INTERGENERATIONAL EQUITY AND ENVIRONMENTAL RESTORATION CLEANUP LEVELS

E.K. Hocking, Argonne National Laboratory

ABSTRACT

Intergenerational equity refers to the fairness of access to resources across generations. Environmental restoration cleanup levels can have unintended and unfair consequences for future generations' access to resources. On first impression, it would appear that the use of low, non-risk-based cleanup levels in this generation's efforts to remediate sites with environmental contamination would benefit future generations and thereby contribute to intergenerational equity because we would be passing on a better and safer environment to future generations. It is possible, however, that this generation's use of very low cleanup levels could contribute to intergenerational inequity on at least two counts.

The potentially higher costs associated with using low, non-risk-based cleanup levels for remediation may divert funding from other activities that could have a greater beneficial impact on future generations. The environmental restoration problem does not exist in a vacuum in society; infrastructure development, national security, urban sprawl, and health research are just a few of the other pressing issues that should be addressed to the benefit of present and future generations.

Low, non-risk-based cleanup levels could also result in more damage to the nation's resources than would occur if a higher cleanup level were used. As cleanup levels lower, more areas may undergo restoration, resulting in damage to or destruction of natural and cultural resources. The loss or impairment of these resources could have an inequitable effect on future generations. However, intergenerational inequity could arise if sites are not completely restored and if access to and use of natural and cultural resources are unfairly limited as a result of residual contamination.

In addition to concerns about creating possible intergenerational inequities related to selected cleanup levels, the tremendous uncertainties associated with sites and environmental restoration can lead site planners to rely on stewardship as a default position. An ill-conceived stewardship plan can contribute to intergenerational inequity by limiting access to resources while passing on risks to future generations and not preparing them for those risks.

Equity among generations may be achieved through a well-developed stewardship plan that provides future generations with the information they need to make wise decisions about resource use. A well-developed stewardship plan would account for the failure mechanisms of the plan's components, feature short stewardship time blocks that would allow for periodic reassessments of the site and of the stewardship program's performance, and provide present and future generations with necessary site information.

INTRODUCTION

In 1994, the U.S. Department of Energy (DOE or Department) requested advice from the National Academy of Public Administration (NAPA) on how it could integrate a fair, intergenerational balancing of the risks, costs, and benefits associated with its decisions into its decision making processes. (1) The Department was particularly interested in how intergenerational issues could be addressed in making environmental remediation decisions. The NAPA realized that responding to DOE's request could "only be dealt with by answering the more fundamental question of what obligations one generation owes to those that follow." (1)

A gentle but forceful answer to that fundamental question could be the following statement by Oren Lyons of the Onondaga Tribe:

> In our way of life, in our government, with every decision we make, we always keep in mind the Seventh Generation to come. It's our job to see that the people coming ahead, the generations still unborn, have a world no worse than ours – and hopefully better. When we walk upon Mother Earth we always plant our feet carefully because we know the faces of our future generations are looking up at us from beneath the ground. We never forget them. (2)

Less poetically but still powerfully, the Economic Declaration of the 1990 Economic Summit of Industrialized Nations answered NAPA's fundamental question by stating, "One of our most important responsibilities is to pass on to future generations an environment whose health, beauty, and economic potential are not threatened." (3)

Even less poetic, but more succinct, is the definition that is used here for what one generation owes another. The term used for that concept is "intergenerational equity," which is defined as the fairness of access to resources across generations.

Intergenerational equity is clearly a moral concept. As such, it might easily be dismissed as irrelevant to discussions on determining cleanup levels for contaminated sites. After all, restoring the environment is more of a legal than a moral issue because it is driven by laws, regulations, and executive orders.

But the degree to which parts of the environment are restored or not restored, though driven in many cases by technological and scientific limitations, also has a moral overtone. The selected cleanup level for a site may result in the transfer of risk. Risk could be transferred from one geographic community to another or from the larger community to site workers. Risk may also be transferred from one generation to another, resulting in intergenerational inequity.

ENVIRONMENTAL RESTORATION AND INTERGENERATIONAL EQUITY

Intergenerational inequity in the context of environmental restoration could arise in at least three ways. First, the drive to achieve complete restoration or cleanup to very low levels at some sites could result in the disproportionate diversion of funding from other national issues that could have greater beneficial impact on future generations. Second, the attempt to achieve complete cleanup or cleanup to very low levels at some sites could lead to damage to or destruction of natural and cultural resources. Future generations would thus be deprived of benefiting from these resources. The third way in which intergenerational inequity could arise is through reliance on site stewardship without giving adequate consideration to its risks and costs and the systems that must be in place to support a stewardship program.

Diversion of Funding

The amount of contaminated land held by federal, state, and private parties and the seriousness of some of the contamination are not problems to be taken lightly. Present and future generations could be harmed if the problems are not adequately addressed. But the problem of environmental restoration does not exist in a vacuum in the nation. It is, unfortunately, just one of many national issues that merit serious attention. National and international security, urban sprawl, energy use and supply, health delivery systems and research, and infrastructure development are only a few of the serious and high-price-tag problems facing the nation and competing for funding.

If the nation should very heavily invest in environmental restoration, it might do so at the expense of investing in other problems for which the solutions could provide greater long-term benefits and have lower costs. With a few exceptions, however, Congress generally does not deliberate on how to invest the nation's resources to ensure the biggest benefit to future generations. Rather, budget allocation decisions are more likely to be political decisions with shorter-term goals and benefits. Thus, it is unlikely that environmental restoration would be heavily funded to the detriment of other national issues with greater benefit to future generations.

It is possible, however, that Congress, with its orientation toward shorter-term goals, could control the Department's decisions about priorities for site restoration by funding certain activities over others. Intergenerational inequity could arise if restoration funding were diverted from sites with high potential risk to sites with relatively lower risk.

Harm to Natural and Cultural Resources

Intergenerational inequity could also arise if the environmental restoration activities were to damage or destroy natural or cultural resources, thus foreclosing or limiting their use by future generations. Alternatively, not completely restoring a site will result in some restricted uses of cultural and natural resources by future generations.

The term "cultural resources" is used broadly here. It obviously includes the resources protected by cultural and historic preservation laws and executive orders. Thus, it includes sites, buildings, structures, and objects that are significant in American history, culture, or archaeology. The term also includes materials such as pottery, weapon projectiles, tools, rock carvings, graves, and human skeletal remains, and it is used to encompass plants, animals, and geo-forms that are culturally significant but possibly not directly protected by law. Damaging or destroying these items could have a harmful effect on the quality of life of present and future generations. (4, 5)

Natural resources, such as sensitive ecosystems, water bodies, or wetlands, could be damaged through environmental restoration activities, thus foreclosing their future use. However, nonrestoration of a site could also lead to restricted access to and use of culturally significant items and areas, minerals, fossil fuels, valuable land, or water bodies by future generations. Integrating the intergenerational equity aspects of natural and cultural resources into the environmental restoration decision-making process could result in a classic lose-lose situation: full restoration of the site could lead to intergenerational inequity, and nonrestoration of the site could lead to intergenerational inequity, too.

This dilemma, however, may pale in comparison to the uncertainty associated with the cost, human health risk, and scientific or technological understanding associated with restoration alternatives, regardless of the cleanup levels. Legitimate concerns about all these uncertainties can lead decision-makers to accept site stewardship as the preferred alternative by default.

Stewardship as the "Convenient" Solution

For many sites, stewardship will be the only reasonable alternative. It will be a reasonable choice in light of the uncertainties associated with present and future site conditions and site contaminants, the performance of available technologies, the nonavailability of technologies, and the risk and cost associated with restoration.

Because stewardship would be instituted at sites with residual contamination, some use restrictions would be imposed on site use. These use restrictions could result in intergenerational inequity. For example, although the site surface might be usable for grazing or recreational purposes, use of the subsurface might be completely restricted, thereby curtailing mineral mining and drilling of water, oil, and gas wells.

Greater intergenerational inequity, however, could result from stewardship programs that are too simply conceived. "Convenient" stewardship plans can have this propensity toward inequity for two reasons. First, the plan might not adequately address the uncertainties and failure mechanisms associated with stewardship, thereby creating the potential for great human and ecological harm and high cost. Second, the plan might not include an information management system that captures, preserves, and disseminates the data present and future generations will need to make decisions related to the site and its use.

Site A/Plot M in Illinois is a good example of the effects of the failure to pass on adequate information. Site A is a 19-acre burial site for two reactors--one of which was the reassembled CP-1 (Chicago Pile-1) reactor from the University of Chicago. Plot M is a 1-acre burial site for radioactive and potentially contaminated materials from radiobiological and radiochemical operations conducted at the University of Chicago and Site A. In the mid-1990s, $12 million was spent to recharacterize the site and $1 million was spent on restoration activities. Site A/Plot M had last been characterized in the late 1970s. If information from that earlier characterization had been available, the cost of the later recharacterization might have been avoided or substantially reduced.

NATIONAL ACADEMY OF PUBLIC ADMINISTRATION PRINCIPLES FOR INTERGENERATIONAL DECISION MAKING

In response to the DOE request, the NAPA identified four principles for intergenerational decision making. The NAPA principles and their definitions are as follows:

> Trustee Principle: Every generation has obligations as trustee to protect the interests of future generations.
>
> Sustainability Principle: No generation should deprive future generations of the opportunity for a quality of life comparable to its own.
>
> Chain of Obligation Principle: Each generation's primary obligation is to provide for the needs of the living and next succeeding generations.
>
> Precautionary Principle: Actions that pose a realistic threat of irreversible harm or catastrophic consequences should not be pursued unless there is some compelling countervailing need to benefit either current or future generations. (1)

The NAPA also stated its belief that the principles must be applied through a decision-making process that actually results in decisions and not just analysis. The process must be open and transparent, honest and realistic, and involve public participation at all crucial stages. The process must be capable of dealing with many values and interests, and it must be "linked" to the current structures, institutions, and decision processes that can influence risk mitigation. Both benefits and risks must be considered in a balanced way, and the process should be capable of distinguishing intolerable risks from modest risks. The process should recognize that the intergenerational obligation entails opportunities as well as risks. Finally, the process must be continuous in that there is a "'rolling' present responsibility flowing from one generation to the next without a break." (1)

ACHIEVING INTERGENERATIONAL EQUITY IN STEWARDSHIP PROGRAMS

As indicated earlier, stewardship will be the legitimately preferred environmental restoration alternative for many sites and for many reasons. But in an effort to try to achieve the optimum in intergenerational equity, all the complexities of stewardship must be examined and confronted in order to avoid "convenient" stewardship. The NAPA principles and processes should be incorporated into stewardship planning. Basically, stewardship planning should be qualified or conditioned by the needs of future generations.

The needs of future generations could best be met through stewardship planning that would first take into account the failure mechanisms associated with the components of stewardship and that would then design strategies to address them. The plan should be built around small blocks of time (20 years, possibly) that would allow for more realistic and believable assessments and reassessments of the risks and costs of stewardship. Lastly, present and future generations should have access to the information that would allow them to make wise decisions about the site.

Stewardship planning requires determining the components of the plan. Just as importantly, the planning requires identifying how these components can fail and then designing systems that minimize the likelihood of those failures or their severity.

The components of a stewardship plan include the containment system (natural or engineered) used to restrict contaminant release and the land use controls (engineered barriers, institutional controls) used to restrict site use or access. Additional components are a monitoring system, to observe and record the performance of all components of the stewardship plan, and an information management system, to gather, store, and disseminate site and stewardship information. The remaining component is the organizational system put in place to ensure that all the other components are functioning properly and to complete periodic site and stewardship assessments.

Component failure could arise, for example, from the obsolescence of the engineered containment system (e.g., the life expectancy of the cap or barrier is reached but the contained contaminant is still hazardous) or the inability of the monitoring system to detect changes in contaminant characteristics. It could also arise from the improper issuance of a well drilling permit, perhaps because the county clerk's office failed to maintain a record of the well drilling restriction. Neglecting to identify and evaluate potential component failure mechanisms and then account for them in the stewardship plan could result in future generations bearing the risk of exposure to hazardous substances and the cost of addressing any releases of those substances.

Developing, implementing, managing, and periodically evaluating stewardship plans that take into account future generations' needs will be more reasonably undertaken if the stewardship program is thought of as a series of short time blocks spread out over a long time frame. Site stewardship planners will probably be dealing with a variety of hazards with different time frames and different risks. They will be making decisions about these hazards on the basis of an inadequate understanding of natural processes through time. Their knowledge about future demographics, economies, technologies, scientific advancements, community preferences, conceptions of risk, and resource needs will also be uncertain.

Given the range and complexity of these unknowns, it would be presumptuous for most sites to pretend to develop a single, static stewardship plan that would be expected to endure and be protective for as long as the hazards would pose a possible threat. Such a plan could expose future generations to human, ecological, and financial harm.

It should be much easier and more ethical to develop a plan that would be built on shorter time horizons and goals. Such a plan would acknowledge uncertainties and should be much more defensible to regulators and members of the public who are concerned about the true risks and costs of stewardship. Such a plan would be built on periodic reassessments of the risks and costs associated with stewardship.

Projecting site risks to human health and the environment far into the future in the face of great uncertainty would likely be too speculative an exercise to be comfortably accepted by regulators and the public--in both this and future generations. Shorter-term (20 years possibly) estimates of the risk posed by the site based on assessments of site, off-site, and contaminant characteristics and stewardship performance would be more likely to be acceptable.

Estimates of the financial costs of stewardship also might be more readily accepted by regulators and the public if they were based on short time frames and periodically reassessed. Cost estimates of stewardship can be calculated to be surprisingly small, as opposed to the cost of full or partial cleanup, depending on the discount rate that is used. For example, if the gross domestic product of the world is expected to be $8 quadrillion in the year 2200, the present value of that amount (using the 7% discount rate recommended by the Office of Management and Budget) is $10 billion. Therefore, it would not be reasonable for the world to expend more than $10 billion now on a measure that would prevent the loss of the entire gross domestic product of the world in 200 years. Rather, the $10 billion could be invested now at a rate of 7% that, in 200 years, would be a greater amount than the expected gross domestic product. (6) Use of a reasonable discount rate, periodic reassessments, and shorter time horizons to calculate the cost of stewardship might avoid the problem of underestimating the cost of stewardship.

Designing stewardship as a series of time blocks and periodically reevaluating the site and stewardship performance could also help inform the public. Such an informed public could contribute to success of the stewardship plan in at least two ways. First, a public who believes it is well-informed about the hazards posed by a site--because the risk assessments are based on reasonable time frames--would be less likely to demand costly recharacterization of a site (outside the periodic site and stewardship performance assessments). Second, a well-informed public would be more likely to be aware of site land use restrictions and aid in their enforcement. If it is fairly common knowledge that home construction is not allowed on the site, any such construction might first be noticed by community members, who could call it to the attention of the proper officials.

However, a well-informed public, regulators, and those who evaluate stewardship performance all depend on an information system that can generate and disseminate valid and reliable data. Stewardship at many sites will continue far into the future. Thus, future generations will be required to both continue the stewardship programs we have begun and respond when the stewardship program is ineffective. In order to efficiently and effectively carry out these functions, these future stewards will need accurate and accessible information on, among other things, site physical characteristics, the nature and extent of site contaminants, prior decontamination efforts, history of site processes and operations, and containment system designs. Failure to provide this and other relevant information to future generations subjects them to the costs and risks of stewardship failure, site recharacterization, and re-remediation.

The iterative nature of stewardship presented here is hardly new. It has been endorsed by NAPA (1) and, most recently, the National Research Council (7). The effectiveness of an iterative approach to stewardship can be attested to by the continual existence of the Shinto Shrine at Ise, Japan, since its original construction circa 4 A.D. The shrine has been reconstructed approximately every 20 years since its original construction. It has been described as an example of "an unbroken lineage of structure, records, and tradition." (8)

REFERENCES

(1) National Academy of Public Administration, "Deciding For The Future: Balancing Risks, Costs, and Benefits Fairly Across Generations," April 1995.

(2) S. WALL, and H. ARDEN, "Wisdomkeepers: Meetings with Native American Spiritual Elders," cited in National Conference of State Legislatures, "Closure for the Seventh Generation: A Report from the Stewardship Committee of the State and Tribal Working Group," February 1999.

(3) Economic Summit of Industrialized Nations, Principle 62, 1990.

(4) A.L. YOUNG, E.K. HOCKING, and C.W. MCGINN, "Commentary on Cultural Considerations in Risk Assessment: An Ethical Responsibility," Environmental Toxicology and Risk Assessment: Recent Achievements in Environmental Fate and Transport, Ninth Volume, ASTM STP 1381, American Society for Testing and Materials, 2000.

(5) E.K. HOCKING, C.L. BENDOWITZ, and M. FLYNN, "Cultural Impact Assessments and Environmental Remediation Decisionmaking," Environmental Science and Pollution Research, Special Issue 2, 2000.

(6) P.R. PORTNOY and J.P. WEYANT, editors, "Discounting and Intergenerational Equity," Resources for the Future, April 1999.

(7) National Research Council, "Long-Term Institutional Management of U.S. Department of Energy Legacy Waste Sites," National Academy Press, 2000.

(8) Software Development, "Lesson from the Long Now," January 2000.

This research was supported by the U.S. Department of Energy under Contract Number W-31-109-ENG-38.