An Integrated Biological Control System at Hanford – 10436

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ABSTRACT

In 1999 an integrated biological control system was instituted at the U.S. Department of Energy's Hanford Site. Successes and changes to the program needed to be communicated to a large and diverse mix of organizations and individuals. Efforts at communication are directed toward the following:

- Hanford Contractors – Liquid or Tank Waste, Solid Waste, Environmental Restoration, Science and Technology, Site Infrastructure
- General Hanford Employees
- Hanford Advisory Board – Native American Tribes, Environmental Groups, Local Citizens, Washington State and Oregon State regulatory agencies

Communication was done through direct interface meetings, individual communication where appropriate, and broadly sharing program reports. The objectives of the communication efforts was to have the program well coordinated with Hanford contractors, and to have the program understood well enough that all stakeholders would have confidence in the work performed by the program to reduce or eliminated spread of radioactive contamination by biotic vectors.

Communication of successes and changes to an integrated biological control system instituted in 1999 at the Department of Energy's Hanford Site have required regular interfaces with not only a diverse group of Hanford Contractors (i.e., those responsible for liquid or tank wastes, solid wastes, environmental restoration, science and technology, and site infrastructure), and general Hanford employees, but also with a consortium of designated stake holders organized as the Hanford Advisory Board (i.e., Native American tribes, various environmental groups, local citizens, Washington state and Oregon regulatory agencies, etc.). Direct interface meetings, individual communication where appropriate, and transparency of the biological control program were the methods and outcome of this effort.

INTRODUCTION

The site selected for the Manhattan Project's Hanford Engineering Works, today known as the Hanford Site, was in the semi-arid region of south-central Washington. The site was selected to develop weapons grade material for a nuclear weapon during World War II and was chosen because of low population, availability of water, and availability of electricity. Total area set aside was 151,630 hectares (374,678 acres), of which 8,743 hectares (21,604 acres) have been impacted by Hanford-related or more recent energy-related operations.

Habitat changes on portions of the Hanford Site resulted from construction to support the Manhattan Project national defense operations, and many have been sources of water, salt, or cover to biota. These have included:

- Production facilities
- Tank farms
- Transfer lines (both raw water and waste streams)
- Ponds, cribs, and ditches
- Solid waste trenches
- Spills and leaks

All have been implicated in radioactive contamination spread via biotic vectors. For example 81 species of biotic vectors (30 species of vegetation and 51 species of wildlife) have been identified from vegetation to wildlife. Approximately 5,400 instances of biological intrusion have been identified. Radionuclides were primarily mixed fission products such as strontium-90 and cesium-137.

From the beginning, the Hanford Engineering Works included ecological monitoring to detect radioactive contamination spread that may be migrating into the environment. Native species found the new sources of water and cover ideal, and habitat disturbance for construction created conditions ideally suited for certain invasive species, such as tumbleweed (*Salsola* spp.) which became a serious vector for contamination uptake and spread. In addition to effluent emissions, certain biota (i.e., vegetation and wildlife), such as vegetation, waterfowl, and deer, were selected for monitoring primarily because they migrated off site or were hunted for human consumption. As early as 1947, reports were generated of radioactive monitoring of waterfowl, and in 1965 ecological radioactive monitoring was formalized in annual reports. In the 1970's engineered barriers to both deep-rooted vegetation and wildlife were developed to preclude species frequenting waste sites and operations facilities. These species had been discovered through radioactivity monitoring or that had the potential to uptake radionuclides. Over the years, monitoring of biota has expanded as knowledge of potential pathways to humans has expanded to include species such as insects, amphibians, reptiles, rodents, lagomorphs (i.e., rabbits), and carnivores (e.g., coyotes).

Interest in radioactive contamination spread has increased over the years from being localized to technical specialists on site, to making national or even international news. Communication needs have also grown over the years, as evidenced by the early reports read primarily within the local technical community to today where a spread of radioactive contamination via biota can become national news. Today communication is to a variety of customers, including Mission Support Alliance, LLC (MSA), the local U.S. Department of Energy office (DOE-RL), U.S. Department of Energy Headquarters (DOE-HQ), multiple Hanford Site stakeholders (e.g., Native American Tribes, neighboring state government agencies), and various media outlets.

INTEGRATED BIOLOGICAL CONTROL

The need for a biological control program was reemphasized as a result of the spread of radioactive contamination by biological vectors (e.g., tumbleweeds, insects, birds, mammals, etc.), as documented in a DOE Inquiry Report [1]. The Inquiry Report noted the significant increase in incidents of radioactive contamination spread by biological vectors (e.g., tumbleweeds and mice) from 1994 through 1998. Fluor Hanford initiated a subsequent investigation, agreed with the DOE report, and responded to the findings by committing to the creation of a new integrated biological control program. In 2009, a new contractor, Mission Support Alliance, LLC (MSA), won the contract for providing infrastructure support to the Hanford Site, including the Integrated Biological Control Program (IBC or the Program). The design and operating procedures for this program have been formalized in a Requirements Document [2].

The Program attacked the growing radioactive contamination problem through four approaches:

- Expanded environmental surveillance in cooperation with Near-facility Environmental Monitoring
- Clean up of radioactive contamination and sources when they are found
- Control of biological vectors (i.e., vegetation & animals) in a coordinated manner
- Restoration of disturbed waste sites with engineered & natural biological barriers

The Program contributed to a reduction in the spread of radioactive contamination via biological vectors by building multidisciplinary teams (i.e., radiation control technicians, teamsters, & nuclear chemical operators in one team), with the combined capability of accomplishing clean up without waiting to bring in a specialized craft, thus avoiding delays and additional contamination spread. Results were significant over the first four years. Animal-caused contamination incidents, which had increased from 12 in 1994 to 46 in 1998, decreased to 17 in 1999, 13 in 2000, and 10 in both 2001 and 2002. Contamination incidents involving vegetation as the vector increased from 20 in 1994 to 51 in 1998. As searches were expanded, it increased to 84 in 1999, but decreased to 65 in 2000, 31 in 2001, and an all time low of 11 in 2002. However, initial success should not lull one into complacency; stakeholders do take notice. Beginning in 2003, increases in biological vector-related contamination spread increased significantly in vegetation (i.e., 32 in 2003 to 127 in 2008), and increased slightly in animals (i.e., 26 in 2003 to 30 in 2008). Primary factors intervening to cause this negative reversal have included:

- Increased numbers of contractors, resulting in more complicated accessibility and reporting
  - Three DOE offices
  - Five major site contractors
  - Multiple subcontractors
- An increase in chemical resistance, verified by herbicide production scientists

- Two major site wild-land fires in the past 10 years, impacting thousands of hectares and increasing tumbleweed habitat

These factors required an increase in effective communication which has been met in the following ways:

- Determining who the primary contacts were among the various contractors responsible for having biological vectors controlled on their sites
- Conducting one-on-one site inspection between IBC and these managing contractors
- Holding monthly working group meetings among IBC managers, DOE, and other Hanford contractors, and inviting stakeholders (e.g., Hanford Advisory Board) to attend
- Participating in both Hanford Advisory Board meetings as invited, and meeting with the interested stakeholders at their request
- Distributing regular status reports to all interested parties
- Contributing an IBC annual status for inclusions in the publicly disseminated Site Environmental Report
- Sharing information to improve relations by converting IBC records such as Pesticide Application Records (formerly controversial to some of these groups) to electronic format and providing them to these groups at their request
- Consulting with offsite experts in herbicide activity and toxicology

Annual tasks completed by the IBC Program in 2009 included:

- 30,000 animal control responses
- Removed ~2,300 pest animals (none of which were contaminated)
- Applied herbicides to ~3,000 hectares of operations areas
- Restored shallow-rooted grasses to ~ 1,000 hectares
- Mowed and controlled deep-rooted vegetation on ~14 kilometers of waste transfer lines

Additional developments in communicating IBC status beyond the site technical level have included increased questions and suggestions for improvement. For example, the need for control of radioactive waste is obvious and required by law, but one of the tools to do that is using herbicides to control the growth of deep-rooted vegetation which uptake selected radionuclides. The use of herbicides is controversial at the Hanford Site because of its location in the middle of an important grape growing area. Communications have had to expand to demonstrate that Hanford is mindful of that concern and not contributing to herbicide impacts to the grape industry. The Site has changed its record keeping of herbicide and other pesticide applications from manual to an electronic format which allows the information to be easily shared with the stakeholders.

SUMMARY

Communicating the status of IBC beyond the local level has had both obvious benefits, apparent when all goes well, and burdens when increased demand for information has stretched the ability to keep up while still meeting implementation needs. The original intent of IBC was singly to reduce and eliminate the spread of biota-related contamination spread, but with additional eyes looking on, additional questions and suggestions have improved aspects of the Program, but not always without pain. In conclusion, while communication has been both time saving and time consuming it has always been advantageous in the long run.

REFERENCES

1. Krupin, P. W. and B. A. Pangborn. *The Control of the Spread of Radioactive Contamination Due to Biological Transport at the Hanford Site*. DOE-RL 98-EAP-584, (January 1999).
2. Johnson, A. R. *Integrated Biological Control Program*. MSC-RD-39470 Rev 0, (November 2009)