturers and published at the Energy and Commerce Committee website finds that "Major new EPA rules could cost manufacturers hundreds of billions of dollars and eliminate millions of American jobs. The study examines the cumulative impact of EPA's new layers of red tape that are burdening job creators with high costs and driving up energy prices. The authors warn EPA's actions will prohibit job creation and investment and could cripple our economic recovery.

The report analyzes the cumulative cost of new major EPA rules affecting our nation's power sector, including the Utility MACT Rule, the Boiler MACT Rule, the Coal Ash Rule, the

Coal Combustion Residuals Rule, the Cooling Water Intake Structures Rule, the Cross-State Air Pollution Rule, and the anticipated new National Ambient Air Quality Standards for Ozone.

The report finds compliance costs for the six regulations could total up to \$111.2 billion by EPA estimates and up to \$138.2 billion by industry estimates. Total capital expenditures are projected at \$174.6 billion to \$539.3 billion according to EPA data and from \$404.5 billion to \$884.5 billion according to industry.”

As stated in the report “EPA’s expansion of red tape is strangling job creators and American consumers at a time when they can least afford it. This report offers further evidence that EPA’s policies will hinder our economic recovery and the growth of American manufacturing,” said Energy and Power Subcommittee Chairman Ed Whitfield (R-KY). “Rather than burdening American businesses with high compliance costs and uncertainty, we need commonsense policies that will foster investment and help bring manufacturing jobs back to America.”

In conclusion, we can better meet the goals of both preserving and protecting our environment and promoting economic growth and prosperity across our land by having efficient, accountable, and fair regulatory system that incorporates improved risk assessment process, elimination of redundant rules, common sense cost-benefit analysis, regulatory reform and enforcement priorities. Overregulation imposes enormous hidden costs on our economy. It creates huge compliance costs on businesses, which in turn slows economic growth and constrains job creation. The cost on our economy continues to grow, as mountain of federal rules and regulations continues to grow. Therefore, in light of the persistent economic recession and growing national deficit, we can not continue to improve the health of the environment that we all are striving for.

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