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Canada

Federal Contaminated Sites Action Plan (FCSAP)

FCSAP Advisory Bulletin (FAB): How clean does a contaminated site need to be to achieve acceptable protection of ecological receptors for subsequent site closure?

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ISBN: 978-0-660-04986-1
Cat. No.: En14-246/2016E-PDF

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Federal Contaminated Sites Action Plan (FCSAP)

FCSAP Advisory Bulletin

How clean does a contaminated site need to be to achieve acceptable protection of ecological receptors for subsequent site closure?

Background

The Federal Contaminated Sites Action Plan (FCSAP) provides financial and technical assistance for the assessment, remediation and/or risk management of eligible federal contaminated sites. Assessment funding is used to assess whether a site is contaminated and to determine the extent of the contamination. Remediation/risk management funding is used to reduce environmental liability by reducing the risk to human health and the environment and from contamination at high priority sites for which the federal government is responsible.

The federal *Policy on Management of Real Property* (Treasury Board of Canada, 2006) stipulates that "…Management activities (including remediation) must be undertaken to the extent required for current or intended federal use*…"*

After completion of remediation and/or risk management activities and any required long-term monitoring at a federal contaminated site, the FCSAP Site Closure Tool is used to help the custodian evaluate if a site should be closed, and also to record site conditions and site-use limitations, where applicable. The status 'Closed' is assigned to sites on the *Federal Contaminated Sites Inventory* when the custodian deems that no further action is required and there is no environmental liability. No further action means that: all risks to human and ecological receptors are acceptable; there is no environmental liability associated with the site; and long-term monitoring is either not required or is complete (FCSAP, 2013a, b)[1].

This FCSAP Advisory Bulletin presents standard FCSAP Expert Support advice pertaining to the required extent of activities on FCSAP-funded federal contaminated sites in regard to protection of ecological receptors. It answers the frequently asked question: "How clean does a contaminated site need to be to achieve acceptable protection of ecological receptors for subsequent site closure?" For human health, guidance on the level of protection required to achieve site closure at FCSAP funded contaminated sites is provided separately by Health Canada (2010a, b) and is not part of this FCSAP Advisory Bulletin.

Standard Approach

The level of protection for ecological receptors that is needed to achieve site closure at FCSAP sites has been adopted from the level of protection inherent in the Canadian Soil Quality Guidelines (Canadian Council of Ministers of the Environment (CCME), 1999). This narrative protection goal is stated as the guiding principle in the protocol for the derivation of soil quality guidelines (CCME, 2006) as follows:

[1] Sites that are being divested or sites where the contamination is moving off-site may be subject to additional requirements subsequent to site-specific divestiture agreements or subsequent to requirements of the jurisdiction responsible for the land impacted by off-site migration.

"*to provide a healthy functioning ecosystem capable of sustaining the current and likely future uses of the site* "

FCSAP considers this as an acceptable protection goal for all media (e.g., soil, sediment, surface water, and groundwater) because the Canadian Soil Quality Guidelines were developed specifically for use at contaminated sites. This FCSAP narrative protection goal is intended to guide remediation and risk management activities at terrestrial and aquatic FCSAP sites to ensure protection of ecological receptors and to allow subsequent site closure[2].

At most FCSAP sites, this narrative protection goal is typically met, when it can be demonstrated that there are:

- No effects on individuals of protected species (e.g., Federal *Species At Risk Act* (SARA) and/or provincially-listed species); and
- Only minimal to low effects on common species, as long as there are no long-term, adverse effects on the local populations or ecosystem functions.

Site closure also requires that the following conditions be met:

- Compliance with all applicable legislation (e.g., *Fisheries Act, SARA, Canadian Environmental Protection Act (CEPA)*);
- No other socio-economic reasons why minimal to low effects to common species would not be acceptable (e.g., culturally-important species).

Site closure at FCSAP funded contaminated sites can be achieved through ex-situ remediation with off-site disposal or treatment, on-site *in-situ or ex-situ* remediation, or risk management as per the FCSAP Site Closure Tool (FCSAP, 2013a). Within these three main operational approaches, several options are available to achieve the FCSAP narrative protection goal and subsequent site closure:

a. remediation where contamination is removed or reduced to CCME guidelines (CCME, 1999);
b. remediation to guidelines from other jurisdictions, if CCME guidelines are not available[3];
c. demonstration with a risk assessment, that the risk to ecological receptors is acceptable;
d. remediation to Site-Specific Target Levels developed through a site-specific risk assessment;
e. risk reduction to where the custodian deems that no unacceptable risk to human health and the environment remains, and this through appropriate risk management strategies; or
f. management of the site using a combination of the above approaches.

It is the custodian's responsibility to determine which approach (a-f) is most suitable and cost-effective for each site. Regardless of which option is used at a particular FCSAP site, the custodian should demonstrate that the FCSAP protection goal for the protection of ecological receptors has been met prior to site closure. To ensure protection of Human Health, the custodian should follow applicable guidance by Health Canada (2010a, b).

For site-specific advice on how clean a contaminated site needs to be to achieve site closure, please contact your regional expert support representatives or the FCSAP Secretariat at FCSAP.PASCF@ec.gc.ca.

[2] The FCSAP narrative protection goal is not intended to be applied when determining if a site is contaminated or if a site is eligible for FCSAP funding, in which case media specific CCME numeric guidelines apply (CCME 1999).

[3] see FCSAP Advisory Bulletin #1*: Can Provincial/Territorial Guidelines be applied in lieu of existing Federal Guidelines?*

Examples

In this section, specific examples are provided to illustrate how approaches a) to f) as listed above can be applied to achieve the FCSAP protection goal for ecological receptors:

a) Remediation to CCME guidelines:
Contamination at the site that exceeds CCME guidelines is removed (e.g. excavated) or reduced (e.g. land farming, monitor natural attenuation, soil vapour extraction) to below guidelines, thus the inherent CCME level of protection for that media is achieved. For example, for a CCME surface water guideline that is derived from a Species Sensitivity Distribution (5th percentile of a no-effect distribution), it would be expected that, at or below this concentration, all aquatic receptors in all life stages are protected and sustainable ecosystem function is achieved. Remediation to CCME water and sediment guidelines meets and actually exceeds the FCSAP protection goal[4]. As another example, the soil contact pathway guideline for soil at an industrial site is based on the 50th percentile of Effective Concentration (EC) 25 and/or Inhibition Concentration (IC) 25 data (CCME, 2006). Low levels of adverse effects are expected to occur in less than half the terrestrial species at contamination levels at or below these guidelines, but overall effects impairing ecosystem function are not expected. Remediation to CCME soil quality guidelines meets the FCSAP narrative protection goal.

b) Remediation to guidelines other than CCME:
When contamination is present at a FCSAP site for which no CCME guidelines exist, the site may be remediated to guidelines from another jurisdiction (e.g., provincial, international). Numerical guidelines from different jurisdictions are often developed using different data, methods or models. It is therefore important to demonstrate that the guideline is consistent with the FCSAP protection goal and no more than minimal effects are expected to occur. If the level of protection inherent in the guideline from a different jurisdiction allows for more significant effects, it would not be acceptable to be used on FCSAP sites. For example, while the CCME soil quality guidelines are often based on a certain percentile of EC/IC 25 data, guidelines from another jurisdiction may be developed by selecting the lowest available EC20 from the literature. In this case, although derived differently, the level of protection is similar to the level of protection provided by CCME and no more than minimal effects are expected to occur. In contrast, if a guideline from a different jurisdiction is intended to protect receptors only from acute and severe effects, and was, for example, derived by calculating an average EC50, then this guideline is not consistent with the FCSAP protection goal and is not acceptable to guide remediation efforts on FCSAP sites.

c) Demonstration, with a risk assessment, that risk to ecological receptors is acceptable:
A custodian may conduct a risk assessment (following FCSAP guidance) to show whether the FCSAP protection goal is met. For example, a weight-of-evidence risk assessment could use numerous lines of evidence to conclude that, despite contamination in surface water, sediment or soil above CCME guidelines, receptors remain protected and a healthy, sustainable, and functioning ecosystem is maintained at the site as required by the FCSAP narrative protection goal. For example if toxicity testing is conducted as one line of evidence, results showing less than EC/IC 25 for terrestrial species (CCME, 2006, Section 7.5.5) or less than EC/IC 20 for aquatic species (CCME, 2007, Part II, Section 1-7) are commonly considered to represent minimal to low effects (i.e. negligible risk if all other parameters are met). Similarly, if benthic community analysis is used as a line of evidence, effects are typically considered minimal to low if observed differences between the site and appropriate reference areas are not statistically significant (Environment Canada and Ontario Ministry of the Environment, 2008).

[4] CCME surface water and sediment guidelines have a more stringent level of protection (i.e., no effect) than the FCSAP protection goal stated in this Advisory Bulletin because they were developed for pollution prevention at pristine sites. Hence, sites that are being closed using approach “a) remediation to CCME guidelines” will likely have chemical concentrations in sediment and surface water lower than the level required for FCSAP Site Closure.

d) Remediation to Site-Specific Target Levels developed by a site-specific risk assessment:
If a risk assessment concluded that certain receptors are not protected, the risk assessment may be used to develop Site-Specific Target Levels (SSTLs). The site would be remediated to these SSTLs, and although the SSTLs differ in value from the CCME guidelines, they would ensure that a healthy functioning ecosystem capable of sustaining the current and likely future uses of the site by ecological receptors is maintained as required by the FCSAP narrative protection goal.

e) Reduction of risk through appropriate risk management strategies:
If a risk assessment identified that, for example, key ecological receptors are not protected and ecosystem function is at risk, permanent risk management measures such as reducing contaminant bioavailability, limiting access through fencing, etc., may reduce or mitigate exposure. These measures ensure that key ecological receptors will be protected to a level indicative of a healthy, sustainable, and functioning ecosystem as required by the FCSAP narrative protection goal. Although the federal custodian remains responsible for maintaining the long-term effectiveness of the risk management measures, FCSAP site closure may be achieved as no additional risk reduction initiatives are required.

f) Management of the site using a combination of the above approaches:
Sites may be managed with a variety of approaches. For example, excavation of hotspot soil contamination to CCME guidelines at a site can be supplemented with a risk assessment for residual contamination that could not be accessed. Although the majority of the contamination would be removed, risk assessment could establish that any remaining contamination does not pose an unacceptable risk to key ecological receptors, thereby maintaining a healthy, sustainable, and functioning ecosystem at this site.

For approaches b) to f), the site specific documentation (e.g., risk assessments, remediation reports, long-term monitoring approaches) should clearly demonstrate how the remediation methods, risk assessment approaches, and/or risk management measures achieved the FCSAP narrative protection goal. For approaches c) to f) it is the responsibility of the custodian to maintain conditions and any risk reduction measures that were deemed necessary to meet the FCSAP narrative protection goal for ecological receptors.

References

CCME 2006: *A protocol for the derivation of environmental and human health soil quality guidelines*. Canadian Council of Ministers of the Environment, Winnipeg, PN 1332, 215 pgs.

CCME 2007: *Protocol for the Derivation of Water Quality Guidelines for the Protection of Aquatic Life*. Canadian Council of Ministers of the Environment, Winnipeg.

CCME 1999: *Canadian environmental quality guidelines*. Canadian Council of Ministers of the Environment, Winnipeg.

Environment Canada and Ontario Ministry of the Environment 2008: *Canada-Ontario decision-making framework for assessment of Great Lakes contaminated sediment*. Ottawa (ON), Canada.

FCSAP 2013a: *Guidance for Site Closure Tool for Federal Contaminated Sites*. 79 pgs.

FCSAP 2013b: *Federal Contaminated Sites – Site Closure Tool*, Version 1.2. January 2013.

Health Canada 2010a: *Federal Contaminated Site Risk Assessment in Canada, Part V: Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals* ($DQRA_{Chem}$). 193 pgs.

Health Canada 2010b: *Federal Contaminated Site Risk Assessment in Canada, Part VI: Guidance on Human Health Detailed Quantitative Radiological Risk Assessment* ($DQRA_{Rad}$). 164 pgs.

Treasury Board of Canada 2006: *Policy on Management of Real Property*.

Acronyms & Glossary

CCME	Canadian Council of Ministers of the Environment
CEPA	Canadian Environmental Protection Act
ECx	Effective Concentration x: The concentration of a chemical in the medium that results in some sublethal effect to x% of the test organisms. The ECx is normally reported as a time dependent value with the sublethal endpoint observed (e.g., 5-day ECx,reproduction). Effective concentrations can be specified for different percentiles (e.g. the EC50 would result in an effect to 50% of the test organisms, the EC25 would result in an effect to 25% of the test organisms) (adapted from CCME 2006)
FAB	FCSAP Advisory Bulletin
FCSAP	Federal Contaminated Sites Action Plan
ICx	Inhibition Concentration x: The concentration of the chemical in a medium which results in an x% response to a measured endpoint (e.g. growth, reproduction) for the test organism. For example: The IC25 is normally reported as a time dependent value with the sublethal endpoint observed (e.g., 28-day IC25, plant growth). Inhibition concentrations can also be specified for other percentiles (e.g. the IC50 would result in a 50% effect to the measured parameter) (adapted from CCME 2006)
SARA	Species at Risk Act
SSTL	Site Specific Target Level

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