

---

# Proposed Environmental Site Closeout Concepts, Criteria, and Definitions

## Technical Background Document and Recommendations

Prepared for  
**Alaska Statement of Cooperation Working Group**

September 2006

Prepared by  
**Geosphere, Inc.**  
**CH2MHILL**

## **Preface**

This document was created under the Alaska Statement of Cooperation (SOC), which is an agreement between the Alaska Department of Environmental Conservation (ADEC), the U.S. Environmental Protection Agency (EPA), the Departments of the Army, Air Force, Navy, Military and Veterans Affairs (Army National Guard), Interior, and the Federal Aviation Administration (FAA) and U.S. Coast Guard. The objective of the agreement is to work cooperatively to identify and resolve issues affecting human health and the environment through promoting compliance with environmental laws, preventing pollution, creating partnerships to identify and cleanup contaminants and pollution, promoting training and coordinating with affected Tribes. A subcommittee or “working group” was formed under the SOC to evaluate the characterization and fate and transport of petroleum hydrocarbons spilled in the environment, and the risks posed by petroleum contamination. FAA contracted with Geosphere and CH2M Hill to research the issues and develop eight technical issue papers. The paper titles are listed below. Staff from ADEC, FAA, the Army and Army Corps of Engineers, and the Army National Guard reviewed and provided feedback on the draft papers. These papers provide sound scientific and technical information along with recommendations for use and/or future consideration.

## **ADEC Disclaimer**

This paper does not constitute ADEC guidance, policy, or rule making, nor does it create any rights or benefits, substantive or procedural, enforceable at law or in equity, by any person. ADEC may take action at variance with this paper.

## **Statement of Cooperation Working Group Paper Titles**

1. Three- and Four-Phase Partitioning of Petroleum Hydrocarbons and Human Health Risk Calculations, Technical Background Report Document and Recommendations
2. Hydrocarbon Characterization for Use in the Hydrocarbon Risk Calculator and Example Characterizations of Selected Alaskan Fuels, Technical Background Document and Recommendations
3. Dilution-Attenuation Factors at Fuel Hydrocarbon Spill Sites, Technical Background Document and Recommendations
4. Maximum Allowable Concentration, Residual Saturation, and Free-Product Mobility, Technical Background Document and Recommendations
5. Groundwater Sampling Techniques for Site Characterization and Hydrocarbon Risk Calculations, Technical Background Document and Recommendations
6. Migration to Indoor Air Calculations for Use in the Hydrocarbon Risk Calculator, Technical Background Document and Recommendations
7. Site Conditions Summary Report for Hydrocarbon Risk Calculations and Site Status Determination, Technical Background Document and Recommendations
8. Proposed Environmental Site Closeout Concepts, Criteria, and Definitions, Technical Background Document and Recommendations

# Contents

---

<b>Section</b>	<b>Page</b>
<b>1 Introduction .....</b>	<b>1</b>
<b>2 Closed and Open Sites and the Hydrocarbon Contaminated Site “Status Map” .....</b>	<b>3</b>
2.1 Human Health Risk Evaluation .....	3
2.2 Ecological/Environmental Risk Evaluation.....	4
2.3 Closed Site and Open Site Categories or Levels .....	5
<b>3 Site Status Determination/Closeout Process – Application and ADEC Review .....</b>	<b>10</b>
<b>4 Permanent Record of Site History, Conditions, and Status .....</b>	<b>12</b>
<b>5 Summary and Recommendations.....</b>	<b>16</b>
<b>6 References .....</b>	<b>18</b>

## **Appendix**

Hydrocarbon Contaminated Site “Status Map”

# Acronyms and Abbreviations

---

ADEC	Alaska Department of Environmental Conservation
ASPLS	Alaska State Professional Land Surveyors
AWQC	ambient water quality criterion
BLM	Bureau of Land Management
CD	compact disk
CORS	Continuously Operating Reference Stations
DAF	dilution-attenuation factor
DNR	Department of Natural Resources
DOT&PF	Department of Transportation and Public Facilities
DRO	diesel-range organics
EPA	U.S. Environmental Protection Agency
GRO	gasoline-range organics
GPS	global positioning system
MCL	maximum contaminant level
NAPL	nonaqueous-phase liquid
NAVD88	North American Vertical Datum of 1988
NFRAP	no further remedial action planned
NGS	National Geodetic Survey
OPUS	Online Positioning Users Service
PDF	portable document format
PLS	Professional Land Surveyor
RRO	residual-range organics
SOCWG	Statement of Cooperation Working Group
SVE	soil vapor extraction
TAH	total aromatic hydrocarbons
TAqH	total aqueous hydrocarbons
USC&GS	United States Coast and Geodetic Survey

## SECTION 1

# Introduction

---

The Alaska Department of Environmental Conservation (ADEC) currently characterizes contaminated sites in three categories: (1) closed sites; (2) “no further remedial action planned” sites, also known as “conditionally closed” sites; and (3) open sites. To be classified as a “closed site” the site must have soil and groundwater concentrations below the cleanup concentration criteria listed in Tables B1, B2, and C of the contaminated site regulations (18 Alaska Administrative Code [AAC] 75). To be classified as a no further remedial action planned (NFRAP) or conditionally closed site the site must have approved alternative cleanup levels, must have a stable or decreasing trend in contaminant levels, or have physical constraints to continued remediation (such as contamination under a building or at a depth that cannot be excavated). Open sites do not meet the criteria for closed or NFRAP/conditionally closed sites. Institutional controls and the ability to transport soils offsite are linked to the site classification. Institutional controls and monitoring are not required for closed sites. Institutional controls and possibly monitoring are required for NFRAP/conditionally closed and open sites. Soils from closed sites can be moved to other sites without notifying ADEC provided the soils are placed in upland areas (not in wetlands), and are placed more than 100 feet from drinking water wells, surface water bodies, and drainage ditches. Soils from NFRAP/conditionally closed and open sites cannot be moved offsite without permission from ADEC. If requested ADEC will make decisions regarding the offsite transport of contaminated soils based on whether the soils will cause a human health or environmental risk at the new site; however, specific criteria are not provided.

Use of the existing contaminated sites classification system has the following issues:

- Although the dividing line between closed and NFRAP/conditionally closed sites is clearly defined, not all of the Table B1, B2, and C criteria are risk-based. Therefore, depending on site conditions, some sites may present risk but have concentrations below Table B1, B2, and C levels while other sites can have concentrations significantly higher than the Table B1, B2, and C values and not present a risk.
- The dividing line between open and NFRAP sites is not well defined, potentially allowing or causing a discrepancy between what sites can receive the NFRAP status.
- The NFRAP or conditional closure status covers a wide range of human health risks. For example, it can include sites which pose only a small fraction of the allowable risk and sites which pose a human health risk but have constraints that limit further remediation (contaminated soil under a building).
- The wide range of human health risks included in the NFRAP/conditionally closed status complicates risk communication, which complicates property transfers and property development.

This document describes a “contaminated site classification system” that is presented as an alternative to the existing system. This proposed alternative contaminated site classification system places all contaminated sites into the major categories of “open sites” and “closed sites.”

The Alaska Statement of Cooperation Working Group (SOCWG) proposes to use the term “closed site” to describe a site that presents an acceptable human health and environmental risk, and the term “open site” to describe a site that presents an unacceptable human health or environmental risk. The terms “open” and “closed” are simple and as described here, present a clear, quantifiable contrast to differentiate contaminated sites. However, the SOCWG recognizes that other terms may also be useful. Closed sites may be further divided into four different categories of “closed sites,” and open sites may be differentiated into three categories of “open sites.” This document also defines the criteria necessary to place any site in a closed site or open site category.

The assignment of a site into one of the open site or closed site categories may be described as determining the “site status.” Note that the site status should be expected to change through time. For example, when a contaminated site is discovered the site conditions may indicate that a human health risk exists that would place the site in an open category 1 status; after taking remedial action, the site may qualify for an open category 3 status; and after a period of intrinsic remediation, the site may qualify for closeout.

This document builds on the information presented in the Alaska Statement of Cooperation Working Group technical background documents describing phase partitioning and the hydrocarbon risk calculator; site characterization; maximum allowable concentrations and free product mobility; dilution attenuation factors; hydrocarbon characterization; groundwater sampling; migration to indoor air exposure route; and existing ADEC guidance documents. The proposed site closeout categories are based primarily on an assessment of whether a potential human health and environmental risk is posed by the site, and by the risk associated with the migration to groundwater route if the soil is transported to another location. The open site categories are based on an assessment of whether the human health exposure routes and environmental exposure routes are complete or incomplete, and on whether the potential risk is actively managed or uncontrolled. Most distinctions between closed and open site levels or categories can be related to exceeding some measured risk-based concentration or calculated risk-based value (that is, the results of field tests and/or calculations define the boundaries between different closed or open site categories).

The contaminated site classification system described here is only a proposed system and not currently accepted by the ADEC. Therefore, when reading this document the reader should preface much of the discussion with the thought “if the proposed alternative contaminated site classification system was accepted or implemented by the ADEC then this is how the system would work and what would be required.”

## SECTION 2

# Closed and Open Sites and the Hydrocarbon Contaminated Site “Status Map”

---

The SOCWG has developed a contaminated site classification system that is a proposed alternative to the existing ADEC contaminated site classification system. This section describes and discusses the criteria that are used to place sites in the different categories of the proposed alternative contaminated site classification system.

**Closed and Open Sites.** All contaminated sites can be divided into the major categories of “open sites” and “closed sites.” Open sites are considered to present an existing or potential human health risk above accepted levels, or an environmental risk above accepted levels. Closed sites do not have the potential to present human health risks or environmental risks above accepted levels. Site closure allows any onsite activity to occur, but acknowledges that if soils are transported to another site they could cause a groundwater or surface water quality problem (but not a soil ingestion or indoor air risk; this is the same for soils meeting the current 18 AAC 75 Table B1 and B2 criteria).

**Hydrocarbon Contaminated Site Status Map.** A form or “status map” has been developed to help identify the status of hydrocarbon-contaminated sites (Figure 1). The status map is divided into a left-hand side (highlighted in green) and a right-hand side (highlighted in yellow). From top to bottom the form is divided into three sections (the section headings are in bold type and have darker highlights). The first section is used to evaluate human health risks, the second section is used to evaluate environmental /ecological risks, and the third section is used to identify the closed or open site category or level. Numbered lines on the extreme left of the form identify different topics addressed on the form. The term “status map” was chosen by the SOCWG because the form shows where a site is relative to risk criteria and allows the responsible party, consultants and regulators, to chart a course to manage the risks posed by a site.

## 2.1 Human Health Risk Evaluation

The first section of the site status map is used to evaluate human health risks. Arrows on lines 1 and 2 of the form indicate that in general, hydrocarbon concentrations and risk increase from left to right across the page. A note informs the user that the exact hydrocarbon concentrations that create risk are dependent on the site conditions. The human health assessment section contains six questions and six answer boxes on the right- and on the left-hand sides of the form (the six questions on the right side mirror those on the left side). The questions should only be answered in the affirmative by checking the appropriate boxes. Sites that present acceptable human health risks meet all of the following criteria:

1. The cumulative increased cancer risk is less than 1 in one hundred thousand ( $1 \times 10^{-5}$ , line 3)
2. The cumulative hazard quotient is less than 1 (line 4)

3. The groundwater concentrations are below state and federal maximum contaminant levels (line 5)
4. The gasoline-range organics (GRO) aromatic and aliphatic soil, vapor, and dissolved concentrations at the site are below the risk-based soil ingestion, outdoor air vapor inhalation, indoor air vapor inhalation, and groundwater ingestion levels (line 6).
5. The diesel-range organics (DRO), aromatic and aliphatic soil, vapor, and dissolved concentrations at the site are below the risk-based soil ingestion, outdoor air vapor inhalation, indoor air vapor inhalation, and groundwater ingestion levels (line 7).
6. The residual-range organics (RRO) aromatic and aliphatic soil, vapor, and dissolved concentrations at the site are below the risk-based soil ingestion, outdoor air vapor inhalation, indoor air vapor inhalation, and groundwater ingestion levels (line 8).

A site that meets all of these criteria is interpreted to present an acceptable human health risk and is eligible for closure (provided it also meets the environmental risk criteria). Failing to meet any one of the above criteria will cause the site to be an open site. Good remedial effort and site conditions such as soil under buildings limiting the ability to excavate the soil; reaching the excavation limit of the backhoe; impracticability to recover more free product; diminishing returns for continued remedial effort as occurs with soil vapor extraction, bioventing, and air sparging; and/or technical limitations (impracticability or cost) cannot be used to argue for site closure. Similarly, temporary site conditions such as asphalt or concrete caps limiting infiltration or migration to air; lack of buildings limiting migration to indoor air; remote sites, absence of current use, or restricted access; and/or no current groundwater use, availability of city water or deep aquifer cannot be used to argue that a potential risk is not present. The groundwater ingestion route is not used in cumulative risk calculations only when ADEC has formally determined that the water is not a potable water source and has recorded the same on the deed.

## 2.2 Ecological/Environmental Risk Evaluation

The second section of the “status map” is used to assess ecological risks. The ecological/environmental risk section contains four questions and four answer boxes on the right- and on the left- hand sides of the form (the four questions on the right side mirror those on the left side). As indicated above, the questions should only be answered in the affirmative by checking the appropriate boxes. Sites that present acceptable environmental/ecological risks meet all of the following criteria:

1. The contaminants at or migrating from the site do not cause surface water bodies to exceed the ambient water quality criteria for benzene, total aromatic hydrocarbon (TAH) and total aqueous hydrocarbon (TAqH; line 9).
2. The contaminants at or migrating from the site do not cause surface water bodies to have a sheen or exceed other water quality standards in 18 AAC 70 (line 10).
3. Terrestrial populations are not impacted by the contaminants at the site (line 11).
4. Individual threatened or endangered species are not impacted by the contaminants at the site (line 12).

Sites that meet all of these criteria are interpreted to present an acceptable environmental/ecological risk and are eligible for closure (provided they also meet the human health risk criteria). Failing to meet any one of the above environmental/ecological criteria will cause the site to be an open site.

## 2.3 Closed Site and Open Site Categories or Levels

The bottom section of the “status map” is used to place the sites in an open or closed category or level, and to describe characteristics of the sites.

**Closed Site Categories or Levels.** Closed sites are differentiated into four different levels or categories based on the potential risk associated with soils transported offsite. The four levels or categories are designated A, B, C and D (line 13). Closure level A is considered unconditional closure and the closure levels B, C, and D are “conditional closures” because there are restrictions on the offsite use of the soil. The criteria used to place a site in a closed site category are shown on line 14 and the permitted offsite use of the soil is listed on line 15, as follows:

- Closure category “A” sites have either no detectable hydrocarbon remaining or BTEX and PAH concentrations that partition into water at concentrations below the ambient water quality criteria and DRO, GRO and RRO concentrations that do not produce sheen on surface water. DRO, GRO and RRO concentrations below about 250 mg/kg are thought to meet the sheen criteria based on observations by BP (Linda Nuechterlein & Jim Chatham, personal communications, 2006 and 2005). These soils may be used as fill in wetlands or surface water bodies.
- Closure category “B” sites have hydrocarbon concentrations that partition into water at concentrations above the ambient water quality criteria, but below the groundwater ingestion risk based criteria. These soils may be used as fill in the saturated zone.
- Closure category “C” sites have hydrocarbon concentrations that partition into water at concentrations above the groundwater ingestion risk based criteria, but below the groundwater ingestion risk based criteria multiplied by the ADEC default dilution-attenuation factor (DAF). These soils may be used as fill in the vadose zone.
- Closure category “D” sites have hydrocarbon concentrations that partition into water at concentrations above the groundwater ingestion risk based criteria multiplied by the ADEC default DAF. These soils may not be used as fill offsite. Note that because the default DAF is conservative, many sites may meet groundwater ingestion risk based criteria but fail the migration-to-groundwater criteria.

**Open Site Categories or Levels.** Open sites are differentiated based on whether human health and/or environmental exposure pathways are complete, whether mobile free product is present, and whether there are institutional controls in place to manage the risk posed by the site. The primary criteria for placing sites into open site categories are as follows (line 14):

- Open category “1” sites are sites with contaminant concentrations exceeding risk based levels and completed human health risk pathways. Examples of completed pathways may include drinking water from a well that has concentrations exceeding groundwater ingestion risk based levels, or working or living in a building that overlies soils with vapor

concentrations exceeding migration to indoor air migration route risk levels (given realistic building parameters), or living at a site which has soil concentrations exceeding the soil ingestion route residential risk based levels.

- Open category “2” sites are sites that exceed risk-based soil, vapor, and/or groundwater concentrations but do not have completed human health risk pathways, and do not have formal institutional controls that prohibit exposure. These sites could pose a human health risk if the land use or groundwater use changed (and by definition there is not an established control to keep the land or groundwater use from changing). For example a site may have groundwater above groundwater ingestion risk based levels but no drinking water wells onsite and no institutional controls to limit groundwater use. (Because the groundwater is above groundwater ingestion risk based values, the groundwater poses a potential human health risk. Because there are not currently wells on site, the groundwater pathway is incomplete. Because there are no institutional controls in place, the site “risk management” is not complete).
- Open category “3” sites are sites that exceed risk-based soil, vapor, and/or groundwater concentrations, do not have completed human health risk or environmental risk pathways, and do have physical and/or institutional controls that prohibit exposure and manage risk. For example: an open category 3 site may have groundwater above Table C levels, no drinking water wells onsite (incomplete pathway), and a recorded deed restriction (institutional control) prohibiting groundwater use; or a different open category 3 site may have a dissolved-phase plume that previously caused a surface water body to exceed the ambient water quality criterion (AWQC), but because physical barriers were installed and institutional controls and management plans are in place, the exposure pathway is incomplete and the risk is formally managed.

Open category 1 sites are considered high-priority sites, open category 2 sites are medium-priority sites, and open category three sites are low-priority sites (line 13). As indicated in line 15, the soil from open sites cannot be used as offsite fill without ADEC permission and/or successful remediation.

**Free Product Issues.** Line 16 of the site status form addresses issues associated with free product detected on the water table in monitoring wells. If free product that is mobile at the site scale is detected, the site is classified as an open category 1 site because fuel hydrocarbon free product that is mobile at the site scale indicates the following:

- The spill is relatively recent.
- Groundwater quality criteria are likely exceeded (all Alaskan fuels tested by the SOCWG had equilibrium concentrations above groundwater ingestion risk based levels).
- The risk associated with the hydrocarbon is likely increasing through time because of the expansion of the free product footprint area .
- The mobile free product presents a potential remediation opportunity.

Free product that is mobile at the site scale collects in monitoring wells at a thickness (or pressure) great enough to overcome the water displacement pressure of the site soils. Information for assessing the presence of free product that is mobile at the site scale is presented

in the technical background document on maximum allowable concentrations and free product (Geosphere and CH2M HILL, 2005) and in many other documents (Charbeneau, 1999). Free product that is mobile at the site scale must be remediated to the extent practicable and this remediation must occur in a short time frame for there to be any benefit to active remediation. Most free product detected in monitoring wells months or years after the release occurred is not mobile at the site scale. Also note that current ADEC regulations require recovery of all free product to the extent practicable. However, as discussed in the SOCWG paper on maximum allowable concentrations and free product recovery, the recovery of free product that is not mobile at the site scale is not practicable in many or most situations because free product that is not mobile at the site scale does not increase risk. Therefore, free product that is not mobile at the site scale does not require immediate active remediation, and does not impact the open or closed site status. As indicated on the closed (green) side of the form, it is possible, although unlikely, for hydrocarbon to be detected on the water table and for the site to still meet human health and environmental/ecological risk criteria.

**Environmental/ Ecological Issues.** Line 17 of the site status form addresses issues associated with environmental/ecological impacts at release sites. Sites that have complete environmental exposure pathways are considered open category 1 sites. Examples of completed environmental exposure pathways include a dissolved-phase plume reaching the edge of a stream at a concentration sufficient to cause the stream to exceed the AWQC, or a sheen on the surface of a pond where birds or other terrestrial animals are exposed. Completed environmental exposure pathways will require physical controls and/or active remediation to remedy the situation. Environmental /ecological exposure pathways that are not complete (that is, potential environmental/ecological risks) are addressed through the closed site levels of the site status map.

**Off-Property Hydrocarbon Migration Issues.** Line 18 of the site status map addresses issues associated with the migration of hydrocarbon off the property where the release occurred, and onto adjacent properties with different ownership. Fuel hydrocarbon release sites where nonaqueous-phase liquid (NAPL) has migrated onto adjacent properties or where dissolved- or vapor-phase plumes are migrating onto adjacent properties with different ownership and the adjacent property owner(s) has(have) not been properly informed of the situation are considered open category 1 sites. Note that the open category 1 status applies whether or not a completed human health exposure pathway has been documented on the adjacent property (the assumption is that if the property owner impacted by an upgradient release does not know of the impact to his property, then the exposure pathway is complete or could be completed at any time). If the adjacent property owner(s) is/are properly informed of the presence of the contaminant, and completed pathways are documented on the downgradient property, then the site remains an open category 1 site. When the adjacent property owner(s) is/are properly informed of the presence of the contaminant and the absence of complete exposure routes is confirmed, and there are not yet institutional controls in place, the site is considered an open category 2 site. When the adjacent property owner(s) is/are properly informed of the presence of the contaminant, and the absence of complete exposure routes is confirmed and there are institutional controls in place to manage the risk on the responsible party's site and the adjacent property owner's site, then the site may be considered an open category 3 site. Open level 3 sites with off-property migration of contaminants above risk-based levels may require a monitoring plan that addresses both the responsible party's property and the adjacent property. Impacts to the adjacent property's dollar value and reimbursement of the adjacent property owner for the

time and effort necessary to deal with the contamination may be settled through civil claims court.

**Institutional Controls.** Institutional controls are risk management tools used to limit the exposure of contaminants to humans and the environment. Institutional controls will likely be necessary at most or all open sites to formalize the protection of human health and the environment. Indeed, the primary distinction between open category 2 and open category 3 sites is the existence of formalized or recorded institutional controls (line 19 of the status map). An example of an institutional control is a deed restriction prohibiting the installation of a drinking water well in the portion of an aquifer impacted by spilled hydrocarbons. Sites that do not pose potential risks do not need institutional controls and therefore closed sites will not have institutional controls. Further, institutional controls cannot be used to achieve site closure. Note that sites with conditional closure status will have notes on the deed indicating that there are limitations on the offsite use of the soils.

**Monitoring Requirements.** Closed sites do not require monitoring, because to achieve closure, the site cannot present a potential risk and it is not necessary to monitor the absence of risk (line 20 of the status map). However, the responsible parties may elect to conduct monitoring after site closure in order to change the conditional closure level. If the data collected after site closure indicate that the site is eligible for a different closure status, then the responsible party must prepare a new site conditions report and apply to ADEC to have the status changed.

Most open sites will require some monitoring. Open category 1 sites have completed human health exposure pathways and/or mobile free product and/or completed environmental/ecological exposure pathways. These sites will likely require a combination of institutional controls, physical controls, and remediation to mitigate site risks, and relatively intense monitoring will be needed to define the extent of contamination, assess the performance of remedial measures, ensure that physical controls are working, and assess changes in risk. Open category 1 sites may include a variety of sites and site conditions, such as new sites where the extent of contamination has not been well-documented and human health exposure routes appear to be complete based on conservative assumptions, and possibly older, large releases that have been studied and really do present risk but where the exposure has not been eliminated because of the difficulties posed by the site conditions.

Open category 2 sites will likely require monitoring following the initial site investigation to help document, for example, that NAPL is not migrating, dissolved-phase plumes are stable, and to assess the migration-to-indoor air pathway. Open category 2 sites may be undergoing active remediation or may be addressed by intrinsic remediation. Monitoring may be conducted at intervals ranging from quarterly to about every 2 years, depending on the objectives of the monitoring.

Open category 3 sites may be characterized as generally well-understood sites where remedial investigations and possibly active remediation have been conducted. The stability of the NAPL and dissolved-phase plume has been documented and an absence of completed exposure routes has been demonstrated. In addition, open category 3 sites have recorded institutional controls. An open category 3 site may be undergoing active remediation, but intrinsic remediation is particularly appropriate for open category 3 sites because the controls are in place to protect human health and the environment for the indefinite future and, therefore, the site may safely remain in an open status for an extended time (decades). Given these site conditions and

controls, relatively little monitoring is required (provided active remediation is not required to control exposures – where active remediation is required to control exposures, routine monitoring will likely be required). The monitoring that is conducted may be directed toward for example – documenting that physical controls are working, that the plume is stable, and/or that the site is eligible for closure – and may be conducted at 2- or 5-year intervals (again, provided active remediation is not required to control exposures; where active remediation is required to control exposures, routine monitoring will likely be required).

**Industrial Sites.** Industrial sites should be addressed using the same approach as residential sites except that industrial exposure assumptions may apply. In addition, an institutional control would be needed stipulating the site may *only* be used for industrial purposes if industrial exposure parameters are used in assessing human health risk. To be eligible for an industrial site closure, the property must be formally zoned as industrial. If the property owner wants to change the use of a closed industrial site from industrial to residential, the site must be remediated to residential levels before the change in land status can be made.

**North Slope Sites.** Sites on the North Slope may be addressed using the same general approach described above but with modifications to account for the presence of continuous permafrost. Examples of the modifications to account for continuous permafrost include eliminating the groundwater ingestion exposure route from the human health risk calculations; adjusting the human health exposure parameters for North Slope conditions (as is currently done); and substituting the AWQC values for the groundwater ingestion levels when assessing the closed category B, C, and D status.

## SECTION 3

# Site Status Determination/Closeout Process— Application and ADEC Review

---

The SOCWG has developed a contaminated site classification system that is a proposed alternative to the existing ADEC contaminated site classification system. This section describes the proposed site conditions documentation that would be required to implement the proposed alternative contaminated site classification system.

***Site Conditions Summary Report.*** The process of determining whether a site may be closed and the category or level of the closed or open site follows a simple process. In the first step of the closeout process, the responsible party or the responsible party's consultant prepares an environmental "*Site Conditions Summary Report*" that describes the site history and, most importantly, documents the site conditions at the time that the report is submitted to ADEC. The *Site Conditions Summary Report*, described herein, is a proposed report and is not currently required by the ADEC (but it overlaps significantly with existing ADEC reporting requirements). The *Site Conditions Summary Report* is proposed to fulfill the requirements of the ADEC required site characterization report (18 AAC 75.335) and/or the final cleanup report (18 AAC 75.380). All of the information requested by the ADEC in the regulations is valuable and/or necessary in the *Site Conditions Summary Report*, but the *Site Conditions Summary Report* differs in that it contains additional data and follows specific formats for the presentation of the data to support use of the hydrocarbon risk calculator and site status map. The *Site Conditions Summary Report* must clearly and fully document critical site data so that ADEC can determine the site status (that is, the closeout or open site level or category). Examples of the data that must be contained in the site conditions report include, but are not limited to the following:

- The division of the site into the NAPL source area, downgradient dissolved phase plume, and unaffected areas
- A statistical characterization of the concentrations of petroleum hydrocarbons within the NAPL-contaminated soil source area
- A characterization of the dissolved-phase plume stability, if the dissolved phase concentrations exceed groundwater ingestion risk-based levels or if the dissolved phase plume extends to a surface water body
- Hydraulic conductivity estimates
- Documentation of seasonal changes in the groundwater flow direction, gradient, and elevation
- Soil texture, structure, and stratigraphy information
- The use of survey grade world coordinates (latitude and longitude) to identify monitoring well locations, boring locations, the NAPL-contaminated soil source area, site infrastructure, property boundaries, and terrain features

- The identification of land ownership through a title search
- The use of the hydrocarbon risk calculator to assess the human health risk posed by the site and to identify the compounds and exposure routes which contribute most significantly to risk
- The use of the site status map to place the site in site status category (which facilitates risk communication and risk management)

Much of the required data may or should be presented in tables and maps. Reports following the recommendations of the SOCWG *Site Conditions Summary Report* technical background document will meet this standard. In addition, the *Site Conditions Summary Report* must include risk calculations for each compound and exposure route, and cumulative risk calculations. The hydrocarbon risk calculator performs these calculations and is the recommended tool for doing the calculations and presenting the results. However, other risk calculation/exposure models and presentation methods are acceptable as long as the calculations are clearly presented and well-documented in the professional technical literature. The *Site Conditions Summary Report* must also include a site status map (see Figure 1) with all appropriate boxes checked. The *Site Conditions Summary Report* and completed site status map will allow the responsible party to make a preliminary assessment of the status of the site before submitting the report to ADEC. If a site has been well-characterized, the status of the site should be readily determined by the responsible party, the responsible party's consultant, and ADEC. However, if the site has not been well-characterized then ADEC must make conservative assumptions regarding site conditions and site status, potentially leading to disagreements on the site status. Fortunately, these disagreements can be resolved by better documentation of the site conditions.

***Site Conditions Summary Report Review.*** Under the contaminated site classification system process proposed by the SOCWG, the ADEC would review the *Site Conditions Summary Report* and assess the quantity, quality, and completeness of the data presented in the report and then make a determination of the site status; that is, whether the site will be listed as "open" or "closed" and the category of open or closed site. Note that when ADEC is reviewing the *Site Conditions Summary Report*, if critical data are not available, are not presented clearly, or are not fully documented, then ADEC must make conservative assumptions about those data and place the site in an appropriately higher in risk category. Also note that when new sites are discovered, by default they will enter the ADEC site tracking data base as open category 1 sites until enough data have been collected, documented, and formally submitted to ADEC to justify a different site status.

The results of the ADEC review of the *Site Conditions Summary Report* would be documented in a letter report addressed to the responsible party. The letter report would present the ADEC's assessment of the quality, quantity, completeness and clarity of the data presented in the *Site Conditions Summary Report* as they relate to determining the human health and environmental risk posed by the site. Shortcomings in the data set and assumptions that the responsible party made that affect the site status and are not supported by the presented data would be identified in ADEC's review letter. The ADEC review letter would also document ADECs' determination of the site status (the ADEC review letter would not need to summarize the site conditions data presented by the responsible party that ADEC agrees with). This ADEC determination of site status would be the site status until the responsible party submits additional data to ADEC and requests another review of the data and site status determination.

## SECTION 4

# Permanent Record of Site History, Conditions, and Status

---

The SOCWG has developed a contaminated site classification system that is a proposed alternative to the existing ADEC contaminated site classification system. This section describes the need for a data base documenting the site status and providing a link to the *Site Conditions Summary Report*.

Under the alternative contaminated site classification system scenario proposed in the SOCWG documents, all sites that have been in the ADEC contaminated sites database would have a permanent record of the environmental conditions at the site and the results of the latest site status determination maintained in the database that may be searched by multiple parameters, including most importantly a legal description of the property (lot and block number) and the sites' world coordinates (latitude and longitude). This permanent record could be an update to the existing ADEC contaminated sites database, a new data base maintained by an agency such as the State Division of Lands or a deed notice. As envisioned in the SOCWG technical background documents, it is likely that the best risk focused description of the environmental conditions at any particular site would be the *Site Conditions Summary Report*. Therefore, the data base should provide a link to *Site Conditions Summary Report*.

The reason for maintaining a public record of the environmental conditions is that the *Site Conditions Summary Reports* will provide a valuable tool for a variety of purposes, such as facilitating property transfers, assessing the fair market value of the property, conducting due diligence audits, planning further development of the property, and conducting subsurface work at the site. An example of how the *Site Conditions Summary Reports* may be used during further development of the property includes avoiding placing a building on a corner of the property with potential indoor air migration risks. An example of how the *Site Conditions Summary Reports* may be used during subsurface construction work at the site includes anticipating and planning for the presence of contaminants along a new sewer line to help limit work stoppages when hydrocarbons are discovered and allow planning of the monitoring of the excavation for protection of the site workers.

**Site Survey Recommendations.** Site conditions and geographic location information contained in the *Site Conditions Summary Report* such as soil borings, monitoring wells, test pits, property corners, easements, infrastructure (buildings, roads, parking lots, utilities), and geologic or terrain features (changes in slope, stream and lake shorelines, vegetation breaks) will have significant value long after the report has been submitted and a determination of the site status has been made. Accurate information is necessary to be able to identify the locations of environmental site data after infrastructure and site conditions have changed (for example after buildings have been removed and/or vegetation has grown over a site). Therefore, the SOCWG recommends site survey standards as described herein. The overall objective of these survey recommendations is to help document the site conditions and to support the environmental

decisions being made about the site. On a site specific basis less detailed and/or less accurate survey may be acceptable provided the existing data supports the decision being made.

Surveying must be performed in accordance with the Alaska State Professional Land Surveyors (ASPLS) Standards of Practice as appropriate for the services being provided. Surveying shall be conducted by, or under the direct supervision of a Professional Land Surveyor (PLS) holding a current registration in the State of Alaska.

Site conditions and geographic location information contained in the *Site Conditions Summary Report*, such as soil borings, monitoring wells, property corners, infrastructure, and geologic or terrain features should be fully documented and geo-referenced to the Alaska State Plane Coordinate System of 1983 (NAD83, in U.S. Survey feet). Metadata (details on the survey methods and accuracy) should be provided for all geographic information.

The primary project survey control should originate from the National Geodetic Survey (NGS) Continuously Operating Reference Stations (CORS) referenced to NAD83 (CORS Epoch) system. The NGS Online Positioning Users Service (OPUS) utility should be used to establish the primary control coordinates for at least two project control points. The global positioning system (GPS) control survey should consist of at least 2 independent 4-hour GPS static observations at each of the 2 control points (yielding a total of 8 hours of observation at each point and a total of 16 hours of observation at the 2 control points). The GPS observations at the two control points must be simultaneous observations. Subsequent GPS and conventional surveys for locating soil borings, monitoring wells, property corners, geologic features, and infrastructure should be tied directly to the primary project control. If existing survey data are translated to State Plane coordinates then the translation parameters must be provided. Elevations should be referenced to the North American Vertical Datum of 1988 (NAVD88) established at each control point using OPUS. The elevations at each monitoring well must be tied directly to the primary control using differential leveling techniques and reported the nearest 0.01 feet.

Boundary surveys should be performed to Third Order, Class I standards, as specified by the ASPLS *Standards of Practice*, with an allowable error of closure of 1:10,000 or better.

Prior to commencement of the survey, the surveyor must review title reports, title documents and mapping which is relevant to the project. Additionally, the surveyor must research additional relevant documentation from other sources. These documents may include, but are not limited to, the following:

Bureau of Land Management (BLM) and Department of Natural Resources (DNR) land status plats, BLM township survey plats, Mineral and U.S. Survey plats and field notes, any records of survey, subdivisions, and relevant engineering control surveys, United States Coast and Geodetic Survey (USC&GS)/ National Geodetic Survey (NGS) control diagrams-descriptions, Department of Transportation and Public Utilities (DOT&PF) right-of-way records and other easement or boundary documents of record, DOT&PF engineering as-builts, DNR surveys, and aerial photos.

One legible portable document format (PDF) copy of the research materials should be submitted on a compact disk (CD) for all of the above referenced reports, plats, notes, and other source materials.

All research for property corner ties (generally includes local platting authority subdivision plats and right-of-way plats, BLM U.S. Surveys, state land survey plats, waiver documents, deeds, record of surveys, and monument records) should be done prior to commencement of searching and tying property controlling corners.

Preliminary engineering information must be analyzed to determine where additional property boundary ties are needed and title reports relevant to the project site should be examined. When preparing base maps, the surveyor must thoroughly review and document existing right-of-way rights and analyze preliminary engineering information to determine where additional survey ties are needed. Survey conflicts with existing right-of-way and boundary locations should be identified. If boundary survey conflicts are resolved, then a written summary of the rationale for the solution must be provided.

A survey base map should be prepared for the entire project limits and should include the following information:

- A. Project Control
- B. Soil borings, monitoring wells, geologic features, and infrastructure
- C. Existing property boundaries, including all Public Land Survey System survey lines
- D. All subdivisions, including name, plat number, and lot and block designations or aliquot parts description
- E. Existing rights-of-ways and easements
- F. Horizontal and vertical control statement
- G. Projection/Coordinates Table, scale, units, source

In addition to the survey described above the *Site Conditions Summary Report* should include the results of a title search conducted by a professional title search company. The title search results should be submitted as an appendix to the *Site Conditions Summary Report*.

In general, hand-held GPS data and swing ties from building corners, by themselves, are not sufficient for the *Site Conditions Summary Report* because, for example, buildings and similar structures are not permanent features, and after the buildings are removed it may be impossible to recreate the contaminant locations. Hand-held GPS data have errors of tens of feet and are subject to operator error (for example, the hand-held GPS user does not know the datum for the measurement, the accuracy of the measurement, and/or how to report the measurement).

An example of the recommended data is presented in Figure 9, from the Strawberry Point project. Figure 9 shows that a section line passes through the NAPL-contaminated soil source area, there is a 33-foot easement on either side of the section line, and the sections have differing land status (that is, Section 15 is part of the Chugach National Forest and selected by both the State of Alaska and Eyak and Chugach Native Corporations, while Section 16 is subject to an interim conveyance to Eyak and Chugach Native Corporations).

**Property Transfer Issues.** The open or closed status of a site and the open or closed site category will undoubtedly affect property transfers. The biggest impediment to transfers of contaminated and/or formerly contaminated properties is thought to be the unknowns, such as

human health risk, monitoring costs, land use restrictions, etc., associated with the contaminated property. The site status or classification system presented herein attempts to clearly identify the human health and environmental risks, land use restrictions, and monitoring required for each property; and also attempts to limit or at least identify the unknowns associated with contaminated properties.

Closed category properties will likely be readily transferred because the site conditions are well-understood and documented, there is no monitoring requirement, and the restrictions associated with moving the contaminated soil are clearly identified.

Open category 3 sites may also be readily transferred because the site conditions are well-understood and documented, there is only a limited and well-identified monitoring requirement, and the restrictions or institutional controls on the property are clearly identified. Given these data, prospective private property purchasers can assess whether the property is suitable for their purposes and account for the cost of monitoring in the offering price. Similarly, prospective public property managers can assess whether the property is consistent with the agency's mission and assess the cost impact to the agency's budget for the proper management of the land.

Open category 2 sites may include a wide range of site conditions and potential risks, but the site status system identifies what issues are associated with the site.

Open category 1 sites likely have many site condition unknowns, unreliable estimates of future remediation costs, unknown monitoring costs, and poorly understood land use restrictions. These conditions likely make open category 1 properties less desirable than properties in the other categories; therefore, transfers of open category 1 sites will likely be limited in number and more difficult to negotiate.

## SECTION 5

# Summary and Recommendations

---

This document describes a “contaminated site classification system” that is recommended for ADEC consideration. This proposed alternative contaminated site classification system places all petroleum hydrocarbon contaminated sites into the major categories of “open sites” and “closed sites.” Closed sites may be further differentiated into four different categories of “closed sites,” and open sites may be differentiated into three categories of “open sites.” In addition, this document defines the criteria necessary to place sites in a closed site or open site category. Closed sites present acceptable human health and environmental risks. The categories of closed sites are based on the potential for impact to surface water and groundwater if the soil is transported to another location. Open sites present an unacceptable human health and/or environmental risk. The open site categories are based on an assessment of whether the human health exposure routes and environmental exposure routes are complete or incomplete, and on whether the potential risk is actively managed or uncontrolled. Most distinctions between closed and open site levels or categories can be related to exceeding some measured risk-based concentration or calculated risk-based value (that is, the results of field tests or calculations define the boundaries between different closed or open site categories).

This document also briefly describes a proposed “*Site Conditions Summary Report*”, that would be used to document environmental site conditions needed to support human health and environmental risk calculations using the hydrocarbon risk calculator and the placement of a site into one of the open or closed site status categories. The *Site Conditions Summary Report* is a proposed report that overlaps significantly with existing ADEC reporting requirements. Not all of the elements of the *Site Conditions Summary Report* are currently required by the ADEC, but the *Site Conditions Summary Report* requires essentially all of the information listed in the site characterization report and final cleanup reports described in the regulations (18AAC 75.335 and 18 AAC 75.380).

The SOCWG recommends that the ADEC use a contaminated site classification system and/or site closeout criteria:

- Based on risk to human health and the environment
- That quantitative measures of human health and environmental risk be used in place of qualitative or subjective contaminated site ranking criteria
- That the contaminated site classification system emphasizes risk management at sites which present unacceptable human health and environmental risks

The SOCWG agrees that the contaminated site classification system presented in this document meets these recommendations in that it: (1) clearly identifies human health risks and environmental risks, (2) uses quantitative measures of risk (not arbitrary non risk criteria), and (3) emphasizes risk management at open sites. In addition, the proposed contaminated site classification system may facilitate the transfer of contaminated properties and would provide an accessible/complete long-term record of site conditions and status. Therefore the Alaska

SOCWG requests that the ADEC consider adopting the contaminated site classification presented in this document.

## SECTION 6

# References

---

Alaska Department of Environmental Conservation. January 22, 1999a. "Oil Spill and Hazardous Substances Pollution Control Regulations." *Alaska Administrative Code*. Title 18, Chapter 75.

Charbeneau, Randall, R. Johns, L. Lake, and M. McAdams. 1999. *Free-Product Recovery of Petroleum Hydrocarbon Liquids*. API Publication No. 4682.

Geosphere and CH2M HILL, 2005. *Maximum Allowable Concentration, Residual Saturation, and Free-Product Mobility Technical Background Document*. A report prepared for the Statement of Cooperation Working Group.

# Hydrocarbon Contaminated Site “Status Map”

---

**Figure 1 Hydrocarbon Contaminated Site "Status Map"**

**Responsible Party and Site Name**

Acceptable Human Health Risk				Unacceptable Human Health Risk			
1							
2	Exact concentration that creates risk is dependent on site conditions!				Exact concentration that creates risk is dependent on site conditions!		
Only check boxes that can be answered in the affirmative (i.e. "yes"). The closure level or open site level is determined by the box furthest to the right that is checked.							
3	cumulative carcinogenic risk < 10 <sup>-5</sup> , and <input type="checkbox"/>			cumulative carcinogenic risk > 10 <sup>-5</sup> , or <input type="checkbox"/>			
4	cumulative Hazard Index < 1, and <input type="checkbox"/>			cumulative Hazard Index > 1, or <input type="checkbox"/>			
5	all groundwater MCLs met, and <input type="checkbox"/>			groundwater MCL(s) exceeded, or <input type="checkbox"/>			
6	GRO soil direct contact, outdoor air inhalation, indoor air inhalation & groundwater ingestion risk criteria met, and <input type="checkbox"/>			GRO soil direct contact, outdoor air inhalation, indoor air inhalation or groundwater ingestion risk criteria exceeded, or <input type="checkbox"/>			
7	DRO soil direct contact, outdoor air inhalation, indoor air inhalation & groundwater ingestion risk criteria met, and <input type="checkbox"/>			DRO soil direct contact, outdoor air inhalation, indoor air inhalation or groundwater ingestion risk criteria exceeded, or <input type="checkbox"/>			
8	RRO soil direct contact, outdoor air inhalation, indoor air inhalation & groundwater ingestion risk criteria met <input type="checkbox"/>			RRO soil direct contact, outdoor air inhalation, indoor air inhalation or groundwater ingestion risk criteria exceeded <input type="checkbox"/>			
Acceptable Environmental Risk				Unacceptable Environmental Risk			
9	surface water meets AWQC for benzene, TAH & TAqH, and <input type="checkbox"/>			dissolved phase from site causes surface water to exceed AWQC for benzene, TAH or TAqH, <input type="checkbox"/>			
10	no surface water sheen, and <input type="checkbox"/>			dissolved phase from site causes surface water sheen, or <input type="checkbox"/>			
11	no impact to terrestrial populations, and <input type="checkbox"/>			contaminant(s) at site measurably impact terrestrial populations <input type="checkbox"/>			
12	no impact to individuals of threatened or endangered species <input type="checkbox"/>			contaminant(s) at site measurably impact individuals of threatened or endangered species <input type="checkbox"/>			
Closed Site Categories				Open Site Categories			
13	A---unconditional closure	B---conditional closure	C---conditional closure	D---conditional closure	3---low priority controlled or managed risk site	2---medium priority potential risk site	1---high priority / present risk site
14	dissolved equilibrium < AWQC and TPH concentration < sheen limit <input type="checkbox"/>	dissolved equilibrium < MCL <input type="checkbox"/>	dissolved equilibrium < MCL * DAF <input type="checkbox"/>	dissolved equilibrium > MCL * default DAF <input type="checkbox"/>	plume stable, potential human health or environmental risk but pathways not complete due to existing, maintained ICs and/or physical controls (fences, SVE systems etc.) <input type="checkbox"/>	plumes stable, potential human health or environmental risk -- pathways not currently complete but ICs and/or physical controls not in place <input type="checkbox"/>	human health or environmental risk pathways complete <input type="checkbox"/>
15	wetlands fill	saturated zone fill	vadose zone fill	soil cannot be used as offsite fill (DAF conservative or nonpotable groundwater at site)	soil cannot be used as offsite fill without ADEC permission or remediation (dissolved equilibrium likely > MCL * default DAF)	soil cannot be used as offsite fill without ADEC permission or remediation (dissolved equilibrium likely > MCL * default DAF)	soil cannot be used as offsite fill without ADEC permission or remediation (dissolved equilibrium likely > MCL * default DAF)
16	immobile free product may or may not be present, but all risk criteria met (mobile free product not present)				mobile free product not present (free product may accumulate in monitoring wells but it is not mobile at the site scale)	mobile free product not present (free product may accumulate in monitoring wells but it is not mobile at the site scale)	mobile free product may be present (check if mobile free product is present--requires active remediation to extent practicable if present) <input type="checkbox"/>
17	no migration to surface water above AWQC and no surface water sheen and no impact to terrestrial populations				none or migration to surface water could occur without active remediation/ controls	none or migration to surface water could occur without active remediation/ controls	migration to surface water above AWQC, or sheen on surface water, or impact to terrestrial populations maybe occurring (check if any of these conditions present--requires active remediation/controls if present) <input type="checkbox"/>
18	no off property migration above risk based limits	no off property migration above risk based limits	no off property migration above risk based limits	no off property migration above risk based limits	off property migration of groundwater, vapor or NAPL has occurred or is occurring (above risk based levels), there are no completed pathways and downgradient impacted property owner(s) has/have been informed of the situation and are in concurrence with controls, and civil claims are in progress or settled (check if off property migration is occurring and this is best description of situation) <input type="checkbox"/>	off property migration of groundwater, vapor or NAPL has occurred or is occurring (above risk based levels), there are no completed pathways and downgradient impacted property owner(s) has/have been informed of the situation (check if this is the best description of the situation) <input type="checkbox"/>	off property migration of groundwater, vapor or NAPL has occurred or is occurring (w or w/o completed pathways) and downgradient property owners not yet informed of the condition (check if off property migration is occurring and downgradient property owner not informed) <input type="checkbox"/>
19	none	no ICs but limitations on offsite transport of soils	no ICs but limitations on offsite transport of soils	no ICs but limitations on offsite transport of soils	ICs to control risk are required	ICs to control risk are appropriate	ICs to control risk are appropriate, but likely not in place
20	none	none required, RP may elect to monitor to change closure status	none required, RP may elect to monitor to change closure status	none required, RP may elect to monitor to change closure status	monitoring required but likely low intensity (few unknowns)	monitoring required but likely low to moderate intensity	high intensity monitoring likely appropriate (many unknowns)