How much cleanup is necessary- Risk-Based End State Land Uses

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Rationale for Contaminated Land Use Choices

- Whatever the **land use choices**, the **responsible organization** needs an **unambiguous mechanism** that ties its **land use choices to risk** through a **sustainably protective system** that can be operated as long as it is needed, in **perpetuity** if necessary. Such a sustainable plan rests on a sound **remediation program** and then requires both **engineered systems and human operations**.

END STATE LAND USES, SUSTAINABLE PROTECTIVE SYSTEMS AND RISK

- Future land use depends on;

❖ The desires and needs of individuals and communities.

❖ The residual risks that might result from past uses of the land.

- Residual Risk depends on;

❖ The toxicity of site contaminants.

❖ Exposure of human and ecological receptors.

- Exposure in turn depends on the end state land usage and associated patterns of human and ecological activity and behavior.

End State Land Uses

- In the United States context, the expression “end state land uses” is virtually an oxymoron.
- “End state” conjures up an image of a use in perpetuity, or at least for many generations.
- Contrary to the image of a petrified end-use, thousands of land use changes take place every day as businesses open and close, people move, green space is converted to shopping malls and new houses, farms are closed and slowly become forests, grasslands, and other ecological uses again, and brownfield sites are remediated and reused.

Land Use and Zoning Ordinances

- Local zoning ordinances, if they exist, are intended to capture the currently envisaged end or planned state.
- But United States cities are full of high-rise buildings whose zoning rules only permitted single-family homes.
- The zoning ordinance should be regarded as the local government's very initial determination, one that is subject to change through negotiation, variances, and legal challenge.
- Covenants, conditions and restrictions (CC&R) are more likely to last.
- The builder/owner indicates what can and cannot be done on a site.
- But many CC&Rs failed because their authors failed to specify in perpetuity in the legal document and courts have ruled that the next owner need not follow the restriction unless it was stated in perpetuity.

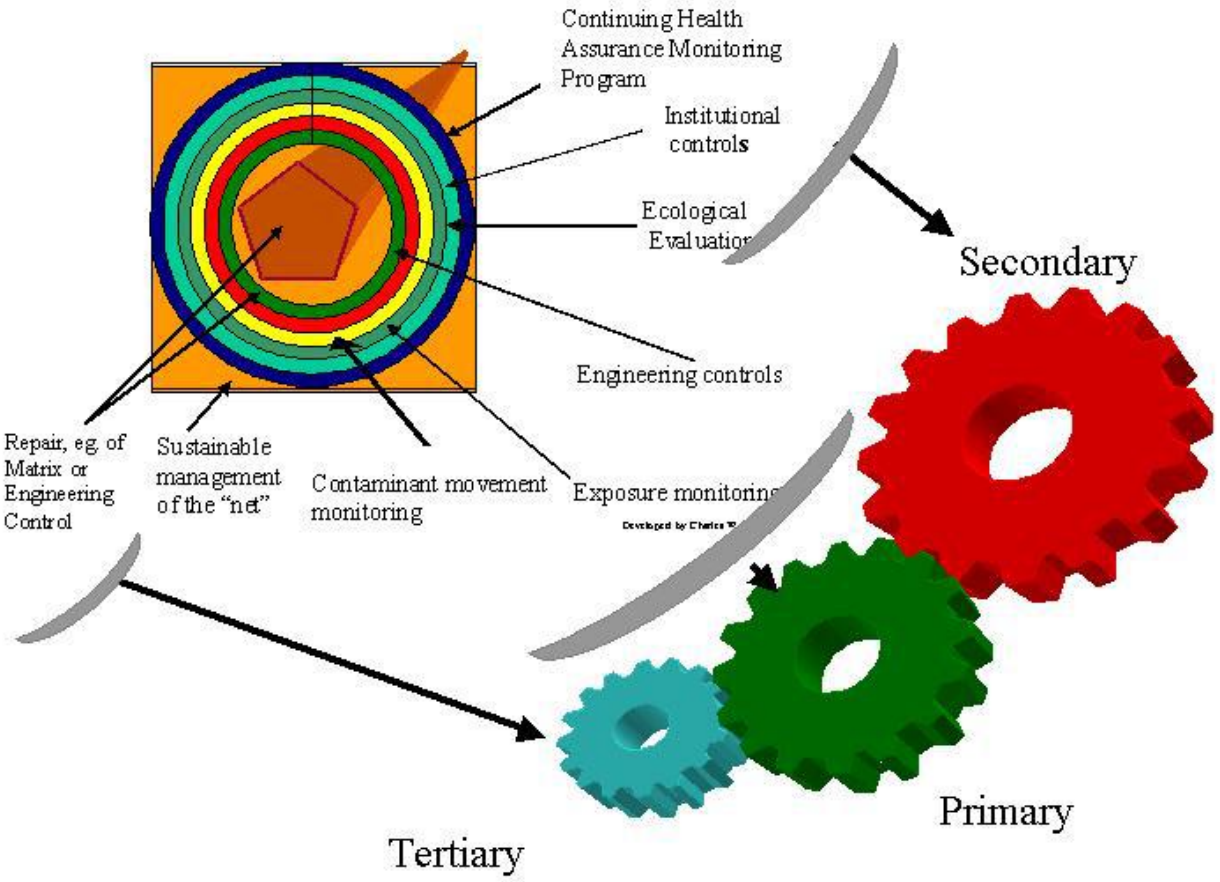
Multigenerational end state land uses

- Needed where the nation makes a decision that it wants to memorialize something of particular importance to its history, freeze a particularly set of natural wonders or treasures – and, when it needs to maintain enduring public safety protections as when high level waste is stored, where land contains buried unexploded ordinance, where soil and aquifer contamination and other hazards make it too dangerous to allow the kind of land use changes that normally occur in the United States.
- Following the precautionary principle, a decision to specify an obvious protective low risk end state for land contaminated with nuclear and chemical wastes is to exclude all unnecessary personnel leaving land fallow to pursue its own ecologic destiny while providing ecological services such as aquifer recharge (Burger et al., 2003a,b,2004a).
- A less restrictive end state is low intensity ecological uses that include research, hunting, fishing, camping, or some combination of these on parts of sites. A low intensity ecological end state makes sense when the owner wants to limit access to the site because of concerns about human exposure, fear of ecological damage caused by human access and/or by remediation, and because of the value of the land to the local people and the nation in its current form.
- The national government, however, has made it abundantly clear that it wants to treat all of its properties as assets and typically shrink its footprint. The DOE's efforts, the DOD's BRAC program, and the GSA's efforts are intended to give, lease or sell land to private or public owners.

Sustainably Protective Systems

- Sustainability requires “persistence over an apparently indefinite future of certain necessary and desired characteristics of the sociopolitical systems and its natural environnent.” (Robinson, Francis, Legge, & Lerner, 1990, p 39)

Sustainably Protective Systems



1. Toxicity and Amount of Hazardous Substance Present

- 1.1. What information is available about known hazards, about multiple chemical hazards, and about potential exposure pathways (direct contact, soil, surface and groundwater, air) to on-site hazards? When were the data last updated? How is the information processed, stored, and made available? Is it in electronic forms? Is it on maps and/or in CSMs? How often is the information and equipment updated?
- 1.2. Who is responsible for the data? Whom do they report to? What is their academic background? How much training to do they have and how often do they go for additional training?
- 1.3. What are the contaminants of greatest concern on the site? What kinds of human and/or ecological biomarkers are available for assessing and monitoring human and ecological exposure and risk associated with these contaminants? How does the site keep track of legal and administrative changes that affect the legal classification of these contaminants?

2. Containment of Substance

- 2.1. What exposure pathways are assigned the highest priority for containment? What data are available about the containment of these hazards and pathways, and other on-site hazards?
- 2.2. What studies have been done about the likelihood of conditions that could produce a leak or a major failure, such as an earthquake, fires, flooding, terrorism.
- 2.6. Who is responsible for keeping track of legal changes that affect the suitability of the containments? How, how often, and to who do they report their observations?

  2.7. Who is responsible for keeping track of the amount of hazardous material that is added and lost in each containment system because of decay and destruction?

3. Potential Dispersal, if Containment was Breached

- 3.2. What mathematical models are used to study transport of materials from the site? How often are they tested? Are they used to develop containment after dispersal scenarios? Do these allow testing of exposure pathways associated with different end states?
- 3.5. What process(es) are used to bring this information to the attention of the site leadership, natural resource trustees, and other key stakeholders, and resolve issues?
- 3.7. Is there a stakeholder/citizen advisory or oversight committee responsible for reviewing and influencing policy on the implications of failed containment?

4. Human and Ecological Populations Exposed

- 4.5. What data are collected, reviewed, and mapped about on-site areas that may be used for housing, commercial and industrial, school, nursing homes, and recreational facilities? Likewise, what data are collected about road, rail, sewer, water and other infrastructure on the site? Who has data and communicates about any negative use easements?
- 4.10. Who on site is responsible for monitoring and reporting actions that could increase the off-site population at risk beyond what is anticipated in the end state and sustainability plans?

5. Dose to and Response of Public and Ecosystems

- 5.1. What data exists about fate, transport, and toxic effects of these substances to humans, if they escape containment?
- 5.3. Who are these data shared and discussed with? Are they shared with local and state governments, special jurisdictions such as school systems, sewer and water districts? Are they shared with federal, state and local agencies, and with natural resource trustees?

6. Authorities' response to the Immediate Event and the Long Term Threat

- 6.1. What funds exist to support the sustainable end state? What is the form of those funds? (Annual set aside, bonds, etc?) Who governs the size of the resources? Who controls and manages the funds? What guarantees exist that the source of funds will not be removed? Specifically, what funds support primary, secondary and tertiary prevention as described above?
- 6.5. Are there affirmative covenants in place on the site that requires signage be constructed and maintained, that a fence or other barriers be constructed and maintained? How is this enforced? Has the state adopted the Uniform Environmental Covenants Act (UECA), which was published in August 2003? If not, what is the status of the state in question with regard to the UECA? Has there been discussion between site, state and local officials about how the UECA might be used to control off-site activities that might threaten the on-site end state sustainability plan?

Extracted From---End State Land Uses, Sustainable Protective Systems, and Risk Management: A Challenge for Multi-Generational Stewards

by Michael Greenberg, Joanna Burger, Michael Gochfeld, David Kosson, Karen Lowrie, Henry Mayer, Charles Powers, Conrad Volz, and Vikram Vyas

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Abstract:

This article discusses creating a sustainably protective engineered and human management system in perpetuity for sites with long-lived radiological and chemical hazards. This is essential at this time because the federal government is evaluating its property as assets and attempting to reduce its holdings. To assist those who have a stake in the remediation, management, and stewardship of these and analogous privatelyowned sites, we provide a list of over 200 questions grouped into six areas of risk analysis.

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