Principles of Perpetual Care:

The Giant Mine, Yellowknife, Northwest Territories

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Remember the Hard Things So They Don't Get Worse
Prevent More Damage So There Aren't Hard Things to Remember
Restore to Health So There Isn't So Much to Remember

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Executive Summary (Plain Language)

What is the Problem?

How can you make wise choices about toxic sites? Here, we are talking about the long-term care of an abandoned gold mine (Giant Mine) near Yellowknife, NWT, Canada.

Giant Mine opened in 1948 and closed in 2004. It produced over 23,000 kg of gold. It also gave us a vast wasteland of arsenic trioxide. The mine contains 237,000 tonnes of arsenic dust that can melt in water. It has already poisoned lakes and creeks in the area.

How Long Does It Last?

Contamination lasts a long, long time. It could be toxic for 250,000 years or even more. How can you even imagine such a long time? The pyramids in Egypt were built only 5,000 years ago.

How Can We Plan for Such a Long Time?

We don't know how to plan for 250,000 years. Instead, the aim of care at places like Giant Mine should be to protect people, other living things, soil, and water for as long as we can. We must try to protect the Earth from any more harm.

How Does This Report Help?

The five rules in this report can help people who have to make decisions about long-term care. They should help us do our best to stop the creation of more sites that need care forever.

The Five Rules of Caring for Contaminated Sites Forever

The five rules must be used in all parts of perpetual care, like stopping contamination, making it less harmful, and returning contaminated places to health.

1. Responsibility to Future Generations

All of life centres on bringing new life into the world. Because of this, there is also a responsibility to take care of future generations. But it is not the idea that rules Western nations. They use "the greatest good for the greatest number" and that number does not include future generations.

In North America, some indigenous cultures have used the Seventh Generation Rule to guide decisions. They ask what the impact of a decision would be on the

seven generations to come. Problems like climate change and toxic sites have pushed us into a new arena. We face decisions that affect not only the seventh generation, but, in cases like Giant Mine, the ten-thousandth generation.

How can we act on this responsibility? One way would be for the Northwest Territories, the City of Yellowknife, the Yellowknives Dene First Nation, or another jurisdiction to appoint a legal guardian for future generations. They would have the authority and responsibility to be the voice of future generations in all talks about Giant Mine.

2. Protection of "the Commons"

"The commons" represent all the gifts of nature and culture that come to us as members of the community of Earth and of a specific place. Air, water, wildlife, literature, the ocean, the moon and sun, and culture are things that we share. We do not own these as private property. We share them and must leave them whole for future generations.

Giant Mine and other toxic sites are failures of law and government to protect the commons from private property owners. The profit went to the owners, but the long-term costs will be paid by future generations.

It is not possible to leave enough resources to care for sites forever. Places needing care forever should not be created in the first place. However, given the existence of Giant Mine or other sites like Port Radium, the commons of air, water, land, wildlife, public health, and culture must be of the first importance.

3. Free, Prior, and Informed Participation and Consent

"Free, prior, and informed consent" (FPIC) means that a community has the right to agree or not, to new projects that may harm the lands they own, occupy, or use.

FPIC is a basic human right. Canada signed the U.N. Declaration of the Rights of Indigenous Peoples in November 2010. The Declaration spells out that FPIC applies to sites needing care forever.

FPIC has two parts. First is the human right to take part in decisions that affect your life. Second is the duty of authorities to make sure no action they take violates that human right.

4. Precautionary Principle

Precaution is about being careful. Science doesn't have any guarantees to offer, so we need to be careful when we make a decision. There are five steps for following this rule.

- Listen to Early Warnings
- Set goals
- Choose the Best Alternatives
- Reverse the burden of proof
- Democratic decision-making

5. Nature as Guide

Nature is a guide for how humans should treat the Earth. One important lesson of nature is humility. People have a history of trying to force nature into their own designs. This has not worked well. Nature has the last word. This is true at Giant Mine, where actions used must work in harmony with nature.

Using the Rules for Perpetual Care

There are 5 parts to taking care of a place forever.

1. Information, memory, and warning systems

It's hard to find ways to send useful information and warnings far into the future. We need to figure out how to tell people in thousands of years how to watch for certain changes and signs. They need to know what happened here. How is the waste stored, and what are the hazards? Warnings must also be joined with action plans.

The Information must be open to all and easy to understand. We have to make sure the information stays the same and is understood over thousands of years. Maybe we need to say the same thing in more than one way. Teams should be formed to watch for and respond to early warning signs. The community must be ready to deal with this different type of emergency.

Humans have passed information down through the ages in ways that do not require advanced technology. Drawings etched in stone, songs, pilgrimages, and storytelling about the land are some of the longest lasting methods for giving information to future generations.

2. Monitoring

A toxic site needs to be watched to stop small problems from getting worse. Monitoring includes looking after the community, the site, and containment. Is the restoration a success?

- Look at changes in the community. Are there any warning signs, like more mental problems?
- Watch the health of soil, water, wildlife and pets. Test the soil. Keep track of human and pet cancers.

- Monitor the impacts of the contamination even if the effects go beyond the site.
- Keep an eye on technology used at the site. Is it working?
- Use the action plans when something has changed. Treat changes as an early warning.

3. Technology

Most toxic sites use technology to control the hazard. For example, concrete or refrigeration might be used. However, none of these ways will last as long as the hazard. Concrete falls apart. Refrigeration fails.

The precautionary principle means looking for and choosing the best technology to stop any more damage to the site or community. No one choice will be perfect. The more backup systems you have, the less likely a disaster will be.

Remember future generations when making a choice. No solution is final until the site is completely cleaned up. As always, no choice should be made without free, prior, and informed consent.

4. Who Pays?

When a site becomes toxic, who pays for protecting the commons?

- Polluter Pays. The best result would be that no toxic site was made. The backup plan is to set up a way that guarantees the polluter pays.
- People today should pay as they go for cleanup of toxic places. Adequate funding must be provided up front for future care.
- Funding must be kept safe for the future.

5. Restoration

It is this generation's duty to leave behind as healthy a natural and social world as possible.

- Admit that this generation has failed to stop contamination.
- Set goals for healing people and nature.
- Find ways to measure the success of the restoration.
- Develop skills in restoring nature.
- Use the best available information. This includes traditional knowledge and science.
- Celebrate successes.

One of the most important actions needed for restoration is for responsible authorities to make a formal apology.

Conclusion

These rules of perpetual care are a starting point for more discussion. At the end of the full paper is a list of questions. They will help you think about and discuss these problems.

Introduction

This paper was prepared to assist decision-makers and community members to make wise decisions for the long-term care of an abandoned gold mine called the Giant Mine near the city of Yellowknife in the Northwest Territories, Canada. In late 2011 the social justice organization Alternatives North commissioned two papers for use in a workshop on the plans for the perpetual care of the Giant Mine. One paper, written by Joan Kuyek, documents nine case studies of other sites requiring care far into the future. It is a companion to this paper and can be found here: http://www.sehn.org/pdf/Kuyek-theory%20and%20Practice%20final%20(July%202011).pdf. It is our hope that the case studies and these principles can be useful to other communities and governments facing the complex issues of hazardous sites that will require care far into the future.

The Giant Mine began production in 1948 and closed in 2004. It produced over 7.6 million ounces of gold. It also produced a vast quantity of arsenic trioxide. The Giant Mine contains 237,000 tonnes of arsenic trioxide dust. This huge quantity of dust is water soluble. It has already contaminated lakes and streams in the surrounding area. The site covers 930 hectares and includes 8 open pits, 4 tailings ponds, 643,000 m^3 of contaminated soils, and approximately 100 buildings including a roaster/bag house complex that is highly contaminated with arsenic, lead, and asbestos.[1] Extraordinary measures will be required to maintain the site forever.

The Giant Mine is not an isolated phenomenon. Since World War II humans have created toxic and nuclear accident and waste sites that will be hazardous for 250,000 years[2] and beyond, essentially the next 10,000 generations. This is a unique problem in all of human history. Archaeologists tell us that the longest we have entertained something even remotely like this are the pyramids in Egypt, which have been among us for 5,000 years or 200 generations. Anatomically modern humans appeared about 4,000 generations ago, and fully modern humans appeared about 2,400 generations ago.[3]

Because planning for 10,000 generations is outside the range of human experience, the aim of care at sites like the Giant Mine should be to protect people, other living things, soil, and water for the foreseeable future. In all likelihood, sooner or later every site will be abandoned or at least lose the attention of future humans, and its contents will be buried or dispersed by geologic processes. This means that the length of time that we will be responsible for sites like Fukushima, Japan; Hanford, Washington; or the Giant Mine poses problems that are now in geological time, not human time. That is, only the rocks know time in this way. Perpetual care by humans is impossible. Nevertheless we are called upon by the presence of these sites and the human activities that led to them to do our best to protect the Earth and future generations from any more harm.

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[1] http://en.wikipedia.org/wiki/Giant_Mine and materials on the Review Board public registry.

[2] http://insidethecapitol.blogspot.com/2006/05/5-26-marking-wipp-site.html.

[3] Jared Diamond, Third Chimpanzee pp. 53-54.

Sites that require perpetual care by the public are market failures. In the case of the Giant Mine, a corporation extracted the value of the gold but externalized the costs of the pollution onto the public. The public is left paying for the care of the mine but did not receive the benefits of the gold. The costs for care of the site, regardless of what they may be in a given year, must be multiplied essentially by infinity. A site that will require $1.9 million a year for care so far into the future demonstrates the market failure and the failure of regulatory cost-benefit analysis.[4]

The sites that will be hazardous far into the future also represent moral failures. Any system that allows private corporations or individuals to benefit from an activity that harms the public good and future generations is a moral failure.

The principles of perpetual care described here are designed to address these failures, begin to obtain justice within this generation, and minimize harm to future generations. These principles are not designed to be a panacea or suggest that once they are in place this generation may go forward with more technologies that add to the burden placed on future generations. Instead, they are designed to deal ethically with places that are long-term disasters and help us recognize market and moral failures. They should help us do our best to prevent the creation of any more sites that require infinite care and boundless resources.

This is the very first principle of perpetual care: *never again.* As Joan Kuyek points out, "The lesson of history is that neither engineered controls nor institutional management measures can be counted upon to remain effective for as long as many of the most dangerous contaminants will remain."[5]

Market and moral failures are a summation of technical, institutional, and financial failures. With moral failure comes moral responsibility. With market failure comes market responsibility. Both require government remedies. By recognizing these failures we acknowledge the imperative of close examination and learning; owning the consequences; and reparation, reconciliation, and remediation.

We often literally bury failures. Society has accepted the practice of opening the earth, putting waste into it, then closing it—sometimes labeling it, sometimes not. We bury, forget, and move on. But we forget to our detriment. Another set of failures is to come.

This document builds on previous reports, essays, books, deliberations, and gatherings, but especially Joan Kuyek's report, "The Theory and Practice of Perpetual Care of Contaminated Sites," which shows how the complexity of systems and unanticipated events holds great potential for future system and communication failures. This report – also written for the Giant Mine environmental assessment - provides nine case studies, an

[4] http://www.reviewboard.ca/upload/project_document/EA0809-001_Giant_DAR_1288220431.PDF , see Table 6.13.5, pg. 6-107.

[5] Kuyek, pg. 5.

extensive bibliography, and a "lessons learned" and is available from The Science and Environmental Health Network here: <http://www.sehn.org/pdf/Kuyek-theory and Practice final (July 2011).pdf>.

Present and future generations will suffer fewer consequences of these failures if we resist the temptation to hide and bury them, and instead fully accept responsibility for the care of sites like the Giant Mine.

The Five Principles of Perpetual Care

There are five linked principles of perpetual care.

1. Responsibility to Future Generations

   Present generations have a responsibility to leave the commons of nature intact to future generations. Future generations have a right to a healthy planet.

2. **Protection of "t**he Commons**"**

   The commons of the Earth, of public health, and of culture are the foundations of community resilience and essential for the success of perpetual care. The commons are the legacy left to future generations by present generations. When perpetual care of contamination is required, then the commons has been damaged. A site requiring perpetual care is essentially an anti-commons, a burden on the public good.

3. The Precautionary Principle

   The precautionary principle calls for taking action to prevent harm in the face of scientific uncertainty. Harm includes that emanating from past wastes and that which is likely to result from current practices, as demonstrated by history and experience. It also includes damage to the very community structures and relationships that are essential to prevent future harms. Protecting the commons for future generations is actualized by applying the precautionary principle.

4. Free, Prior, and Informed Participation and Consent

   Residents of the affected area, Aboriginal peoples in particular, and members of the public have the right to free, prior and informed participation and consent. To the extent possible, this right should be extended to future generations.

5. Nature as Guide

   Nature is measure, mentor, and model[6] for how humans must treat the Earth, including places requiring perpetual care.

[6] http://biomimicryinstitute.org/about-us/what-is-biomimicry.html

The five principles must be applied in all processes involved in perpetual care. These processes are prevention, mitigation, adaptation, and restoration. We must prevent foreseeable harm. Many harms can be mitigated. Mitigation means reducing the severity of harm. Some problems can't be avoided or reduced, so communities must adapt to a new reality—but only if they are fully informed and consent to such changes. Plans to adapt must be made in advance. Restoration of the Earth and communities to health is integral to prevention and mitigation.

How the Five Principles Should Inform Decisions about Perpetual Care

All of the principles can be stated simply: *Present generations will use the precautionary principle to prevent harm to future generations and the ecosystem so that the future ones inherit a healthy commons. No action will be taken without the free, prior, and informed participation and consent of the residents and future generations.*

Each of the five principles brings an essential set of ideas and orientation that must guide decisions about perpetual care.

1. Responsibility to Future Generations

All of life is centered on regeneration and bringing new life into the world. This is a biological fact that compels the corresponding ethic of taking responsibility for the wellbeing of future generations. But it is not the ethic that undergirds Western economies and political systems. These are instead predicated on utilitarianism, the ethic of the greatest good for the greatest number—a number in which future generations are not included.

In the 1980s the German philosopher Hans Jonas and others began calling for a new ethic of responsibility for future generations, given the rapid rise of serious environmental problems that presented new challenges to civilization. This was not a new idea; making decisions with future generations in mind has been the practice of many cultures. In North America, some indigenous cultures have used the Seventh Generation Rule to guide decisions, asking what the impact of a given decision would be on the seventh generation to come.

Emerging problems like climate change, the loss of biodiversity, mountaintop removal, and toxic and radioactive sites requiring perpetual care have vaulted humanity into an entirely new arena. We face decisions that affect not only the seventh generation, but, in cases like the Giant Mine, the ten-thousandth generation. Accordingly, it is essential to adopt and act out of an ethic that asserts a duty and responsibility for future generations.

This ethic must be and is being incorporated into laws and policies. It requires imagination and experimentation. Various countries are creating new institutions to inject an ethic of care for future generations into political decision-making. The Giant Mine offers an opportunity to incorporate this ethic and new models for care of future generations.

One significant way to incorporate this ethic would be for the Northwest Territories, the City of Yellowknife, the Yellowknives Dene First Nation, or another jurisdiction to appoint a legal guardian for future generations who would be charged with the authority and responsibility to be the voice of future generations in all deliberations around the Giant Mine.

2. Protection of "The Commons"

The commons represent all of the gifts of nature and culture that come to us as members of the community of Earth and of a specific place. Air, water, wildlife, literature, the ocean, the moon and sun, and culture are things that we share. We do not own these individually as private property. We have rights with each other and responsibilities to each other for the things we share. The commons provide the basis for community wellbeing, physically, spiritually, and emotionally. It is the commons that present generations must leave intact to future generations.

The Giant Mine and some other places that require perpetual care are failures of law and government to protect the commons from private property owners who reap the financial benefits but externalize their costs onto the commons—and from present generations who reap the financial benefits but externalize their costs onto future generations. Essentially, sites like the Giant Mine are anti-commons, public liabilities, and moral failures.

For too long governments in Western societies have protected individual private property at the expense of the commons. The pendulum must now swing in the other direction: governments at all levels must accept their responsibilities as trustees of the commons and protect them for present and future generations. At minimum this means that private property owners, such as mining companies, as well as present generations, must internalize their costs. This also means that present generations will not leave debts to future generations without corresponding assets.

Since it is impossible to leave adequate resources to care for sites in perpetuity, sites requiring perpetual care should not be created in the first place. However, given the existence of Giant Mine or other sites like Port Radium and their requirements for infinite care, the commons of air, water, land, wildlife, public health, and culture must be the first order of that care.

3. Free, Prior, and Informed Participation and Consent

"Free, prior, and informed consent (FPIC), is the principle that a community has the right to give or withhold its consent to proposed projects that may affect the lands they customarily own, occupy, or otherwise use."[7]

Free, prior, and informed consent is a fundamental principle of human rights and law that can be traced back to the Nuremberg trials of doctors who experimented on patients without their consent. It applies to many areas of human activity that threaten the integrity of the body, or the dignity of the person. Apart from medical and scientific ethics, the most developed area of the law of free, prior, and informed consent is the right of indigenous and Aboriginal peoples. Canada endorsed the U.N. Declaration of the Rights of Indigenous Peoples in November of 2010.

The Declaration spells out when this right is applicable to sites requiring perpetual care. The Declaration includes these provisions for free, prior, and informed consent (see http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf for the full document).

> Article 10
> Indigenous peoples shall not be forcibly removed from their lands or territories. No relocation shall take place without the free, prior and informed consent of the indigenous peoples concerned and after agreement on just and fair compensation and, where possible, with the option of return.
>
> Article 28
> 1. Indigenous peoples have the right to redress, by means that can include restitution or, when this is not possible, just, fair and equitable compensation, for the lands, territories and resources which they have traditionally owned or otherwise occupied or used, and which have been confiscated, taken, occupied, used or damaged without their free, prior and informed consent.
>
> Article 29
> 2. States shall take effective measures to ensure that no storage or disposal of hazardous materials shall take place in the lands or territories of indigenous peoples without their free, prior and informed consent.
>
> Article 32
> 2. States shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free and informed consent prior to the approval of any project affecting their lands or territories and other resources, particularly in connection with the development, utilization or exploitation of mineral, water or other resources.

Consent implies full participation in the decision-making process. Accordingly, consent cannot be given to perpetual care plans by the public, indigenous and aboriginal people or by local residents

[7] http://www.forestpeoples.org/guiding-principles/free-prior-and-informed-consent-fpic

without full participation in the process leading up to any decision on perpetual care technologies, financing or clean-up standards.

Access to free, prior, and informed consent should be extended to future generations for any decisions that will bind them. Perpetual care will require future generations to pay for a liability they did not create and from which they will not benefit. To the extent possible a legal guardian should be appointed to participate in all decisions regarding perpetual care to assert the interests of future generations and give or withhold free, prior, and informed consent to any decision.

Mitigation of and adaptation to perpetual care sites have such profound implications for communities and future generations that they must be undertaken with the free, prior, and informed consent of the community, especially indigenous communities who will be affected by the site and long-term decisions made about it.

The requirement for free, prior, and informed consent has two parts. The first is the human right to participate in decisions that affect one's life. The second is the corresponding duty of responsible parties to guarantee that no action is taken that violates that right. The right and the duty are matters of ethics and law. The embedded wisdom, which goes beyond ethics and law in the requirement for free, prior, and informed consent, is that decisions made in this way are much more likely to result in the health and wellbeing of the people and the land over the long term.

4. Precautionary Principle

A common definition of precaution comes from the 1998 Wingspread Statement: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically." There are many international versions of the precautionary principle in treaties, most of which originate in the Rio Declaration on Environment and Development "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." The precautionary principle is used in Canada. Health Canada uses the principle in decision-making.[8]

The precautionary principle directs us to take action to prevent harm in the face of scientific uncertainty. It is the Golden Rule for future generations.

While the definition directs us to take precautionary measures, it does not specify what those measures might be. Over the years implementing the precautionary principle has been distilled into five steps or measures: 1) heed early warnings, 2) set goals, 3) identify and select the best alternative to a harmful activity, 4) reverse the burden of proof, and 5)

[8] http://www.hc-sc.gc.ca/dhp-mps/advert-publicit/report-rapport/hc-sc_issue_paper-document_reference_section_221-eng.php#2.4

practice democratic decision-making. All five of these steps should be applied to perpetual care. The precautionary principle is the central tool that guides the perpetual care processes of prevention, adaptation, and mitigation.

- Early Warnings

We must pay attention to the first signals that harm may happen in order to prevent greater damage. At sites requiring perpetual care, systems must be in place to pick up such signals. Trend data can serve as warnings that things are amiss. What are background levels of toxic chemicals? What is changing over time? What specific actions are planned if early warning targets or thresholds are reached? Reporting systems and early-response mechanisms must also be created so that responsible parties can act on emerging information about leaks, human or wildlife illnesses, or contamination of water.

- Setting goals

Goals provide direction for action. What short and long term goals does the community have for the Giant Mine and its surroundings? What do Yellowknife and Canada wish to leave to future generations? If the community sets goals and mobilizes all possible scientific and cultural tools, it is far more likely that the damage will be minimized and the site and community will begin to heal.

- Alternatives

The third step in implementing the precautionary principle is to identify and choose the best alternatives to a harmful practice. What are all the possible technologies for containing the arsenic at the Giant Mine? Which ones use the least energy, are the most easily monitored, and are most harmonious with nature? Which are the most cost-effective—not just to this generation but to future ones as well?

- Reversing the burden of proof

Reversing the burden of proof means that the polluter must pay for damage. This idea, which is usually used in a courtroom, stands for the notion that the corporation or person who puts something into the market or the environment must internalize its cost. The precautionary principle puts responsibility back on the proponents of an activity, rather than the customer, the public, or government. In the context of a contaminated site that is now a public liability or responsibility, this may mean that the national or regional government should bear the financial costs and ensure there is local capacity to deal with perpetual care.

- Democratic decision-making as free, informed, prior participation and consent

Finally, since the precautionary principle embodies the ethic of preventing harm in the context of what we know and do not know, it is best carried out by all affected

stakeholders in a democratic process. All parties should be at the table to decide on goals, search for the best alternatives, and attend to warnings. But the concept of democracy is not one person, one vote; it must satisfy the principle of free, prior, and informed participation in decisions and of free, prior, and informed consent before a decision is taken in any perpetual care "solutions." This is especially true when Aboriginal or indigenous peoples are involved. Participant or intervenor funding, to allow for local capacity and access to independent technical expertise, is essential for an even playing field.

5. Nature as Guide

The fourth principle is that nature is measure, mentor, and model[9] for how humans must treat the Earth, including places requiring perpetual care. Current decisions use economics rather than ecology as measure. Perpetual care decisions must use nature as a model and emulate ecological forms, processes, and strategies. Perpetual care should employ an ecological standard to judge the sustainability of the technology and systems designed to deal with the waste and site. As the Biomimicry Institute description says, "After 3.8 billion years of evolution, nature has learned what works and what lasts."[10] Nature will be the primary teacher through time about what will work and what will not. Humans must be learning from nature for as long as the site is hazardous.[11]

One important lesson of nature is humility: it may be impossible to foresee the ways in which parts of complex systems will interact, or to anticipate how failures propagate through complex systems. Scientists have a history of trying to overpower, outsmart, or simply ignore natural systems. In contrast, the emerging field of biomimicry or ecomimicry seeks to mimic and replicate nature's processes.

Because nature will prevail at the Giant Mine given the timeframe of perpetual care, technologies and restoration techniques employed at the site must work in harmony with nature. Insofar as possible we must rely on natural processes such as erosion and foreseeable trends such as climate change in planning for perpetual care, rather than engineered structures that require large inputs of energy, maintenance, and special skills or equipment.

Applying the Principles to Specific Components of Perpetual Care

The five principles are not only sound general guides for decision-making; they also can be applied in specific ways to the components of perpetual care. Those components are:

- Information, warning, and memory systems;

[9] http://biomimicryinstitute.org/about-us/what-is-biomimicry.html

[10] http://www.biomimicryinstitute.org/about-us/what-is-biomimicry.html

[11] http://www.biomimicryinstitute.org/about-us/what-is-biomimicry.html

- Monitoring;
- Technology;
- Financial mechanisms; and
- Restoration.

The categories are interrelated and connected. Warning systems are often technology-based but are fundamentally about information. Financial mechanisms are necessary to build and maintain technologies and guarantee restoration. Monitoring can provide warnings and information. Nevertheless, they are separated here to illustrate how the principles can guide perpetual care.

The mechanisms for applying the principles are meant to provide examples. They are not the only means for fulfilling the duty this generation holds toward future generations and bringing justice to injured parties within this generation. They should be used to instigate community creativity and brainstorming and tailored to fit a specific place.

Information, memory, and warning systems

One of the greatest challenges of perpetual care is developing mechanisms for obtaining, conveying, and maintaining information from the present far into the future. Human memory and information systems are not designed to hold onto information over long time periods, in part because living beings, language, and technology evolve. It should be noted that individuals and groups such as the mining company and the government agencies that allowed the mine to go forward have an interest in forgetting and getting others to forget. Evolution can work against memory as well as encode it: as living systems change over time, some pieces of information are lost and the information about adaptation is carried on.

Present generations have a duty to warn future generations of the hazards imposed on them by a site requiring perpetual care, through long-term information and memory systems. But such static warning systems are insufficient. Systems must also be put in place to monitor ongoing developments and obtain information about potential danger. This monitoring information should be treated as a de facto warning system.

Warning systems need to be coupled with action plans that are triggered by specific thresholds or targets. What actions will be taken if leaks are detected or changes in public health are noted? The precautionary principle requires taking action in the presence of early warnings and not waiting for scientific certainty.

Many kinds of information are needed so future generations can be warned and possibly find solutions to problems left to them. The information needed for both present and future generations includes a historical record of the site and ongoing monitoring information. What happened here? What are the hazards? What has been done to contain the waste and restore the site? What has worked and what has failed?

Humans have passed information down through the ages in ways that do not require advanced technology. Drawings etched in stone, songs, pilgrimages (Mecca, Bethlehem, the Vietnam Memorial in Washington, DC), and parables and storytelling anchored to a landscape (Navajo creation story) are some of the most enduring methods for giving information to future generations.

Future generations have a right to the information they will need to address the legacy of waste left to them by this generation. They have a right to be warned of any danger, to know the history of their home, and to understand what has worked and failed at restoring the land to health. Present generations also have a right to open information because they, too, have a right to know about the threats to their health, opportunities to mitigate the damage, and when actions can be taken to prevent further damage.

With the exception of personal medical monitoring information, information about the site under perpetual care is part of the commons. It belongs to everyone. Government can serve as the trustee of the information, but it is a public commons. Government does not supplant the cultural encoding of wisdom in places, but it can reinforce and add multiple ways of retaining information. Part of the rationale for putting this information into the commons is that it supports the right to free, prior, and informed participation and consent.

Furthermore, the democratic decision-making aspect of the precautionary principle is in place for the potential to make more robust decisions in light of uncertainty and the need to care for future generations. Democratically made decisions are part of restoring trust and healing the social wounds to community that is a concurrent legacy.

Applying the five principles to information, warning, and memory systems:

a) Information must be open, accessible, and transparent. Information necessary for present and future generations to know and act on the history of the site, any dangers, and any changes in site integrity should be part of the commons and not proprietary. Open, accessible, and transparent information allows stakeholders to participate in democratic decision-making.

b) Systems have to be in place for preserving the integrity of information. Cultural systems for passing on information over long periods of time have universal themes but reflect the special language of the specific culture and place.

c) Systems must be in place to pass on information. Because information will get lost over time, multiple ways must be incorporated to convey and preserve the integrity of information within generations and to future generations.

d) Systems must be in place to act on information as it is passed along.

e) Data and trends will be treated as early warnings. They will initiate action upon evidence of change. For instance, when monitors show increased levels of arsenic

in water, immediate action will be taken to repair the facility and prevent additional arsenic from being discharged into water. Data showing increased levels of disease in wildlife, humans, or pets should initiate precautionary actions.

f) Early-warning teams will be established comprised of members of all monitoring programs and the community. What are the observations from the medical, site, ecological, social, and technological monitoring systems? Early-warning teams at perpetual care sites should have authority to initiate or require precautionary action in the face of uncertainty.

g) Emergency preparedness will be maintained. This requires uncommon vigilance on the part of a community and government. Perpetual care requires us to rethink the current organization of emergency systems, which are usually set up to deal with major, sudden, short-term crises rather than to the slow buildup of incremental incidents that, when taken together, produce disasters.

h) Information and warning systems will be developed with the free, prior, and informed consent of the public.

Examples

Humans have made markers, usually stone, for millennia. In Japan, rock tsunami markers have been in place for 600 years.[12] Similar markers could be encoded at the Giant Mine. For instance, memorials that commemorate all of a nation's perpetual care sites could be place in national capitals, with corresponding and matching markers at each site. (An example is the similarity of the Vietnam Memorial in Washington, D.C., to the 9/11 memorial in New York City, each bearing the names of the deceased.) These witness stones, with GPS latitude and longitude markings, could carry the memory of these places for the benefit of future generations. The witness stones could be accompanied by international registries. Another model for conveying the history of sites like the Giant Mine is the Rosetta Stone, created about 200 years BC, which was a record of a decree in three languages. This suggests that it would be helpful to create a central repository and a set of master decoder stones that could be used to translate the markings on the witness stones. Another example might be a special category of World Heritage Sites that are contaminated in one way or another that require perpetual care. Another option would be the deposition of duplicate records for key sites at a number of world archival institutions. This information might also be duplicated in a number of forms such as paper, electronic files, or other media. Redundance and duplication help reinforce memory.

Universal human practices like pilgrimages, songs and stories, and religious symbols of death can also be used to hold the memory of the tragedy of sites like the Giant Mine and of the valor of those who suffered because of it but still became guardians of the commons around it. For example, the song Ring Around the Rosy is about the Bubonic

[12] http://www.nytimes.com/2011/04/21/world/asia/21stones.html?pagewanted=all

Plague that occurred in London in 1665. We still sing this song today.[13] If the bubonic plague was still a threat, it is likely we would remember the origins and information held in the song.

Other common cultural institutions like museums, parks, and heritage sites can be used to record and transmit the history and convey warnings through time.[14]

Indigenous cultures have longstanding warning systems that are encoded in parables and aphorisms, often anchored to specific places. Anishinaabe peoples say, "As goes the wolf, so go our people." The wolf is used as an indicator of their own health.

Monitoring

Sites that require perpetual care have caused immeasurable harm and will cause damage in the future. Monitoring a site allows humans to assess risk, act early, and prevent small problems from escalating or expanding into big problems. Monitoring includes methods for assessing community wellbeing, the site, and containment technologies as well as the success of restoration.

Monitoring must be thorough and include the following:

a) Social, community, and distinctive Aboriginal issues. Toxic sites requiring perpetual care take their toll on the social fabric of communities. Indicators of problems include high unemployment, mental health problems, and people moving away. Identifying baseline indicators and monitoring for changes and trends can help the community to intervene and act on early warnings.

b) Ecological—soil, water, wildlife, and pets. The ecological and biological community will provide a great deal of useful information, provided someone is watching. Pets and wild animals close to the site often will serve as the proverbial canaries in the mine. Some monitoring systems like human or pet cancer registries or similar mechanisms can serve as monitoring devices. Regular soil and water testing is essential for monitoring the long-term containment of the waste at the Giant Mine. This, too, is a function of government or parties responsible for the perpetual care of the site and facility.

c) Site and perimeter monitoring. Monitoring stations established at the site and on the perimeter are the frontline of monitoring.

d) Technology used on the site to isolate waste must be monitored regularly to ensure it is successful. This is essentially a quality assurance program of the waste isolation technology.

[13] http://www.rhymes.org.uk/ring_around_the_rosy.htm

[14] See Kuyuk and the Hanford case study for proposals about a national park or monument.

e) Action plans are designed and put in place as part of the monitoring system. Certain findings will trigger action. For example, if the frozen blocks start to melt, specific action is taken such as turning on the freezing plant again or putting more thermosyphons in place.

f) Funding for monitoring is prepaid to the extent possible. This is part of the idea that any debt left to future generations must be an asset, not a liability. This generation must pay for liabilities as we go.

g) Results of monitoring will be treated as early warnings.

h) All monitoring of public health or social factors must be conducted and analyzed with free, prior, and informed consent and be publicly reported .

Technology

Most perpetual care facilities rely on technology to isolate the hazard from the biosphere. Concrete, refrigeration, liners for landfills, and many other techniques are used to contain the hazard and prevent it from contaminating air, water, soil, and living things. However, none of these technologies is foolproof, nor as long-lasting as the hazard. They are insufficient to meet the challenges of perpetual care, which require isolation from the biosphere for thousands and thousands of years. Concrete disintegrates. Refrigeration fails. Liners leak. Virtually all human interventions or actions are overtaken by natural processes.

The precautionary principle requires a search for the best technologies among an array of alternatives and choosing the best technology to prevent any additional harm from accruing to the site or community. The best alternatives will be those that increase the odds for long-term protection of the ecosphere. Criteria for selecting the best alternatives should be determined by all stakeholders and include such things as maintenance and energy requirements, monitorability, reversibility, and reparability. Consideration should be given to alternatives that minimize requirements for specialized skills, knowledge, and equipment.

No single technology will be fail-safe. The more backup systems that can be employed, the less likely catastrophic failure will be.

It is tempting for governments and those paying for perpetual care to settle on a technology to contain the waste. However, no technology should be considered a final solution unless it guarantees total restoration of the site and facility to pristine pre-site conditions.

It should be evident that any technology used for treating or isolating waste from the ecosphere should not have the potential to add to the contamination of the site.

Applying the principles to monitoring:

a) Consider all alternatives and choose the best ones. The best alternatives are those that:

   i) best isolate the waste, given current ecological and geological conditions;
   ii) require the least short and long term maintenance;
   iii) require the least energy;
   iv) are most easily monitored;
   v) are easily repaired; and
   vi) do not create additional hazards (such as the toxic chemical dispersants used in the BP oil spill in the Gulf of Mexico).

b) Employ multiple backup technologies. Single solutions will ultimately fail. Multiple technologies increase the likelihood of isolating the waste from the environment and people.

c) Technological decisions should always be made carefully and reflect the interests of future generations. For example, the decision to move waste from a site may seem to provide a technological advantage, but it may only displace the problem from one community to another. That is, contaminated sites tend to become places where other wastes can be brought and managed collectively. Contamination attracts more contamination.

d) No solution should be considered final or permanent until the site is completely cleaned up and restored to pre-mine standards or an agreed-upon alternative. It should not attempt to put a single technology or solution into place and consider the problem solved.

e) No solution will be put in place that does not satisfy the principle of free, prior, and informed consent.

While it is important to build in redundancies on the technological side, there is a need for the same redundancy on the social and institutional side in order to build in resilience. This can be accomplished through a variety of mechanisms such as independent oversight, along with regular and systematic reviews of new technologies or alternatives for remediation or perpetual care. Creating and improving local capacity to manage perpetual care sites can also help ensure social and institutional redundancies that make it more likely that long-term harm can be avoided.

Financial mechanisms

Perpetual care facilities that have reverted to public responsibility are liabilities governments must take on. They are examples of market failure since the cost of the

product did not fully incorporate the cost of doing business. Governments have also created toxic or radioactive sites large enough to require perpetual care. Whether perpetual care sites are privately or publicly created, these are examples of government failure to serve as the trustee of the commons.

Basic financial principles are derived from the rights of future generations and the precautionary principle.

Applying the five principles to financial mechanisms:

a) Polluter Pays: the first basic financial mechanism is that the polluter has a duty to pay for the pollution it generated. All due care must be taken so that no perpetual care facility is actually created. The backup plan is to establish financial mechanisms that guarantee the polluter pays. Financial security and pre-pollution financing ensure that the public and future generations are not left with a mess they have to pay to clean up. However, when a site is orphaned and left to the care of government, mechanisms can still be created that provide funding to care for the site for the long term.

b) Present generations should pay as they go for cleanup of contaminated sites. A basic principle of the rights of future generations is that no debt should be left to future generations without a corresponding asset. Present generations need to provide for the care of the hazards they created. Accordingly, adequate funding must be provided up front for future care.

c) Funding must be safeguarded for the future. As much upfront funding as possible must be dedicated to the perpetual care facility. Investments should not be discounted, thereby reducing funds available for monitoring, appropriate containment or cleanup technologies, or restoration. Local control of and access to the funding is likely to improve decision-making for emergencies and long-term care.

The Superfund program designed to clean up toxic waste sites in the United States is a useful model for funding mechanisms that can guarantee long-term care and cleanup of sites like the Giant Mine.[15] The Saskatchewan provincial government has set up an institutional care program for mine sites that consists of both a regular monitoring and maintenance fund and an unforeseen-event fund.[16]

[15] See Joan Kuyek, 2011, The Theory and Practice of Perpetual Care of Contaminated Sites. pg. 16, the Case Study on Love Canal and Superfund.

[16] See Joan Kuyek, 2011, The Theory and Practice of Perpetual Care of Contaminated Sites . pg. 56, the Case Study on Uranium Mine-Mill Tailings in Saskatchewan.

Restoration

Restoration is our obligation to future generations. It is this generation's duty to leave as healthy a natural and social ecology as possible. Restoring the social fabric and repairing the natural world are processes that will go on as long as the site is hazardous.

Of course both nature and humans will adapt to the circumstances of living in the presence of a site that is likely to be hazardous far into the future. But setting goals for healing the land and people is a precautionary step in restoring the commonwealth and the common health.

Sociologists who have studied the consequences of contaminated places describe at least two types of insults that result from contamination like this. The first is from the actual pollutant, hazardous material, or exposure—the biological and ecological insult. Second is the socio-political insult resulting from the process whereby the original biological/ecological insults were (or were not) discovered, disclosed, and addressed. Both insults must be addressed in the process of restoration.

Applying the five principles to restoration:

a) Acknowledge this generation's moral failure and move forward to prevent future contaminated sites. Authorities responsible for sins of omission or commission, even if they inherited the problems and are not directly responsible for the damage, need to acknowledge the problems that were created and accept responsibility on behalf of government and the public by learning from mistakes.

b) Set goals for healing the human and ecological communities.

c) Establish ways to measure the success of the restoration.

d) Attend to the healing and restoration of human communities. For instance, restoration might include a transition from feeling helpless to becoming true stewards of the land.

e) Develop skills in ecological restoration.

f) Use the best available information for ecological and social restoration. This includes Traditional and scientific knowledge.

g) Create measures of successful restoration, for instance, that children return or stay in the community when they are adults, that no contamination of surface water occurs, or leaks are cleaned up.

h) Celebrate restoration successes.

One of the most important actions necessary for restoration in the context of the Giant Mine and other sites requiring perpetual care, is for responsible authorities to make a formal apology. Only then can a true partnership based on trust begin to be established. Apologies can arise out of taking responsibility rather than asserting blame. Making an apology is a noble act and opens the door to true reconciliation and restoration.

Conclusion

We offer the principles of perpetual care as a starting point for further discussion and development. They are a beginning for this generation and the people who are charged with the care of the Giant Mine and other sites requiring long-term care to take responsibility for restoration, care, and healing of the land and community. We also offer the principles as a statement of hope that there will be benefits to future generations . We aspire to be wise ancestors to those generations to come.

Questions for Communities and Decision-makers

Although this guide was developed for Giant Mine and uses the mine as an example, the principles are adaptable to various contaminated sites and can be used as a flexible tool for communities struggling with a legacy of toxic or radioactive sites. The study guide questions presented below are designed to spark creative problem-solving on the part of communities and decision-makers. They may be adapted to other long-term care situations.

Information, Memory and Warning Systems: How do we communicate with each other and with future generations?

1) Who needs to know the story of Giant Mine now, in 100 years in 1000 years?
2) What do we think they need to know?
3) What have we learned from the story of the Giant Mine that will help us prevent this kind of harm from happening in the future? Are we acting on that wisdom now?
4) How can we pass on the information to those who need to know? How do we remember the story of the Mine, the story of the land, the story of the people?
    --a Museum
    --Pilgrimages
    --Memory stones
    --Stories
    --Government records
    --What else?
5) What are the dangers of the mine today and in a thousand years? How do we warn people of those dangers?
6) Are there recommendations this community has for other communities considering a new mining operation or cleanup of an existing mine?
7) Are there other questions we need to ask?

Monitoring

1) What monitoring systems are needed to make sure the Mine does not cause further harm?
2) What monitoring systems do we need to make sure the land, animals, water, plants, and people are healthy and not harmed by the Mine over time?
3) Who should do the monitoring?
4) Who should get monitoring information?
5) What Traditional Knowledge monitoring systems are there? Do the land, plants, animals give information about what might be happening at the Mine?
6) Is any public health monitoring needed? If so, who should do it and pay for it?
7) What environmental monitoring is needed?
8) What plans are in place in case monitoring shows that the technology is failing or that the people are suffering from the Mine? Should those plans be in place so there are triggers for action?

9) What specific triggers or thresholds should be identified before hand for the monitoring data? What specific actions, studies or work will be undertaken if the triggers of thresholds are reached?
10) Are there other questions we need to ask?

Financial Mechanisms

1) Can the polluter be held accountable?
2) What obligations will be left to future generations? Can those be avoided?
3) How can long-term funding be guaranteed?
4) Are there ways to solve multiple problems with simple solutions? For example, creating jobs in the restoration processes of perpetual care sites?
5) Are there debts owed to current generations because of injustice—for example, to those who must pay for water because their water was polluted?
6) Who will control the funding and who will have access to it? Will there be restrictions on what the funding can be used for?
7) How will the available funding be periodically evaluated for its adequacy in dealing with regular monitoring, maintenance and emergencies?

Technology

1) What criteria should be used to determine what technology or other technologies should be used to isolate the waste and protect the environment?
2) Is the freezing technology adequate to protect present and future generations forever?
3) How should the pilot project be evaluated? Should the community be part of the evaluation team? What happens if the outcome of the pilot project indicates this is not a successful technology?
4) Have all the alternatives been considered?
5) Does the technology limit other solutions in the future? Is it fully reversible?
6) Are there other technologies that should be used to serve as a backup to the current freezing technology?
7) What happens if funding is cut to maintain and monitor the site?
8) How do we ensure the ongoing research and development of new technologies that may provide a more permanent solution or a way to deal with the arsenic that reduces perpetual care requirements?
9) How do we ensure regular and periodic review of new technologies or alternatives that can be used for perpetual care or that may reduce perpetual care requirements?
10) Are there other questions we need to ask?

Restoration

1) What did the site look like before it was damaged?
2) What would it take to restore the site to health?
3) What are the indicators of health at this site?

4) What knowledge—indigenous, local, expert—is needed to set goals for restoration of this site?
5) What is preventing this site from being restored?
6) What needs to be done to repair the social damage that the mine has caused?
7) What are the barriers and obstacles to meaningful local involvement and participation in restoration?