



General Permit for In Situ Remediation: Chemical Oxidation

Issuance Date: June 30, 2014
Expiration Date: June 30, 2024

Bureau of Water Protection and Land Reuse
Remediation Division

860-424-3705

Printed on recycled paper

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Section 1. Authority

This general permit is issued under the authority of sections 22a-133z, 22a-430, 22a-430b, and 22a-454(e) of the Connecticut General Statutes (CGS).

Section 2. Definitions

The definitions of terms used in this general permit shall be the same as the definitions contained in sections 22a-430-3(a) and 22a-133k-1(a) of the Regulations of Connecticut State Agencies (RCSA). In addition, as used in this general permit:

“Approval of registration” means an approval of registration issued by the commissioner under this general permit;

“Area of concern” is a location or area where hazardous waste and/or hazardous substances (including petroleum products) have been or may have been used, stored, treated, handled, disposed, spilled, and/or released to the environment;

“Authorized activity” means any activity authorized by this general permit;

“Borehole” means a bored, drilled, or driven shaft or hole, extending below the ground surface, that may or may not intersect the water table or yield recoverable water;

“Certificate of coverage” means a document issued by the department acknowledging that a particular activity for which a registration was submitted to the department is authorized pursuant to this general permit;

“Chemical oxidant” means any substance that oxidizes another substance, being itself reduced in the process, including permanganates, persulfides, peroxides, percarbonates and ozone, and combinations thereof;

“Coastal boundary” means the boundary described in section 22a-94(b) of the Connecticut General Statutes;

“Coastal water” means coastal waters as defined by section 22a-93 of the Connecticut General Statutes;

“Commissioner” means commissioner as defined by section 22a-2(b) of the Connecticut General Statutes;

“Conceptual site model” or *“CSM”* means a representation of an environmental system, incorporating information about a chemical’s release, fate, transport mechanisms and pathways, and any potential receptors, that is used as a tool for understanding and for explaining to others the basis and rationale for the site investigation and the conclusions drawn about the environmental conditions at a site;

“Constituent of concern” or *“COC”* means a component, breakdown product, or derivative of a substance that may be found in the environment as a result of a release or discharge, or a reaction caused by such a release or discharge;

“Day” means the calendar day;

“Department” or *“DEEP”* means the Connecticut Department of Energy and Environmental Protection;

“Discharge” means discharge as defined in section 22a-423 of the Connecticut General Statutes and also includes, for the purposes of this general permit, the injection or emplacement of substances on or below the ground surface, above or below the water table, that are intended to react with or dissolve into the waters of the state to affect their chemical properties or react with pollutants in the water or soil, and shall also include the substances generated within an expected zone of influence as the result of expectable reactions of such injected or emplaced substances with groundwater, pollutants, and naturally occurring substances in soil and groundwater;

“Discharge monitoring well” means a monitoring well used for evaluation of the quality of groundwater that may be affected by activities authorized by this general permit;

“Emplacement” means the physical introduction on or below the ground surface of a substance, by any means, either permanently or temporarily;

“Endangered or threatened species” means endangered or threatened species as defined by section 26-304 of the Connecticut General Statutes;

“Fluid” means fluid as defined in section 22a-430-8(a) of the Regulations of Connecticut State Agencies;

“Free product” means free product as defined in section 22a-449(d)-101 of the Regulations of Connecticut State Agencies;

“Groundwater” means groundwater as defined in section 22a-133k-1 of the Regulations of Connecticut State Agencies;

“Ground water classification” means the water quality classification for groundwater at a location, as established in accordance with the water quality standards adopted pursuant to section 22a-426 of the Connecticut General Statutes;

“Heating oil” means heating oil as defined in section 22a-449(d)-101 of the Regulations of Connecticut State Agencies;

“Heating oil tank” means a tank, and its associated fill and distribution lines, that is or was used primarily to store petroleum fuel used in the operation of on-site heating equipment, boilers, or furnaces, often containing # 2 grade fuel oil or other heating oil at a residential, institutional or retail-commercial property, and, depending on configuration, size, and ancillary uses, may be subject to various parts of the Connecticut Underground Storage Tank Regulations (sections 22a-449(d)-1 through 22a-449(d)-113 of the Regulations of Connecticut State Agencies);

“Individual permit” means a permit issued to a named permittee under sections 22a-430 or 22a-454 of the Connecticut General Statutes;

“Infiltration structure” means a structure, excavation or other facility designed to allow liquids to percolate into the underlying soil without overflow and to mix with the groundwater;

“Injection” means injection as defined in section 22a-430-8(a) of the Regulations of Connecticut State Agencies;

“Inland wetlands” means wetlands as defined by section 22a-38 of the Connecticut General Statutes;

“Leaching system” means a structure, excavation or other facility designed to allow sewage or other liquids to percolate into the underlying soil without overflow and to mix with the groundwater;

“Licensed Environmental Professional” or *“LEP”* means an environmental professional licensed pursuant to the requirements of section 22a-133v of the Connecticut General Statutes;

“Monitoring well” means a well designed and used to obtain representative samples of groundwater for evaluation of groundwater quality;

- “Municipality”* means a city, town, or borough of the state;
- “Permittee”* means any person who or municipality which has filed a registration and to whom or to which the commissioner has provided a certificate of coverage or has issued an approval of registration;
- “Person”* means person as defined by section 22a-2(c) of the Connecticut General Statutes;
- “Professional Engineer”* or *“P.E.”* means a professional engineer licensed by the Connecticut Department of Consumer Protection;
- “Petroleum”* means petroleum as defined in section 22a-449a of the Connecticut General Statutes;
- “Petroleum fuel”* means a petroleum product produced for use as fuel, usually for heating or transportation, including but not limited to gasoline, jet fuel, diesel fuel, and heating oil, excluding petroleum products produced for use as lubricants or solvents, and excluding fuels blended with solvents or wastes or over twenty percent (20%) non-petroleum in origin;
- “Pollution”* means pollution as defined in section 22a-423 of the Connecticut General Statutes;
- “Public water supply well”* means a water supply well that is a source of drinking water supply for a public water system, as defined in section 19-13-B102 of the Regulations of Connecticut State Agencies;
- “Registrant”* means a person who or municipality which files a registration pursuant to Section 4 of this general permit;
- “Registration”* means a registration form filed with the commissioner pursuant to Section 4 of this general permit, including any fees, supplemental documents, and certifications as specified in Section 4 of this general permit;
- “Residential property”* means real property with a house, apartment, trailer, mobile home, condominium or other structure, composed of up to four residential units, solely occupied by individuals as a dwelling;
- “Retail-commercial property”* means real property that is not residential property, has been primarily used for sale or distribution of goods or services or for institutional purposes, and has not been used as a location for industrial or commercial manufacturing or repair.
- “Site”* means geographically contiguous land or water on which an authorized activity takes place or on which an activity for which authorization is sought under this general permit is proposed to take place, and includes, for the purposes of this general permit, consideration as a single site of contiguous parcels and associated roads and rights of way, even if owned by different persons, which are located over a single free product or groundwater pollution plume;
- “Source of drinking water supply”* means active source of supply, as defined in section 19-13-B102 of the Regulations of Connecticut State Agencies;
- “Source water area”* means an area of land, delineated by the state, that contributes water to a source of drinking water supply, whether the source is groundwater, surface water, or both;
- “Supervised remediation site”* means a site at which remediation is being conducted:
- i) in accordance with sections 22a-133x, 22a-133y, 22a-134a , or 32-9mm of the Connecticut General Statutes,
 - ii) under sections 22a-449(c)-105(h) or 22a 449(d)-106 of the Regulations of Connecticut State Agencies, or
 - iii) to achieve compliance with an order of the commissioner issued pursuant to section 22a-432 of the Connecticut General Statutes;

“*Surface water classification*” means the water quality classification for a surface water body, as established in accordance with the water quality standards adopted pursuant to section 22a-426 of the Connecticut General Statutes;

“*Tank*” means tank as defined in section 22a-449(d)-101 of the Regulations of Connecticut State Agencies, and also including, but not limited to, any associated fill and distribution lines;

“*Tidal wetland*” means wetland as defined in section 22a-29 of the Connecticut General Statutes;

“*Total petroleum hydrocarbons*” or “*TPH*” means the reported results of an analysis conducted using the Connecticut Extractable Total Petroleum Hydrocarbons test, or other methodology approved by the commissioner to determine the concentration of gross oil or hydrocarbon in a substance or material;

“*Underground source of drinking water*” means underground source of drinking water as defined in section 22a-430-8 of the Regulations of Connecticut State Agencies;

“*Unprotected subsurface structure*” means a metal structure, such as a tank, pipe or conduit, that is below the ground surface, in contact with the soil, and not protected from corrosion by either an applied dielectric coating or a cathodic protection system, or any other structure that may come into contact with groundwater containing substances that could affect the structure’s integrity;

“*Watercourse*” means watercourse as defined in section 22a-38 of the Connecticut General Statutes;

“*Water supply well*” means water supply well as defined in section 19-13-B51b of the Regulations of Connecticut State Agencies; and

“*Well*” means well as defined in section 22a-430-8(a) of the Regulations of Connecticut State Agencies.

“*Zone of Influence*” means the area or spatial volume of groundwater within which some alteration of water quality or inconsistency with water quality criteria is anticipated as a result of the permitted discharge and its interaction with the hydrogeology and pollution on the site.

Section 3. Authorization Under This General Permit

(a) *Eligible Activities*

Provided the requirements of Section 3 of this general permit are satisfied, this general permit authorizes, except as limited by Section 5 of this general permit, the introduction at a single site of chemical oxidants and necessary supplemental substances into soil or groundwater to remediate pollution in situ through chemical oxidation, as follows:

- (1) Emplacement of chemical oxidants and associated substances, in solid, powdered, or any fluid form, in an open excavation resulting from removal of a tank or polluted soil, to remediate soil or groundwater polluted by *petroleum fuel*;
- (2) Injection or emplacement of chemical oxidants and associated substances, in solid, powdered, or any fluid form, on or below the ground surface at one or more points, infiltration structures, wells, or boreholes that are in an area of *petroleum fuel* pollution, or up-gradient or down-gradient from such area, to remediate soil or groundwater polluted by *petroleum fuel*, sources of such pollution, or to limit the migration of such pollution;
- (3) Discharge of chemical oxidants and associated substances, in any form, in open excavations or on or below the ground surface by any means at one or more points, infiltration structures, wells, or boreholes that are in an area of pollution, or up- or down-gradient from such area, to remediate soil or groundwater polluted by *polyaromatic*

hydrocarbons or halogenated or non-halogenated organic solvents, or sources of such pollution, or to limit the migration of such pollution;

- (4) Discharge of chemical oxidants and associated substances, in any form, by any means, at locations suitable to remediate soil or groundwater polluted by *substances amenable to chemical oxidation that are not included in sections 3(a)(1) through 3(a)(3) of this general permit*, or sources of such pollution, or to limit the migration of such pollution; and
- (5) Ancillary short term discharge into groundwater of substances demonstrated necessary to maintain a condition facilitating continued use as intended of any well, borehole, or infiltration structure used for introduction of substances pursuant to Sections 3(a)(1) through 3(a)(4) of this general permit, at any time during the implementation of such other activities.

Generation, and subsequent presence in water of chemical intermediates, daughter- by- and end- products, and metabolic byproducts associated with the authorized activities, transient mobilization into groundwater of target pollutants, other substances, or natural materials due to the authorized activities, and deposition in the aquifer of residues associated with the authorized activity are all authorized within the zone of influence. Discharge of atmospheric air or potable water as necessary for delivery of the authorized substances to the subsurface is also authorized.

Any discharge of water, substance or material into the waters of the state other than those specified in this section is not authorized by this general permit, and any person who or municipality which initiates, creates, originates or maintains such a discharge must apply for and obtain authorization under section 22a-430 or 22a-430b of the Connecticut General Statutes prior to the occurrence of such discharge.

(b) Requirements for Authorization

This general permit authorizes the activities listed in Section 3(a) of this general permit provided:

(1) Registration

A completed registration with respect to such discharge (see Section 4 of this general permit), including all applicable fees, has been filed with the commissioner and the commissioner has issued an approval of registration or a certificate of coverage with respect to such activity.

(2) Coastal Area Management

Such activities are consistent with all applicable goals and policies in section 22a-92 of the Connecticut General Statutes, and will not cause adverse impacts to coastal resources as defined in section 22a-93 of the Connecticut General Statutes.

(3) Endangered and Threatened Species

Such activities do not threaten the continued existence of any species listed pursuant to section 26-306 of the Connecticut General Statutes and will not result in the destruction or adverse modification of habitat designated as essential to such species.

(4) **Aquifer Protection**

Such activities, if located within an aquifer protection area as mapped under section 22a-354b of the Connecticut General Statutes, comply with regulations adopted pursuant to section 22a-354i of the Connecticut General Statutes.

(5) **Conservation and Preservation Restrictions**

If such activities are on or may affect property subject to a conservation or preservation restriction, pursuant to section 47-42d of the Connecticut General Statutes proof of written notice to the holder of such restriction of the proposed activity's registration pursuant to this general permit, or a letter from the holder of such restriction verifying that the proposed activity is in compliance with the terms of the restriction, has been provided to the commissioner.

(6) **Sources of Drinking Water**

Such activities do not affect an underground source of drinking water or a watercourse, or any tributary thereto, which is or contributes to a source of drinking water supply; unless the discharge is necessary and appropriate to remediate groundwater pollution and its sources and, to the maximum extent practical, the discharge does not impair public health or the environment or cause a violation of the Standards for Quality of Public Drinking Water, Section 19-13-B102 of the Regulations of Connecticut State Agencies, as amended.

(7) **Wetlands and Watercourses**

Such activities cause only minimal adverse impacts on the environment, including, without limitation, watercourses, coastal waters, inland wetlands, tidal wetlands, and fish and wildlife habitat.

(8) **Local Authorizations**

Any local authorizations required for such activities have been obtained.

(c) ***Geographic Area***

This general permit applies throughout the State of Connecticut.

(d) ***Effective Date and Expiration Date of this General Permit***

This general permit is effective on the date it is issued by the commissioner and expires ten years from such date of issuance. Post-discharge monitoring and reporting requirements of this general permit applicable to an authorized activity at a site shall remain in effect after expiration of this general permit except as approved by the commissioner.

(e) ***Authorization and Effective Date for Eligible Activities***

(1) **Authorization by Approval of Registration**

A commissioner's approval of registration is required to authorize eligible activities pursuant to Sections 3(a)(1) through 3(a)(4) of this general permit (except that additional phases of activity may be authorized under Section 3(e)(4) of this general permit), and the effective date is the day of issuance of such approval of registration for the following:

- (A) activities that will occur or will cause a zone of influence:
 - (i) within an area with a groundwater quality classification of GAA;
 - (ii) within an identified aquifer protection area;
 - (iii) within a public water supply source water area; or
 - (iv) on land owned by an owner or operator of a public water supply that is defined as class I or class II water company land pursuant to section 25-37c of the Connecticut General Statutes;
- (B) activities that:
 - (i) are only permissible with the commissioner's approval pursuant to Section 5(a)(11)(B) of this general permit;
 - (ii) use energy or any substance to desorb, mobilize or otherwise make available for collection or treatment non-aqueous phase product, or emplacement of chemical oxidants in areas where surfactants have previously been emplaced;
 - (iii) use hydrogen peroxide at a concentration greater than twelve and one half percent (12.5%), use ozone at a concentration greater than seven percent (7%), or combine ozone and hydrogen peroxide as a chemical oxidant; or
 - (iv) are any substance-specific activity that is identified in Appendix I of this general permit as requiring approval;
- (C) activities, except as authorized pursuant to Sections 3(e)(2) through 3(e)(4) of this general permit, creating an expected zone of influence in locations where any of the following conditions are present:
 - (i) the expected zone of influence is within 1,000 feet of a public water supply well, or within 200 feet of any water supply well other than one owned by the registrant;
 - (ii) an existing groundwater or soil vapor control system being operated to control migration of pollution to receptors is within twenty-five (25) feet of the expected zone of influence;
 - (iii) a confined space or structure is present within twenty-five (25) feet of the expected zone of influence and volatile organic substances or gasoline are present; or
 - (iv) a coastal water, tidal or inland wetland, or watercourse is within twenty-five (25) feet of the expected zone of influence; and
- (D) any other eligible activity pursuant to Sections 3(a)(1) through 3(a)(4) of this general permit, except as authorized pursuant to Sections 3(e)(2) through 3(e)(4) of this general permit.

(2) Authorization by Certificate of Coverage

Except as required in Section 3(e)(1) of this general permit, the following eligible activities are authorized by the commissioner's issuance of a certificate of coverage (except that additional phases of activity may be authorized under Section 3(e)(4) of this general permit), and the effective date is the day of issuance of such certificate of coverage:

- (A) Activities referenced in Sections 3(a)(1) through 3(a)(3) of this general permit at a supervised remediation site, *provided that*:
 - (i) the activity is not listed in Sections 3(e)(1)(A) through 3(e)(1)(B) of this general permit, and
 - (ii) the activity is not listed in Sections 3(e)(1)(C)(i) through 3(e)(1)(C)(iii).
- (B) Activities referenced in Sections 3(a)(1) and 3(a)(2) of this general permit at a site polluted solely by a release from a *heating oil tank* with a capacity of less than 2,100 gallons, *provided that*:
 - (i) the proposed zone of influence has no dimension greater than thirty (30) feet in size, and
 - (ii) the activity is not listed in Sections 3(e)(1)(A) through 3(e)(1)(C) of this general permit.
- (3) **Reserved**
- (4) **Authorization of Additional Phases of Activity**
 - (A) Except as may be authorized pursuant to Sections 3(e)(4)(B) through 3(e)(4)(D) of this general permit, any additional phase(s) of implementation for activity authorized pursuant to this general permit, including scale-up of project scope from an authorized pilot study, is(are) authorized upon the date the commissioner approves in writing a work plan for such additional phase(s) of activity submitted pursuant to Sections 5(c)(3)(C) or 5(a)(9) of this general permit.
 - (B) At supervised remediation sites, or at residential or retail-commercial sites where a release associated with a *heating oil tank* with a capacity of less than 2,100 gallons is or had been present, implementation of planned additional phases of activity pursuant to Sections 3(a)(1) through 3(a)(3) of this general permit that are described in detail in the work plan and substantially identical to a previous authorized phase, with either similar or smaller amount(s) of discharged substance(s), is authorized without an additional submittal or written approval *provided that*:
 - (i) there is no increase in either the amount of substance emplaced for the phase, by more than ten percent, or the extent of the expected zone of influence, by more than ten feet, when compared to the amount and extent described for a phase in the initial registration or an approved modification;
 - (ii) a notice that an additional phase will be implemented is submitted to the commissioner, on a form prescribed by the commissioner, not later than seven (7) days prior to the proposed discharge phase, identifying the date(s) of proposed discharge and the amount of substance(s) to be discharged in the phase to be implemented;
 - (iii) no notifications pursuant to Section 5(d) of this general permit were necessary as a result of implementation of previous phases of authorized activity; and
 - (iv) periodic reports are submitted pursuant to Sections 5(c)(2) and 5(c)(4)(C)(ii) of this general permit.
 - (C) Additional planned episodic discharge phases of activity to remediate pollution pursuant to Sections 3(a)(1) through 3(a)(4) of this general permit, where the discharge specifications of each phase are determined through review of the

results of a previous phase, and additional unplanned repetitions of an authorized activity, are authorized without a written approval thirty (30) days after the commissioner's receipt of a work plan modification for the additional phase submitted pursuant to Section 5(c)(3)(C)(i) of this general permit, *provided that*:

- (i) there is no change in type of activity or substance;
 - (ii) the work plan modification identifies the amount of substance(s) to be discharged in the phase to be implemented, and any changes in the distribution or delivery specifications from the prior phase;
 - (iii) the work plan modification includes a certification that the monitoring and performance results of the previous phase were incorporated in the design of the current phase;
 - (iv) if the proposed recurrence is unplanned, there is no increase in either the amount of substance injected for the phase, by more than ten percent, or the extent of the expected zone of influence, by more than ten feet, when compared to the amount and extent described for a phase in the initial registration or an approved modification;
 - (iv) if the recurrence was planned and the initial registration or an approved modification described in detail the design criteria to be used for subsequent phases, there is no increase in either the amount of substance injected for the phase, by more than fifty percent (50%), or the extent of the zone of influence, by more than twenty (20) feet, when compared to the amount and extent described for a phase in the registration or, if greater, in a work plan modification for a previous phase approved pursuant to Section 3(e)(4)(A) of this general permit;
 - (v) no notifications pursuant to Section 5(d) of this general permit were necessary as a result of implementation of previous phases of authorized activity; and
 - (vi) the work plan is not modified or disapproved by the commissioner in writing within thirty days of receipt by the department.
- (D) Additional planned recurring intermittent discharge phases of activity, or planned continuous discharges that may be periodically adjusted, to establish and maintain for a period of time a specified target modified subsurface condition suitable to remediate pollution pursuant to Sections 3(a)(1) through 3(a)(4) of this general permit, are pre-authorized upon initial authorization of activity pursuant to this general permit where discharge specifications, monitoring and adjustment procedures, and recurrence scheduling rationale for non-continuous discharge phases are described in the registration, or an approved modified work plan, and otherwise are authorized without a written approval thirty (30) days after receipt of a proposed work plan modification pursuant to Section 5(a)(9)(C) or 5(c)(3)(C) of this general permit, *provided that*:
- (i) there is no change in type of activity or substance;
 - (ii) periodic reports are submitted pursuant to Sections 5(c)(2) and 5(c)(3)(C)(ii) of this general permit;
 - (iii) there is no increase in either the amount of substance injected, by more than ten percent, or the extent of the zone of influence, by more than ten feet, when compared to the amount and extent described in the initial registration or an approved modification;

- (iv) no notifications pursuant to Section 5(d) of this general permit were necessary as a result of implementation of previous phases of authorized activity; and
 - (v) if more than ninety (90) days has elapsed from the previous phase, and no work plan modification is necessary, a notice that an additional phase will be implemented is submitted to the commissioner, not later than seven (7) days prior to the proposed discharge phase, identifying the date(s) of proposed discharge and the amount of substance to be discharged in the phase to be implemented.
- (5) Any activity pursuant to Section 3(a)(5) of this general permit to maintain a condition facilitating continued remediation activity already authorized pursuant to this general permit is authorized upon the date the commissioner approves a work plan for such activity submitted pursuant to Section 5(c)(3)(D) of this general permit, *however*:
- (A) for activity at supervised remediation sites not subject to the restrictions listed in section 3(e)(1)(A) of this general permit, such activity shall be authorized thirty (30) days after receipt by the department of a work plan submitted pursuant to Section 5(c)(3)(D) of this general permit unless the work plan is modified or disapproved by the commissioner in writing within thirty days of receipt by the department;
 - (B) if activity pursuant to Section 3(a)(5) of this general permit is expected to be necessary and specifications meeting the requirements of Section 5(c)(3)(D) of this general permit are included in the work plan submitted with the registration, such activity is authorized upon authorization of the primary remediation activity pursuant to this general permit, *provided that* the department is notified seven (7) days in advance of the date of implementation of activity pursuant to Section 3(a)(5); and
 - (C) if activity pursuant to Section 3(a)(5) of this general permit will be a recurrence of a previous substantially similar discharge authorized pursuant to this general permit such activity shall be authorized seven (7) days after notification to the department of the date the recurrence is proposed to be implemented.
- (6) Any authorization of activity effective pursuant to Section 3(e) of this general permit also authorizes generation, and subsequent presence in water within the area of authorized activity, of chemical and metabolic intermediate- and by-products associated with the authorized activity.

(f) *Expiration of Authorization for Eligible Activities*

Authorization of discharge activity pursuant to section 3(e) of this general permit shall, unless otherwise approved by the commissioner, expire three (3) years from the effective date of authorization of discharge activity or the date of expiration of this general permit, whichever is earlier, unless a request for extension of authorization, describing the reason an extension is needed, an update of the site conditions report, and a modified work plan and monitoring plan are submitted to the commissioner for review and approval not less than thirty (30) days prior to the expiration of authorization to discharge. After expiration of the active discharge authorization monitoring requirements of this permit shall remain in effect, and may be modified as permissible pursuant to this general permit.

(g) *Transition to and from an Individual Permit*

No person shall operate or conduct an activity authorized by both an individual permit and this

general permit. The requirements for transitioning authorization are as follows:

(1) Transition from an Individual Permit to Authorization under this General Permit.

If an activity meets the requirements of authorization of this general permit and such operation or activity is presently authorized by an individual permit, the entity to whom any such individual permit has been issued (“the permittee”) may surrender the right to operate or conduct any activity under such individual permit. The permittee shall acknowledge its intention to surrender its permit in writing to the commissioner. However, any such surrender shall not take effect, and such permittee’s individual permit shall continue to apply, until the date that the commissioner issues an authorization for such operation or activity under this general permit.

(2) Transition from Authorization under this General Permit to an Individual Permit.

If the commissioner authorizes activity under this general permit and subsequently issues an individual permit for the same activity, then on the date any such individual permit is issued by the commissioner, the authorization issued under this general permit shall automatically expire.

Section 4. Registration Requirements

(a) ***Who Must File a Registration***

Any person seeking, under the authority of this general permit, to introduce chemical oxidants and necessary supplemental substances into soil, groundwater, or an open excavation to remediate pollution shall file with the commissioner:

- (1) The applicable fee as specified in Section 4(c)(1) of this general permit,
- (2) A complete and accurate registration form meeting the requirements of Section 4(c)(2) of this general permit,
- (3) Supporting documents as specified in Section 4(c)(3) of this general permit, and
- (4) Certifications to meet the requirements of Section 4(c)(4) of this general permit.

(b) ***Scope of Registration***

A registrant shall submit one registration form for all activities taking place at a single site for which the registrant seeks authorization under this general permit. Activities taking place on more than a single parcel may not be consolidated on one registration form unless they are associated with remediation of a single pollution release or a contiguous area of groundwater pollution associated with multiple individual releases.

(c) ***Contents of Registration***

(1) **Fees**

- (A) Except as provided in Sections 4(c)(1)(B) and 4(c)(1)(C) of this general permit, a registration fee of \$500 shall be submitted with a registration form.
- (B) Fees required pursuant to this general permit are reduced to \$250 if the registrant or the property owner of the primary parcel is a municipality.
- (C) Fees required by this general permit are waived for any activity addressing pollution originating from a single family residence.

- (D) A registration shall not be deemed complete and the subject discharge or activity shall not be authorized by this general permit unless the registration fee has been paid in full.
- (E) The registration fee shall be paid by check or money order payable (or may be paid by electronic means as may be prescribed by the commissioner) to the **Department of Energy and Environmental Protection**.
- (F) The registration fee is non-refundable.

(2) **Registration Form**

A registration shall be filed on forms prescribed and provided by the commissioner (which may include submittals by electronic means as may be prescribed by the commissioner) and shall include, but not be limited to, the following:

Registrant and Contact Information

- (A) Legal name, address, and telephone number of the registrant and, if the registrant is not the owner of property on which the subject activity is to take place, the registrant's relationship to such owner(s);
- (B) Legal name, address, and telephone number of the owner(s) of the property(ies) on which the subject activity is to take place;
- (C) Legal name, address, and telephone number of any consultant(s) or engineer(s) retained by the registrant to prepare the registration or to design, construct, or supervise the subject activity;

Site Information

- (D) Name, location, street address, and town of the site, and, if the site includes multiple parcels, a list of all parcels where activity, including support activity, is proposed, under which active oxidation is expected to occur, or where groundwater quality may be affected (as delineated by the zone of influence), providing such parcels are associated with remediation of a single pollution release or a contiguous area of groundwater pollution associated with multiple individual releases on the same source parcel;
- (E) Identification of whether the primary parcel of the site is or is not a residential or retail-commercial property as defined in this general permit and, if so, whether it is a single family residential property;

Site Setting

- (F) Identification of whether the area where the subject activity, zone of influence, or access and support activity will occur is or is not, in whole or in part, within the coastal boundary, upon federally recognized Indian lands, subject to a conservation or preservation restriction, in essential habitat of an endangered or threatened species, or in an area identified on the department's map depicting Natural Diversity Data Base locales;
- (G) Identification of whether the area where the subject activity, zone of influence, or access and support activity will occur is or is not within 100 feet of any watercourse, coastal water, inland wetland, or tidal wetland; or within any identified floodplain;
- (H) The name and surface water classification, pursuant to section 22a-426 of the Connecticut General Statutes, of the nearest surface water downgradient from the

area where the subject activity will occur and its distance from the zone of influence;

- (I) Identification of whether the area of proposed activity or zone of influence is or is not within one mile of any public water supply well;

Site Character

- (J) Identification of whether the primary parcel of the site is or is not undergoing remediation being conducted in accordance with:
 - (i) sections 22a-133x, 22a-133y, or 22a-134a of the Connecticut General Statutes,
 - (ii) sections 22a-449(c)-105(h) or 22a-449(d)-106 of the Regulations of Connecticut State Agencies,
 - (iii) a brownfield redevelopment program, including section 32-9mm of the Connecticut General Statutes, or
 - (iv) an order of the commissioner issued pursuant to section 22a-432 of the Connecticut General Statutes;
- (K) Identification, including any DEEP ID numbers, of whether the area where the subject activity, zone of influence, or access and support activity will occur is or is not on a parcel(s):
 - (i) regulated under Subtitle C of the Federal Resource Conservation and Recovery Act (RCRA), as amended, under section 22a-454 of the Connecticut General Statutes, or section 22a-449(c) of the Regulations of Connecticut State Agencies,
 - (ii) regulated under Subtitle D of RCRA, as amended, or under section 22a-208 of the Connecticut General Statutes,
 - (iii) for which notification of an Underground Storage Tank was submitted under section 22a-449(e) of the Connecticut General Statutes, or
 - (iv) subject to a discharge permit, other than a stormwater discharge permit, issued by the department under section 22a-430 of the Connecticut General Statutes;

Site Proximity to Water Supplies

- (L) Identification of whether the subject activity, including support activity, area under which active oxidation is expected, or zone of influence will or will not occur at a location within an identified aquifer protection area, or within a public drinking water source water area, or will occur on land owned by an operator of a public water supply system;
- (M) The groundwater classification(s), pursuant to section 22a-426 of the Connecticut General Statutes, of the area where the subject activity or zone of influence will occur;
- (N) Identification of whether the subject activity or zone of influence will or will not occur within 1,000 feet of a public water supply well, or within 200 feet of any other water supply well, and a list of all public water supply wells located within 1,000 feet and all other water supply wells located within 500 feet of the subject activity zone of influence;

Site Setting Mitigation Measures

- (O) A summary of the design measures of the proposed activity that will prevent adverse impact as it may affect compliance with Section 3(b) of this general permit, affect receptors identified pursuant to Sections 4(c)(2)(F) through (I), (L) and (N) of this general permit, or affect compliance with programs identified pursuant to Section 4(c)(2)(K) of this general permit, and a summary of any measures proposed to identify and correct any adverse impact that does occur;

Complexity Considerations

- (P) Identification of whether the subject activity will or will not involve an activity that requires an approval of registration pursuant to Section 3(e)(1)(B) of this general permit or the activity or zone of influence will occur at a location where:
 - (i) the water table is less than 15 feet above the bedrock surface,
 - (ii) the aquifer permeability is less than 10^{-4} cm/sec (0.28 ft/day),
 - (iii) a soil vapor control system or groundwater pumping system operating to reduce potential human or environmental exposure to pollutants is within 25 feet,
 - (iv) a storm-water drainage system or leaching system is located within 25 feet,
 - (v) a coastal water, tidal or inland wetland, or watercourse is located within 25 feet,
 - (vi) an underground utility, unprotected subsurface structure, or occupied basement is located within 25 feet, or
 - (vii) any structure or confined space is located within 25 feet and volatile organic substances or gasoline are present;
- (Q) A description of the pollution present on the site, and a statement that migrating and mobile free product petroleum fuel is not present or has been removed to the maximum extent technically practicable from the area of proposed activity, taking into consideration soil and site characteristics and the proposed remedial design, and that any other migrating or mobile non-aqueous phase substance has been removed to the extent feasible, taking into consideration soil and site characteristics, the proposed remedial design, and cost;

Activity Mitigation Measures

- (R) A summary of the operational and design measures of the proposed activity that will limit adverse impact associated with site complexity conditions identified pursuant to Sections 4(c)(2)(P) and 4(c)(2)(Q) of this general permit, project complexity conditions identified in Section 5(a)(11)(B) of this general permit, chemical specific issues identified in Appendix I of this general permit, human health and safety on the site, or compliance with the operating conditions listed in section 5(a) of this general permit, and a summary of the proposed monitoring and response measures to identify and mitigate such impact should it occur;

Other Information

- (S) An 8 ½ inch by 11 inch copy of the relevant portion(s) of United States Geological Survey (USGS) quadrangle map(s), with the quadrangle name(s) and numbers(s) identified and with a scale of 1:24,000, or full-sized originals of such map(s), showing the exact location of the site, the area within a one mile radius of the site, mapped location of any boundaries or features associated with

information listed in Sections 4(c)(2)(F) through 4(c)(2)(I) and 4(c)(2)(L) through 4(c)(2)(N) of this general permit and within one mile of the site; and

- (T) If the subject activity is an existing activity, the date it began and the date it is expected to end, and any departmental permit or authorization number; if the subject activity is a new activity, the date the registrant intends to initiate the activity and the date it is expected to end.

(3) **Required Supporting Documents**

The following required supporting documents shall be submitted (and may be submitted by electronic means as may be prescribed by the commissioner) with the registration form:

(A) *Site Conditions Report*

A site conditions report shall describe in detail the environmental conditions resulting in the necessity of the proposed discharge to remediate soil or groundwater pollution, and those conditions potentially affecting or affected by such discharge.

- (i) If the site is residential or retail-commercial property with only a heating oil release originating on the site, the site conditions report shall include, at a minimum:
 - 1) a description of the origin and character of the petroleum release, and all details (construction, size, depth, age, etc.) of any associated tanks or release pathways;
 - 2) an identification (“site review”) of any historical releases of pollution, non-residential or non-retail uses, or importation of fill at the site;
 - 3) a description of any remediation conducted to date to prevent further releases or remove free product, polluted soil, or polluted groundwater;
 - 4) a summary of available information regarding hydrogeology, groundwater flow, and groundwater quality, including a discussion of data gaps that may affect design or monitoring of the remedial activity and how they will be resolved during work plan implementation, and incorporating evaluation of any substance-specific characterization requirements listed in Appendix I of this general permit; and
 - 5) an identification of potential discharge migration pathways and receptors that may be affected by the proposed discharge.
- (ii) If the site is not solely residential or retail-commercial property or has any release other than heating oil, the site conditions report shall include a description of the conceptual site model and conditions relative to the activity proposed, including at a minimum:
 - 1) the origin and character of the petroleum or other pollutant release and all details of any associated tanks or other materials management physical plant features;
 - 2) a review, to the extent that the proposed activity may be affected, of current and past activities at and uses of the site, identification of any potential pollutants other than petroleum that may be present as a result of releases due to such activity or use or due to importation of polluted fill, and identification and description of specific areas of concern, other

than the target pollution, that may be affected by or could affect the proposed activity;

- 3) a description of any remediation conducted to date to prevent further releases or remove free product, polluted soil, or polluted groundwater;
 - 4) a description of the hydrogeology, groundwater flow and soil and groundwater quality at the site and its variability, including depths to water table and bedrock, and, for soil and groundwater within the proposed discharge area, basic chemical quality data identified in the conceptual site model as important for design or monitoring of the proposed activity or listed in Appendix I of this general permit for the substances proposed to be discharged;
 - 5) a delineation of the extent of polluted soil, free product, and groundwater pollution present;
 - 6) an identification of potential pollution migration pathways and receptors that may be affected by the proposed discharge; and
 - 7) a discussion of data gaps that may affect design or monitoring of the remedial activity and how they will be resolved during work plan implementation.
- (iii) For all sites, if a site is identified as subject to any of the authorities in Section 4(c)(2)(K) of this general permit, excluding those subject only to section 22a-449(d)-106 of the Regulations of Connecticut State Agencies, or if the site review or site conditions report determines there are potential pollutants other than petroleum fuel, volatile organic chemicals, or polyaromatic hydrocarbons, the site conditions report shall include:

A listing of constituents of concern, based on either pre-existing characterization or monitoring data, knowledge of systems and processes at the site, or a minimum of two screening analyses each of the soil and groundwater within the area of proposed activity and zone of influence, to determine if any constituents listed in Appendix B to section 22a-430-4 of the Regulations of Connecticut State Agencies are present above concentrations occurring naturally in the environment.

(B) *Site Plan*

Site plan(s) and cross section(s) shall, for the entire area of proposed activity and zone of influence, depict, at a minimum:

- (i) the site and parcel boundaries;
- (ii) the location of the subject activity, including staging and support areas;
- (iii) the location, on the site or off-site but within 100 feet of the proposed activity or zone of influence, of structures, paved areas, water supply wells, leaching systems, known wetlands boundaries, floodplains, watercourses, and existing tanks (including pipelines, and fill and dispenser locations) or other materials management physical plant features, drains, utilities and other structures, along with notes of any installed corrosion protection on any underground structures;
- (iv) the location of the pollution to be remediated, its source location, the area of any prior remedial activity, and the current extent and concentration

- distribution of pollution in soil and groundwater, including the distribution of any residual non-aqueous phase product identified;
- (v) the location of any other area of concern identified pursuant to the requirement of Section 4(c)(3)(A) of this general permit;
 - (vi) the locations of all existing and proposed wells and other data points;
 - (vii) the inferred direction of groundwater flow, including vertical components;
 - (viii) the location and expected zone of influence of each specific point where substances will be emplaced on or below the ground surface, and a resultant composite zone of influence that incorporates hydrogeologic and hydrochemical behavior of the discharge after it is within the subsurface;
 - (ix) the location of all potentially affected receptors and migration pathways, both under existing conditions and those that are predicted to be created by the proposed activity; and
 - (x) planned monitoring locations for the proposed activity.

(C) *Work Plan*

A work plan shall describe in detail all activities planned for the introduction of substances on or below the ground surface at the location for which a registration is submitted, including, at a minimum:

- (i) a detailed description of the technology selected for the remediation project, the rationale for its selection, and the remedial project goals for the proposed activity;
- (ii) information regarding the exact substance(s) to be introduced, including any additives, activators, amendments or supplements proposed to be used, and the rationale for their necessity and, if the substances are not listed in Appendix I of this general permit, also include identification of all chemical constituents of the substances, material safety data sheets (MSDSs), an identification of potential impurities present in the substance, an evaluation of byproducts and residuals that may be produced due to the use of the substances at the site and the potential effects of these impurities or produced substances on human health and the environment or the long term aquifer condition, and a list of proposed monitoring parameters to evaluate the substance's effects;
- (iii) evaluation, based on the conceptual site model and any requirements identified for substances listed in Appendix I to this general permit, of the interaction between the proposed substance(s) to be emplaced and the location's target pollution, aquifer matrix and groundwater, and also any non-target pollutants identified as present, identification of end-intermediate- and by-products that may be produced, and any residuals that may remain in the aquifer or groundwater, and discussion of how any adverse chemical interaction or hydrogeologic effects will be mitigated and monitored;
- (iv) results of any design studies, treatability studies, bench scale studies, or pilot studies conducted to gather information to design the proposed action, or an explanation of why no such studies were necessary;

- (v) details of the concentration and amount of substance(s) to be used, including the total amount of each substance that will be discharged during each discharge phase, the data and calculations used to determine the amount(s), the proposed distribution relative to the pollution to be remediated, and a description of the detailed emplacement locations and depths, and their expected zones of influence;
- (vi) a detailed description of specific emplacement mechanisms, including proposed concentrations, volumes, injection pressures and flow rates, and a discussion of how these activities will be monitored at the discharge point(s);
- (vii) details of the procedures for material storage and handling, including procedures for reagent handling, mixing, measurement, applicable controls and alarms, and methods for disposal of excess or off-specification material;
- (viii) site safety procedures, including identification of applicable OSHA requirements (note that the department does not explicitly review or approve OSHA mandated safety plans), measures to prevent public access, and measures to ensure that no threats to public safety or health result from the proposed activity, and to identify and mitigate any that do;
- (ix) contingency procedures, including spill management procedures, actions to take in response to observations during active emplacement, and actions to take in response to monitoring results;
- (x) additional information and design and implementation specifications if necessary to meet substance-specific requirements in Appendix I of this general permit, to demonstrate that further non-aqueous phase product removal is not necessary prior to the proposed discharge, or to demonstrate any proposed activities identified in Sections 3(e)(1)(B) or 5(a)(11)(B) or in locations identified in Sections 3(e)(1)(A) or 3(e)(1)(C) of this general permit are protective of human health and the environment and may be approved by the commissioner pursuant to this general permit; and
- (xi) for planned multi-phased discharges either:
 - 1) a detailed description of the target aquifer geochemical condition and specifications for a phased recurring discharge to establish and maintain such condition, along with a fixed recurrence schedule or methodology for determining when the next phase is required, and also a methodology for periodically evaluating the appropriateness or effectiveness of the discharge, or
 - 2) a detailed description of the decision criteria to be used for episodic results-based remediation phases to establish the specifics of the subsequent phase of discharge based on monitoring of the results of the previous phase.

(D) *Monitoring Plan*

A monitoring plan shall describe in detail a monitoring program that is based on the conceptual site model and meets the requirements of Section 5(b) of this general permit, incorporates the substance-specific requirements for substances listed in Appendix I of this general permit, monitors the remediation process and

performance of any discharge delivery system, and documents the effect, if any, of the proposed activity on the waters of the state.

Such plan shall include, at a minimum:

- (i) identification of water supply wells within 75 feet of the proposed activity or zone of influence, and any other supply wells proposed or required to be monitored pursuant to this general permit, specifics of the well and water system construction, and rationale for exclusion of any required wells from the proposed monitoring program;
- (ii) identification of environmental receptors other than water supply wells that will be monitored because they may be affected by the proposed activity or are otherwise proposed or required to be monitored pursuant to this general permit, and the objectives of the proposed monitoring;
- (iii) identification of proposed discharge monitoring wells outside the expected zone of influence, their hydrogeologic relationship to such zone; the specifics of their construction, and the rationale for their inclusion in the monitoring program;
- (iv) identification of monitoring wells within the expected zone of influence, and activity monitoring at discharge points and, for all monitoring wells, the specifics of their construction, the rationale for their inclusion in the monitoring program, and the objective of the proposed monitoring;
- (v) a detailed description of how any discharge will be evaluated for its effects on the hydrogeologic flow regime and its conformance with the zone of influence identified in the registration, taking into account documented or expectable variation in water quality and elevation, and also taking into account transient hydrogeologic effects of the discharge or incorporating an explanation of why transient effects on the zone of influence are not significant;
- (vi) a list of all project-specific constituents of concern, including parameters specific to the substance proposed for discharge, the pollutant present, and those based on the substance-specific requirements listed in Appendix I of this general permit and on the results of any site specific evaluations conducted in fulfillment of Sections 4(c)(3)(A)(iii) and 4(c)(3)(C) of this general permit, and also a proposed project-specific monitoring parameter list, which may vary based on monitoring location and objective, and which includes the rationale for any exclusion from the monitoring program of a constituent of concern;
- (vii) a detailed description of sampling and analysis procedures, and the sampling schedule to be used, including a summary of any proposed reductions in frequency from the requirements of section 5(b)(2) of this general permit and the rationale justifying this alternative schedule as protective of human health and the environment such that the proposed sampling frequency may be approved pursuant to section 5(b)(5)(D) of this general permit; and
- (viii) a detailed description of the data evaluation procedures to be used in drawing conclusions from the monitoring data consistent with the objectives of the monitoring program and requirements of this general permit and how they will take into account documented or expectable variation in water quality and elevation.

(4) **Certifications**

(A) The registration shall include the signature of the registrant(s) and of the individual or individuals responsible for actually preparing the registration, each of whom shall certify in writing as follows:

(i) "I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I certify that this general permit registration is on complete and accurate forms as prescribed by the commissioner without alteration of their text. I understand that a false statement made in the submitted information may be punishable as a criminal offense, in accordance with section 22a-6 of the Connecticut General Statutes, pursuant to section 53a-157b of the Connecticut General Statutes, and in accordance with any other applicable statute."

and (ii) "I certify that I have read the *General Permit for In Situ Remediation: Chemical Oxidation* issued by the Connecticut Commissioner of Energy and Environmental Protection; that the activities which are the subject of this registration are eligible for authorization under such permit; that if such activities commenced prior to the issuance of such permit, all applicable requirements of such permit are being met; and that a functioning and effective system is in place to assure that all such requirements are met so long as the activities which are the subject of this registration continue."

(B) A Certification, set forth below, signed by a P.E. or LEP, is required.

Certification:

(i) "I certify that I have reviewed the: site conditions report, including the past and present uses of the site and fill history; site plan; work plan; and monitoring plan; and, if applicable, results of screening samples included with this registration and any other site characterization samples. I certify, based on such review and on my professional judgment, that any constituent of concern list includes all known non-petroleum potential pollutants present in the area of proposed activity or zone of influence and that the proposed activities are based on a site characterization that, for the area of interest, is consistent with prevailing standards and guidelines. I also certify that I have reviewed the proposed activities and, based on such review and on my professional judgment, I certify that the activity design, specifications, and implementation procedures are appropriate to remediate the pollution present at the area of the site where activity is proposed. I also certify that the oversight and monitoring provisions, and contingency measures, described in the work plan and/or monitoring plan, were developed to be substantially consistent with prevailing standards and guidelines, and the proposed activities are not expected to cause changes in groundwater or surface water quality beyond the designated zone of influence, are not expected to adversely affect any identified underground source of drinking water supply or water supply well, are not expected to create any explosion hazard or adversely affect indoor air quality in any structures overlying the expected zone of influence, and are not expected to adversely affect any underground utilities, underground structures or leaching fields in the expected zone of influence. I also certify that, in my professional judgment, the proposed work plan and

monitoring plan considered potential adverse effects that could reasonably be expected to impact the site, and provide a mechanism to address and mitigate such effects.”

and (ii) “I am aware that any professional services rendered pursuant to this general permit shall conform to the applicable rules of professional conduct of the Regulations of Connecticut State Agencies (for P.E.s section 20-300-12(a) and for LEPs section 22a-133v-6). I am also aware that there are significant penalties for false statements in this certification, including the possibility of fine and imprisonment for knowingly making false statements”.

(d) *Where to File a Registration and Other Related Documents*

(1) A registration shall be filed with the commissioner at the following address:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

(2) If the proposed activity or zone of influence is within any part of an aquifer protection area, an area of the state with a groundwater Water Quality Classification of GAA, or a public drinking water source water area, or if the proposed activity is on land owned by an owner or operator of a public water supply, an electronic copy of the registration filed with the department, including attached supporting documents, shall be filed with the Department of Public Health at the following address:

DPH.SOURCEPROTECTION@CT.GOV

or a duplicate or certified copy of the registration filed with the department, including attached supporting documents, shall be filed with the Department of Public Health at the following address:

DRINKING WATER SECTION
DEPARTMENT OF PUBLIC HEALTH
410 CAPITOL AVENUE - MS #51 WAT
P.O. BOX 340308
HARTFORD, CT 06134-0308

(3) If the proposed activity or zone of influence is within 200 feet of any water supply well pumping over ten (10) gallons per minute, or within seventy-five (75) feet of any other water supply well, a duplicate or certified copy of the registration form filed with the department, without any attachments except the location map, shall be filed with the local Director of Health.

(e) *Additional Information*

The commissioner may require a registrant to submit additional information, which the commissioner reasonably deems necessary to evaluate the consistency of the subject activity with the requirements for authorization under this general permit.

(f) *Action by Commissioner*

(1) The commissioner may reject without prejudice a registration if it is determined that it does not satisfy the requirements of Section 4(c) of this general permit or more than thirty (30) days have elapsed since the commissioner requested that the registrant submit additional information or the required fee and the registrant has not submitted such

information or fee. Any registration re-filed after such a rejection shall be accompanied by the fee specified in Section 4(c)(1) of this general permit.

- (2) The commissioner may disapprove a registration if it is found that the subject activity is inconsistent with the requirements for authorization under Section 3 of this general permit, or for any other reason provided by law.
- (3) Disapproval of a registration under this subsection shall constitute notice to the registrant that the subject activity may not lawfully be conducted or maintained without the issuance of an individual permit.
- (4) The commissioner may approve a registration pursuant to this general permit, or may issue a certificate of coverage in lieu of an approval, when an approval is not required pursuant to Section 3(e)(1) of this general permit.
- (5) The commissioner may approve a registration with reasonable conditions, in lieu of either disapproval or issuance of a certificate of coverage pursuant to this general permit. If the commissioner approves a registration with conditions, the permittee shall be bound by such conditions as if they were a part of this general permit.
- (6) Rejection, disapproval, or approval of a registration shall be in writing.

Section 5. Conditions of This General Permit

The permittee shall at all times meet the requirements for authorization set forth in Section 3 of this general permit. In addition, a permittee shall ensure that activities authorized by this general permit are conducted in accordance with this Section and Section 6 of this general permit.

(a) *Operating Conditions*

- (1) Authorized activities shall be conducted:
 - (A) under the supervision of a P.E. or LEP, who must at a minimum be present at the site during the initial period of active injection or emplacement, and
 - (B) in accordance with the work plan submitted with the registration, and, as applicable, any approval of registration or approved work plan modification issued pursuant to this general permit.
- (2) Written consent from each property owner who owns property under which direct oxidation is likely to occur who is not a registrant under this general permit shall be received and submitted to DEEP prior to conducting any such injection or emplacement, except that such consent is not required for public rights of way that are within this area but where injection or emplacement do not occur, provided subsurface utilities in such rights of way are identified as a sensitive site condition and evaluated pursuant to this general permit.
- (3) The local director of health, local fire marshal, and any abutting property owners within twenty-five (25) feet of the anticipated zone of influence shall be notified of the nature of the proposed activity at least forty-eight (48) hours before a discharge into an open excavation. All abutting property owners, the local director of health and the local fire marshal shall be notified in writing or by other methods acceptable to the commissioner at least fifteen (15) days before the first initiation of any other authorized activity. Such notices shall provide the name and telephone number of a point of contact who is knowledgeable of the proposed activity. A summary of notification activity and example copies of any written notifications shall be included in the first report submitted to the commissioner pursuant to Section 5(c)(3) of this general permit.

- (4) Discharges shall be conducted in a manner that insures to the extent practical that contact between oxidant and target pollutant(s) shall be achieved and that the risk of pollutant migration is minimized.
- (5) Activities authorized pursuant to Sections 3(a)(1) through 3(a)(4) of this general permit, unless otherwise approved by the commissioner, shall not occur until any migrating petroleum fuel free product present has been removed to the maximum extent technically practicable, taking into consideration soil and site characteristics, and other non-aqueous phase liquid, including non-migrating mobile petroleum fuel, has been removed to the extent prudent, taking into consideration soil and site characteristics and cost, and the non-aqueous phase liquids are reduced sufficiently to ensure that the volume of oxidant discharged is calculated to react with the anticipated mass of target pollutant(s).
- (6) No substance shall be injected or emplaced without documentation that such substance is appropriate and necessary to remediate soil and/or groundwater pollution present at the site.
- (7) Substances authorized for discharge pursuant to this general permit shall not be discharged, injected, or emplaced into, or within fifteen (15) feet of, any well designated as a discharge monitoring well to be used to delineate the downgradient extent of the ZOI, in the registration or by the commissioner in an approval of registration, except as site conditions dictate and technical justification is included in the monitoring plan, or any well explicitly excluded by any approval of registration issued pursuant to this general permit.
- (8) If discharge(s) are needed to maintain the continued use of an injection well or wells, such discharges must be authorized pursuant to section 3(e)(5) of this general permit..
- (9) If *phased activity* is proposed pursuant to this general permit, including scale-up of project scope from an authorized pilot study:
 - (A) evaluation of the implementation, monitoring and results of each phase of the project may be used to either:
 - (i) confirm that the proposed (and approved) plan submitted with the registration is adequate and will continue to be followed, or
 - (ii) establish that modifications to the plan are required and will be proposed based on an evaluation of earlier phase(s);
 - (B) reports of such evaluation shall be submitted as specified in Sections 5(c)(3)(C) and 5(c)(4)(C) of this general permit and such reports may include proposed modifications to the discharge specifications for a subsequent phase in the work plan, subject to approval pursuant to section 3(e)(4) of this general permit, and changes to the monitoring plan originally submitted with the registration, subject to approval pursuant to section 5(b)(5)(E) of this general permit;
 - (C) the permittee may submit to the Commissioner a work plan modification, subject to approval pursuant to section 3(e)(4) of this general permit, to change for subsequent discharge phases the specific details of discharge procedures, change the schedule for periodic discharges, increase the number of remediation phases proposed, increase the duration of time during which discharge is authorized, increase the amount, volume or concentration of substance(s) proposed for each discrete discharge episode above the amount(s) specified in the registration or any approved work plan modification, or increase the proposed zone of influence; and
 - (D) for each specific phase, any change in type of activity or substance and any work plan modification involving an increase in either the amount of substances

discharged or the zone of influence of the discharge in comparison to the specifications in the initial registration or any previously approved modification, may not be implemented until reviewed and approved by the commissioner pursuant to Section 3(e)(4) of this general permit.

(10) **Discharge Limits**

- (A) Hydrogen peroxide solutions discharged pursuant to this general permit shall not exceed a concentration of thirty percent (30%) unless a project specific health and safety plan has been approved by the commissioner.
- (B) Ozone enriched air introduced to the subsurface pursuant to this general permit shall not exceed ten percent (10%) ozone.
- (C) No discharge shall exceed 125 percent (125%) of the volume or concentration proposed in the work plan, and any volume or concentration deviations shall not result in either an increase of the total amount of substance discharged during a remediation phase over the amount authorized or an increase in the zone of influence by more than ten (10) feet laterally beyond that authorized.
- (D) No discharge of a substance shall exceed any substance-specific concentration or amount specified in Appendix I of this general permit.

(11) **Prohibitions**

- (A) Activities authorized under this general permit shall not cause:
 - (i) atmospheric oxygen or ozone concentrations to be enriched within fifty (50) feet of any fuel dispensing or use area;
 - (ii) explosive gasses to accumulate at levels above ten percent (10%) of the lower explosive limit in any confined space or basement;
 - (iii) corrosion or other degradation of active subsurface infrastructure present within the zone of influence unless the owner(s) of such infrastructure authorize such impacts and an agreement is in place to evaluate and repair any public infrastructure.
 - (iv) volatile organic chemicals to migrate into indoor air in occupied structures;
 - (v) the groundwater level in the zone of influence to rise to the ground surface;
 - (vi) groundwater to enter into any occupied basement;
 - (vii) a release of chemical oxidants directly to surface water;
 - (viii) discharge into a storm-water drainage system that discharges to surface water, unless such discharge is evaluated pursuant to section 5(b)(1)(G) of this general permit and determined to meet the more stringent of the criteria specified in section 5(a)(11)(A)(xii) of this general permit or the chronic aquatic toxicity criteria in Connecticut's Water Quality Standards Regulations Section 22a-426-9, or is contained and removed for proper disposal;
 - (ix) disruption of the effectiveness of any existing soil vapor control system or groundwater pumping system that is installed and operated to protect human health or the environment from the pollution that is present except as site conditions dictate, technical justification is included in the work plan, and alternative provision is made for protection of human health and the environment;

- (x) discharge of ozone or catalyzed hydrogen peroxide, or a combination thereof, that creates a zone of influence within 25 feet of any occupied structure without installation and operation of a soil vapor control system capable of capturing vapors migrating as a result of the discharge effects, unless such discharge is explicitly approved by the commissioner;
 - (xi) treatment of soil also contaminated with greater than 1.0 ppm total PCBs, or groundwater also contaminated with greater than 0.5 ppb total PCBs; or
 - (xii) any effect on groundwater quality outside the identified zone of influence of the registered discharge that exceeds the lower of either any groundwater protection criterion or surface water protection criterion listed in the Remediation Standard Regulations (RCSA 22a 133k), any substance-specific criterion identified in Appendix I of this general permit, or the pre-discharge background condition if higher than the criteria.
- (B) The following activities shall not occur without prior written authorization of the activity pursuant to Section (3)(e) of this general permit:
- (i) injections using pressures greater than thirty (30) pounds per square inch;
 - (ii) discharge of greater than fifty percent (50%) of the pore volume in the zone of influence;
 - (iii) hydraulic or pneumatic fracturing of aquifer materials to enhance permeability or chemical contact;
 - (iv) installation, operation or use of engineered groundwater controls, or active pumped withdrawal of groundwater in order to protect human health or environmental receptors from effects of the discharge, or use of active or passive groundwater flow controls to establish and maintain the proposed zone of influence;
 - (v) discharge that incorporates recirculation or any return to the subsurface of groundwater that is affected by the discharged substance or by pollution, even if treated;
 - (vi) discharge of ozone or catalyzed hydrogen peroxide, or a combination thereof, that relies on installation and operation of a soil vapor control system to limit vapor migration to an occupied structure within 25 feet;
 - (vii) discharge on or below the surface of the bedrock, or within two feet above such surface; and
 - (viii) any substance-specific activity that is identified in Appendix I of this general permit as requiring approval.
- (12) The permittee shall have the responsibility to make notifications and file reports required under this general permit. The permittee shall also have the responsibility to make notifications, file reports, and implement contingency actions as specified in any work plan or monitoring plan applicable to activity authorized pursuant to this general permit. In addition, the permittee shall make any monitoring results or data available to the commissioner upon request.

(b) Monitoring Requirements

(1) Monitoring Objectives and Locations

- (A) The permittee shall establish a perimeter network of discharge monitoring wells, placed at appropriate locations and depths, to be sampled to determine if there any effects of the discharge authorized by this general permit outside the zone of influence defined in the registration.
- (B) The permittee shall, through monitoring discharge points and sampling discharge monitoring wells within the defined zone of influence, establish a process monitoring program to ensure activity authorized by this general permit is implemented and proceeds as proposed in the work plan and to determine the effects of the discharge on the groundwater within the zone of influence.
- (C) Potable water supply wells within seventy-five (75) feet of the authorized activity or zone of influence shall be sampled and analyzed for the parameters specified in Section 5(b)(3)(C) of this general permit to determine if there is any effect of the discharge authorized by this general permit.
- (D) Potable water supply wells more than seventy five (75) feet but within 500 feet of the expected zone of influence of activities pursuant to Sections 3(a)(1) through 3(a)(3) of this general permit shall, unless otherwise approved by the commissioner, be sampled and analyzed for the parameters specified in Section 5(b)(3)(C) of this general permit to determine if there is any effect of the discharge authorized by this general permit if:
 - (i) the authorized activity is in an area where the water table is within fifteen (15) feet of the bedrock surface or the discharge is into bedrock or within two (2) feet of the bedrock surface,
 - (ii) the well is a public water supply well of any type,
 - (iii) free product or non-aqueous phase liquids have not been removed to meet the requirement of Section 5(a)(5) of this general permit but the proposed activity is designed to remediate remaining mobile and residual non-aqueous phase liquids and the commissioner has authorized the proposed discharge activity,
 - (iv) groundwater analyses within the zone of influence determines the concentration of any individual chlorinated volatile organic solvent prior to initiation of a discharge pursuant to this general permit is greater than 1,000 ug/l at any location, or
 - (v) sampling the well is proposed in the monitoring plan, identified as a substance-specific requirement by Appendix I of this general permit, or required in any approval of registration by the commissioner.
- (E) Potable water supply wells within 500 feet of activities pursuant to Section 3(a)(4) of this general permit or the expected zone of influence of such activities shall, unless otherwise approved by the commissioner, be sampled and analyzed for the parameters specified in Section 5(b)(3)(C) of this general permit to determine if there is any effect of the discharge authorized by this general permit.

- (F) The permittee shall establish a monitoring program, including field observations, field parameter measurements, and chemical analyses, to identify if the discharge authorized by this general permit has an effect on environmental receptors other than potable water supply wells, including but not limited to surface water, storm-water systems, soil gas and indoor air quality.
- (G) If storm-water management drains are present within 25 feet of the zone of influence they shall, at a minimum, be visually inspected periodically for any flow associated with the authorized discharge during the active discharge period and the following calendar day. If flow associated with the authorized discharge is present, it shall be sampled and analyzed to evaluate the effect of the discharge unless the flow is contained and removed for disposal.
- (H) The permittee shall establish and conduct, consistent with prevailing standards and guidelines, a monitoring program, with a monitoring frequency and including field observations, field parameter measurements, and chemical analyses, to determine that any passive control systems or active control systems, including pumping wells to control groundwater flow and soil vapor control systems, 1) if designed or used to meet requirements of this general permit, operate as proposed in the work plan or 2) if preexisting protections for human health and the environment, continue to adequately meet the designed protection objective.
- (I) Downgradient monitoring wells, when required pursuant to this general permit, shall be installed at a location and depth that monitors a point that is not further from the identified zone of influence than the distance groundwater travels in six (6) months, based on hydrogeologic evaluation of the site, unless the proposed monitoring frequency and duration in the monitoring plan are adjusted, based on the site hydrogeologic analysis, from those specified in Section 5(b)(2) of this general permit.

(2) Monitoring Frequency and Duration

Monitoring of activities pursuant to Section 5(b) of this general permit, unless required otherwise for a specific substance in Appendix I of this general permit, otherwise increased or modified in an approval by the commissioner, increased in a monitoring plan based on the conceptual site model, or otherwise required through Section 5(d) or modified by Section 5(b)(5) of this general permit, shall be conducted, for the parameters listed in the project-specific monitoring parameter list in the monitoring plan submitted with the registration, or any approved modification of the monitoring plan, at least once prior to initiation of activity pursuant to this general permit (“baseline conditions”) and then as follows:

- (A) Monitoring of activities pursuant to Sections 5(b)(1)(A) and 5(b)(1)(F) of this general permit shall at a minimum be conducted:
 - (i) for field observations and field determined parameters:
 - daily during the first week of active discharge then
 - weekly for the remaining period of active discharge,
 - monthly for the first quarter after active discharge has ended, and
 - quarterly thereafter for a period of twelve (12) months after either cessation of active discharge, injection, or emplacement or end of anticipated chemical activity, whichever is later, and

- (ii) for laboratory determined parameters:
 - once during the first five days after discharge initiation, and again two weeks later for any active discharge lasting more than ten days then
 - monthly for any remaining period of active discharge,
 - once one month after the cessation of active discharge, and
 - quarterly thereafter for a period of twelve (12) months after either cessation of active discharge, injection, or emplacement or end of anticipated chemical activity, whichever is later.
- (B) Monitoring of activities pursuant to Sections 5(b)(1)(B) of this general permit shall at a minimum be conducted:
 - (i) for field observations and field determined parameters:
 - daily during the first week of active discharge then
 - weekly for the remaining period of active discharge,
 - once one month after the cessation of active discharge, and
 - quarterly thereafter for a period of twelve (12) months after either cessation of active discharge, injection, or emplacement or end of chemical activity, whichever is later, and
 - (ii) for laboratory determined parameters:
 - monthly for the first quarter after discharge initiation, and
 - quarterly thereafter until twelve (12) months after either cessation of active discharge, injection, or emplacement or end of chemical activity, whichever is later.
- (C) Water supply well monitoring that is required pursuant to Sections 5(b)(1)(C) through 5(b)(1)(E) of this general permit shall at a minimum be conducted:
 - (i) for field observations and field determined parameters:
 - once during the first and third weeks after initial discharge then
 - monthly for the remainder of the quarter, and
 - quarterly thereafter for a period of eighteen (18) months after either cessation of active discharge, injection, or emplacement or end of chemical activity, whichever is later, and
 - (ii) for laboratory determined parameters:
 - monthly for the first quarter after initial discharge, and
 - quarterly thereafter until eighteen (18) months after either cessation of active discharge, injection, or emplacement or end of chemical activity, whichever is later.
- (D) If monitoring conducted outside the zone of influence or monitoring of drinking water supply wells or other environmental receptors determines that these monitoring locations show any effects of the discharge, quarterly monitoring of the affected locations shall continue for a minimum period of one year after such effects are no longer detected above the criteria identified in Section 5(a)(11)(A)(xii) of this general permit.
- (E) If monitoring conducted within the zone of influence determines that groundwater standards in Appendix C, D or E to sections 22a-133k-1 to 3 of the Regulations of Connecticut State Agencies or any chemical-specific limit listed in Appendix I of

this general permit are exceeded due to the authorized discharge, quarterly monitoring of the affected locations shall continue for a minimum period of one year after such effects are no longer above the criteria. This requirement does not apply to constituents that baseline monitoring has documented as similarly above the specified comparison criteria prior to the authorized discharge.

- (F) Monitoring of activities pursuant to Section 3(a)(5) of this general permit shall be as specified in the work plan submitted with the registration or a supplemental work plan submitted pursuant to Section 5(c)(3)(D) of this general permit, or as such monitoring is otherwise increased or modified in an approval by the commissioner pursuant to Section 3(e)(5) of this general permit.
- (G) Monitoring that is required more than ninety (90) days after initiation of authorized activity may be conducted concurrently with any quarterly monitoring schedule already established for the site.
- (H) Water supply well monitoring that is required pursuant to Sections 5(b)(1)(D) and 5(b)(1)(E) of this general permit shall also be conducted once one year after the end of monitoring required pursuant to Section 5(b)(2)(C) of this general permit, or as such monitoring is otherwise increased or modified in an approval by the commissioner, or increased in a monitoring plan.

(3) Monitoring Parameters

- (A) Monitoring conducted outside the zone of influence and monitoring of environmental receptors to meet the requirements of sections 5(b)(1)(A) and 5(b)(1)(F) respectively shall, unless otherwise approved by the commissioner, include at a minimum sampling and analysis for the following:
 - (i) field measurements, which shall be taken and reported in a log to be submitted with laboratory analysis:
 - Oxidation-reduction Potential (ORP),
 - Conductivity,
 - pH,
 - Temperature,
 - Water Surface Elevation;
 - (ii) contaminant constituents of concern associated with the pollution being remediated and proposed for monitoring in the project-specific monitoring parameter list in the monitoring plan developed pursuant to Section 4(c)(3)(D)(vi) of this general permit;
 - (iii) discharged chemical-specific parameters proposed for monitoring in the project-specific monitoring parameter list in the monitoring plan developed pursuant to Section 4(c)(3)(D)(vi) of this general permit, and also including any analyses identified in Appendix I of this general permit; and
 - (iv) if results of monitoring identify that there is an effect of the discharge at a location, unless a second sample within two weeks does not confirm such effect subsequent monitoring at that location shall, unless otherwise approved by the commissioner, include all project-specific constituents of concern identified in fulfillment of the requirement of Sections 4(c)(3)(A)(iii) and 4(c)(3)(C) of this general permit and included in the project-specific constituent of concern list in a monitoring plan developed pursuant to Section 4(c)(3)(D)(vi) of this general permit, or listed in

Appendix I of this general permit, and any additional monitoring parameter required in any approval of registration, using appropriate methods consistent with Section 5(b)(4) of this general permit.

- (B) Monitoring conducted within the zone of influence to meet the requirements of section 5(b)(1)(B) of this general permit shall, unless otherwise approved by the commissioner, include at a minimum sampling and analysis for the following:
- (i) field measurements:
 - Oxidation-Reduction Potential (ORP),
 - Conductivity,
 - pH,
 - Temperature,
 - Water Surface Elevation;
 - (ii) general operational parameters:
 - Injection pressure,
 - Injection flow rate,
 - Injectant concentration;
 - (iii) operational and chemical-specific parameters identified in Appendix I of this general permit; and
 - (iv) any additional project-specific constituents of concern identified in fulfillment of the requirement of Sections 4(c)(3)(A)(iii) and 4(c)(3)(C) of this general permit, and proposed for monitoring in the project-specific monitoring parameter list in a monitoring plan developed pursuant to Section 4(c)(3)(D)(vi) of this general permit, and any additional monitoring parameter required in any approval of registration, using appropriate methods consistent with Section 5(b)(4) of this general permit.
- (C) Potable water supply wells required to be sampled pursuant to sections 5(b)(1)(C) through 5(b)(1)(E) of this general permit shall be sampled and analyzed for the following:
- (i) field measurements, which shall be taken and reported in a log to be submitted with laboratory analysis:
 - Oxidation-reduction Potential (ORP),
 - Conductivity,
 - pH;
 - (ii) contaminant constituents of concern associated with the pollution being remediated and proposed for monitoring in the project-specific monitoring parameter list in the monitoring plan developed pursuant to Section 4(c)(3)(D)(vi) of this general permit; and
 - (iii) any additional project-specific constituents of concern identified in fulfillment of the requirement of Sections 4(c)(3)(A)(iii) and 4(c)(3)(C) of this general permit and included in the project-specific monitoring parameter list in a monitoring plan developed pursuant to Section 4(c)(3)(D)(vi) of this general permit, or listed in Appendix I of this general permit, and any additional monitoring parameter required in any approval of registration, using appropriate methods consistent with Section 5(b)(4) of this general permit.

- (iv) if results of monitoring identify that there is an effect of the discharge at a location, unless a second sample within two weeks does not confirm such effect subsequent monitoring at that location shall, unless otherwise approved by the commissioner, include all project-specific constituents of concern identified in fulfillment of the requirement of Sections 4(c)(3)(A)(iii) and 4(c)(3)(C) of this general permit and included in the project-specific constituent of concern list in a monitoring plan developed pursuant to Section 4(c)(3)(D)(vi) of this general permit, or listed in Appendix I of this general permit, and any additional monitoring parameter required in any approval of registration, using appropriate methods consistent with Section 5(b)(4) of this general permit.
- (D) Sampling conducted to meet the requirements of section 5(b)(1)(G) of this general permit shall use appropriate methods consistent with section 5(b)(4) of this general permit and shall be for parameters identified as appropriate to monitor the discharge or its effects on groundwater in the work plan submitted pursuant to section 5(c)(3)(D) of this general permit, or listed in Appendix I of this general permit, or as otherwise approved by the commissioner pursuant to section 3(e)(5) of this general permit.
 - (E) Monitoring conducted to meet the requirements of section 5(b)(1)(H) of this general permit shall use appropriate methods consistent with section 5(b)(4) of this general permit and shall be for parameters that are, consistent with prevailing standards and guidelines, appropriate to monitor the function of the control system to meet the specifications in the work plan submitted pursuant to section 4(c)(3)(C) of this general permit, or as otherwise approved by the commissioner pursuant to section 3(e) of this general permit.
- (4) **Sampling and Analysis Requirements**
- (A) All discharge monitoring wells identified in the monitoring plan submitted with the registration, or in any approval of registration issued pursuant to this general permit, shall be installed at least seven (7) days prior to the first sampling required pursuant to Sections 5(b)(2)(A) and 5(b)(2)(B) of this general permit.
 - (B) All sampling and analyses required to monitor activities authorized by this general permit shall, unless otherwise specified in this general permit, comply with the following requirements:
 - (i) all samples collected to monitor groundwater impacts shall be grab samples composed solely of groundwater representative of the subject groundwater, and shall be collected in a manner consistent with prevailing standards and guidelines;
 - (ii) laboratory analyses, and the reporting of such analyses, shall be conducted by a laboratory certified by the Connecticut Department of Public Health, and analyses shall be performed using methods consistent with Connecticut's Reasonable Confidence Protocols or methodologies that contain a level of quality control and documentation at least equivalent to the reasonable confidence protocols; and
 - (iii) monitoring required by this general permit for temperature, dissolved oxygen, dissolved carbon dioxide, pH, conductivity, turbidity, oxidation-reduction potential, or other field-measured parameters shall be conducted in the field using field test kits or electronic probes as appropriate.

- (C) The permittee shall periodically calibrate and perform maintenance on all monitoring and field equipment used to monitor the groundwater, as required under this general permit, at intervals that will ensure the accuracy of measurements, and shall document such calibration in field logs.

(5) **Monitoring Exceptions**

- (A) In addition to the monitoring requirements specified in Sections 5(b)(1) through 5(b)(3) of this general permit, monitoring, including monitoring of discharge volume and concentration, proposed in any work plan or monitoring plan as a result of evaluation of the conceptual site model, shall be conducted as proposed in such documents, or as otherwise increased or modified in an approval of registration by the commissioner pursuant to Section 5(b)(5)(D) of this general permit.
- (B) If the authorized activity is chemical oxidant emplacement into open excavations resulting from removal of, or remediating a release from, tanks with a capacity of less than 2,100 gallons used to store petroleum fuel:
 - (i) the monitoring requirements specified in Sections 5(b)(1)(A) and 5(b)(1)(B) of this general permit are not required unless otherwise specified in Appendix I of this general permit or in an approval of registration or work plan or monitoring plan, provided that any monitoring results that are collected shall be submitted in the report required by Section 5(c)(3)(B) or as otherwise required by Section 5(c)(4) of this general permit; and
 - (ii) any monitoring required by Sections 5(b)(1)(C) and 5(b)(1)(D) of this general permit shall be conducted initially on or before the day of discharge initiation, to establish “baseline conditions”, monthly for the first quarter and then quarterly for one year, and then annually for the remaining monitoring period, or as otherwise increased or modified in an approval of registration or in a work plan or monitoring plan. *However*, if no mobile free product was present at any time prior to the authorized emplacement, such monitoring may be discontinued after the first year, unless otherwise extended or modified in Appendix I of this general permit, in an approval of registration, or in a work plan or monitoring plan.
- (C) If the authorized activity is chemical oxidant injection or emplacement pursuant to Section 3(a)(2) of this general permit, at a residential or retail-commercial site where a heating oil tank with a capacity equal to or smaller than 2,100 gallons is or had been present:
 - (i) the monitoring requirements specified in Section 5(b)(1)(A) may be met using monitoring wells installed and sampled to establish “baseline conditions” on or before the day of discharge initiation;
 - (ii) the monitoring requirements specified in Section 5(b)(1)(B) of this general permit are not required, for the first activity phase only, unless otherwise specified in Appendix I of this general permit or in an approval of registration or work plan or monitoring plan, provided that any monitoring results that are collected shall be submitted in the report required by Section 5(c)(3)(B) of this general permit; and
 - (iii) any monitoring required by Sections 5(b)(1)(C) and 5(b)(1)(D) of this general permit shall be conducted initially before discharge initiation, to establish baseline conditions, monthly for the first quarter and then

quarterly for one year, and then annually for the remaining monitoring period, or as otherwise increased or modified in an approval of registration or in a work plan or monitoring plan. *However*, if no mobile free product was present at any time prior to the authorized emplacement, monitoring required by Sections 5(b)(1)(C) and 5(b)(1)(D) of this general permit may be discontinued after two (2) years unless otherwise extended or modified in Appendix I of this general permit, in an approval of registration or in a work plan or monitoring plan.

- (D) The commissioner, when approving a registration, may increase or modify the monitoring requirements specified in Section 5(b) of this general permit, or otherwise required at the site pursuant to this general permit, in order to protect human health or the environment. Such action by the commissioner may be taken for any proposed activity, in lieu of issuance of a certificate of coverage, even if an approval is not otherwise required pursuant to this general permit.
- (E) The permittee may request that the commissioner approve a modification of the Monitoring Plan, to include a reduction of the requirements of this section of the general permit for monitoring conducted more than one year after initiation of a discharge authorized by this permit, provided that the request demonstrates through evaluation of the first year monitoring data that such reduction will ensure protection of human health and the environment.

(c) ***Reporting and Record Keeping Requirements***

- (1) Unless otherwise stated in this general permit, or otherwise specified in writing by the commissioner, notifications, plans, and reports required by this general permit (which may include submittals by electronic means as may be prescribed by the commissioner), shall identify the permittee name, department assigned permit identification numbers, site name, site location, street address, and town, and shall be submitted to:

COORDINATOR – IN SITU REMEDIATION
REMEDICATION DIVISION – BUREAU OF WATER PROTECTION AND LAND REUSE
CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5027

- (2) **Report of Monitoring Data Evaluation**

The permittee shall submit, on or in a form prescribed by the commissioner, a summary review of the monitoring data relative to compliance with this general permit within sixty (60) days of the end of each sampling period. Monitoring analytical reports and field logs shall not be submitted with such summary unless required by the commissioner. However such data shall be incorporated in reports and notifications submitted pursuant to Sections 5(c)(3) and 5(d) of this general permit. Furthermore, field data shall be evaluated pursuant to Section 5(d) of this general permit within forty-eight (48) hours of collection, and the date and results of such evaluation shall be noted on the report of monitoring data evaluation form.

- (3) **Other Required Reports**

Except as specified in Section 5(c)(4) of this general permit, reports, prepared by the LEP or P.E. supervising the authorized activity pursuant to Section 5(a)(1) of this general permit, are required by this general permit to document the activity as implemented.

- (A) A report of the site activities conducted in accordance with the work plan shall be submitted within ninety (90) days after the cessation of active discharge, except as waived for phased activity pursuant to Section 5(c)(3)(C) of this general permit.
- (B) A final report summarizing all site activity and monitoring shall be submitted within one hundred twenty (120) days after completion of all activity and post-discharge monitoring required pursuant to this general permit.
- (C) If phased activity pursuant to this general permit, including scale-up of project scope from an authorized pilot study, is proposed or determined by the permittee to be necessary, instead of the report required in Section 5(c)(3)(A) of this general permit the following reports are required, except as waived by Section 5(c)(4)(C) of this general permit:
 - (i) for an unplanned recurrence of activity or planned episodic discharge phases where the discharge specifications of each phase are determined through review of the results of a previous phase the permittee shall submit not later than 180 days after the end of the discharge phase, or not less than thirty (30) days prior to the planned implementation date of the subsequent discharge phase, whichever is earlier, an evaluation report of the previous phase, including a summary of the discharged substances and amounts for the event, a summary of the discharge activity identifying any departures from the work plan, a summary of monitoring results, a supplement to the site conditions report as necessary to reflect changed conditions or additional information, a reevaluation of the conceptual site model and remedial design and progress, and recommendations for any modifications to the work plan or monitoring plan, including identified discharge locations and amounts for the next discharge phase; or
 - (ii) for planned recurring periodic discharge phases with specifications delineated in the registration or an approved modified work plan the permittee shall submit semiannual reports of discharge activity no later than sixty (60) days after the end of each six month period, with the first report due in the eighth month after the date of initial authorization of the discharge pursuant to this general permit. Such reports shall include a summary of the discharged substances and amounts for the period, a summary of the discharge activity identifying any departures from the work plan, a summary of monitoring results, and a reevaluation of the conceptual site model and remedial design and progress, and may include recommendations for any modifications to the work plan or monitoring plan, including identified discharge locations and amounts for the next discharge periods.
- (D) If short term discharge of treatment chemicals, either at a single point in time or at defined recurrence intervals based on triggering conditions or elapsed time, is proposed pursuant to Section 3(a)(5) of this general permit to maintain a condition facilitating the continued implementation of other activities pursuant to this general permit, a report detailing why such discharge is needed, with identification of any recurrence trigger or interval, and including a supplemental work plan for such discharge and proposed monitoring shall be submitted for review and approval not less than thirty (30) days prior to the proposed discharge date, and such submittal shall be subject to review and approval as specified in Section 3(e)(5) of this general permit.

(4) **Reporting Exceptions**

- (A) For activities at supervised remediation sites, permittees are, except as otherwise specified in writing by the commissioner, not required to submit any report required under Sections 5(c)(3)(A) or 5(c)(3)(B) of this general permit, provided the information referenced in Sections 5(c)(3)(A) and 5(c)(3)(B) of this general permit is included in a Remedial Action Report or other required reports submitted separately to the commissioner as required under the applicable remedial program. Notifications of certain conditions must be made in accordance with Section 5(d) of this general permit, and reports pursuant to Sections 5(c)(2) and 5(c)(3)(C), except as provided in Section 5(c)(4)(C), of this general permit are required.
 - (B) For activities pursuant to this general permit which are to address pollution at a residential or retail-commercial location not a supervised remediation site where a *heating oil tank* with a capacity less than 2,100 gallons is or had been present, permittees are, except as otherwise specified in writing by the commissioner or in a work plan or monitoring plan, not required to submit reports pursuant to the requirements of Section 5(c)(3)(A) of this general permit, however the information referenced in Section 5(c)(3)(A) of this general permit shall be incorporated in the report submitted pursuant to Section 5(c)(3)(B) of this general permit. Notifications of certain conditions must be made in accordance with Section 5(d) of this general permit, and reports pursuant to Sections 5(c)(2) and 5(c)(3)(C), except as provided in Section 5(c)(4)(C), of this general permit are required.
 - (C) For planned multi-phased activities pursuant to Sections 3(a)(1) through 3(a)(3) of this general permit at supervised remediation sites or at residential or retail-commercial sites with a release associated with a *heating oil tank* with a capacity of less than 2,100 gallons is or had been present:
 - (i) reports pursuant to section 5(c)(3)(C) of this general permit are not required for additional phases of activity that are eligible to be authorized without written approval pursuant to Section 3(e)(4)(B) of this general permit, unless the permittee seeks, for a subsequent phase, a change in the details of the work plan pursuant to Section 5(a)(9) of this general permit, *however,*
 - (ii) the permittee shall, instead of the reports required in section 5(c)(3)(C) of this general permit, submit, not later than sixty (60) days after the anniversary of the effective date of discharge authorization, an annual report of the status of the discharge activity, including the number of phases of discharge, the number of days of active discharge for each phase, amount of substances discharged in each phase, aggregate amount of substances discharged, a summary of the discharge activity identifying any departures from the work plan, a summary of monitoring results, and a reevaluation of the conceptual site model and remedial design and progress, and may include recommendations for any modifications to the work plan or monitoring plan, including identified discharge locations and amounts for future phases.
- (5) Except as otherwise specified in writing by the commissioner, each analytical result of a groundwater sample taken and all data generated by any other monitoring, including field parameter monitoring, conducted under this general permit shall be retained at the subject site or at the place of business of the P.E. or LEP responsible for supervising the

authorized activity under this general permit, for at least five (5) years from the date such result or data was generated or received by the permittee, whichever is later. The commissioner may specify a longer retention period as reasonably deemed necessary upon written notice to the permittee stating the reasons for such longer period. If, during the required retention period, the commissioner, under chapter 446k of the Connecticut General Statutes, issues an order or commences a civil action against the permittee, such retention period shall be extended as necessary. Other statutory or regulatory provisions requiring retention of records on site are unaltered.

- (6) The requirements of Section 5(c)(5) of this general permit for retention of records at the subject site are waived after all such information is included in a remedial action report submitted to the commissioner in accordance with the provisions of sections 22a-133x, 22a-133y, 22a-134a, or 32-9mm of the Connecticut General Statutes, sections 22a-449(c)-105(h) or 22a-449(d)-106 of the Regulations of Connecticut State Agencies, or an order of the commissioner issued pursuant to section 22a-432 of the Connecticut General Statutes, or after all such information is included in a final report submitted to the commissioner pursuant to Section 5(c)(3)(B) of this general permit. Other statutory or regulatory provisions requiring retention of records on site are unaltered.
- (7) In addition to the reporting requirements specified in Sections 5(c)(1) through 5(c)(4) of this general permit, the permittee shall submit reports as required by any approval of registration issued pursuant to this general permit.

(d) *Notification and Mitigation of Certain Conditions*

- (1) When required, pursuant to this general permit or any approval, immediate, two (2) hour, or twenty-four (24) hour notification to the department shall, unless otherwise specified in an approval of registration or certificate of coverage issued pursuant to this general permit, be to the Remediation Division of the Bureau of Water Protection and Land Reuse at:

Phone Number: 860-424-3705 or

Telefax Number: 860-424-4057.

If notification is the result of a condition that poses a risk to human health or imminent impact to the environment, or results in a prohibited activity as defined in subsection 5(a)(11)(A), notification shall also be made to the DEEP Emergency Response Unit at (860) 424-3338 unless directed by Remediation Staff that such notification is not required.

- (2) Notifications or reports required pursuant to this general permit Section or any approval, including required follow-up written notifications (which may include notification by electronic means as may be prescribed by the commissioner), shall be submitted to:

COORDINATOR – IN SITU REMEDIATION
REMEDATION DIVISION – BUREAU OF WATER PROTECTION AND LAND REUSE
CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5027.

- (3) The department shall be notified within twenty-four (24) hours if field monitoring required pursuant to this general permit is not conducted at the specified time. If such notification is by telephone, a follow-up written notification shall be submitted within forty-eight (48) hours.

- (4) Written notifications and associated reports required by this general permit shall, unless otherwise specified by the commissioner, be in letter form and include, but not be limited to: the permittee name, department assigned permit identification numbers, site name, site location, street address, town, and date of certificate of coverage or approval of registration, if such certificate or approval was issued; monitoring location triggering notification or report, date(s) of sampling and analysis, monitored constituent(s) triggering notification or report, and reported concentration(s); a summary of any response action taken or planned; and the name and telephone number of a person the department may contact for further information.
- (5) **Supply Well Polluted Above Standards**
- (A) If post-baseline monitoring of any water supply well detects any constituents, not already identified as present at similar levels by baseline monitoring, above the standards in Appendix C to sections 22a-133k-1 to 3 of the Regulations of Connecticut State Agencies, above a maximum contaminant level applicable to public water supply systems for any contaminant listed in section 19-13-B102 of the Public Health Code, or above contaminant levels listed on the state drinking water action level list established pursuant to section 22a-471 of the Connecticut General Statutes, the permittee shall, within twenty-four (24) hours of receipt of the analytical results by the permittee or the permittee's consultant or engineer, verbally notify the department. The permittee shall also, within twenty-four (24) hours, provide written notification to the department, the owner of record of the property upon which any such water supply well is located, at least one occupant of each dwelling unit or business obtaining drinking water from such water supply well (except for community water supply systems), the local director of public health, and, if the affected well is a public water supply well, the Department of Public Health and the water system operator.
- (B) The permittee shall also, within forty-eight (48) hours, provide bottled water or another alternative supply of potable water, except for community water supply systems, and shall resample the affected supply well, and any other wells as may be required by the commissioner. The permittee shall, within five (5) days, provide to the department for review and approval a follow-up written report of the initial mitigation actions with recommendations for further actions. Any such additional proposed mitigation measures shall be implemented not later than seven (7) days after approval by the commissioner.
- (C) The requirements of subsection 5(d)(5)(A) of the general permit apply to the results of baseline monitoring of water supply wells when such baseline monitoring determines that a well is polluted above the comparison criteria and such pollution has not previously been reported to the department.
- (D) When permit-required monitoring of a community public water supply system results in a notification under the requirements of subsection 5(d)(5)(A) of the general permit, within twenty-four (24) hours the permittee shall consult with the operator of the public water supply system and the Department of Public Health to identify any additional response or notification necessary, and immediately implement such response and notification in coordination with these parties. The permittee shall, within five (5) days, provide to the department for review and approval a follow-up written report of such response and notification actions with recommendations for further actions. Any such additional recommended measures shall be implemented as directed by the commissioner and not later than seven (7) days after approval by the commissioner.

(6) **Supply Well Affected**

If post-baseline monitoring of a water supply well detects any monitored chemical constituents above three times the analytical reporting limit or, if higher, twenty-five percent (25%) greater than any established baseline condition for the water supply well (or greater than 10 ug/l if the measured baseline is less than 20 ug/l), such detection or increase shall, unless documented to be reasonably explained by the variability of groundwater quality described in the monitoring plan or otherwise specified by the commissioner in writing, be reported in writing to the department within seven (7) days of receipt of the analytical results by the permittee or the permittee's consultant or engineer.

The permittee shall, within fourteen (14) days after determining the presence of such detection or increase that requires notification, resample any supply well so affected to confirm the detection or increase, and shall report such resampling results to the department within five (5) days of receipt of the analytical results by the permittee or the permittee's consultant or engineer. If such resampling confirms the supply well is affected, the report shall also include recommendations for further actions, or an explanation why no further actions are necessary, for the review and approval of the commissioner. Any such recommended actions shall be implemented not later than seven (7) days after approval by the commissioner.

The requirements of this section apply to results of baseline monitoring of water supply wells when such baseline monitoring determines that a well is polluted by organic chemical constituents above three times the analytical reporting limit or by naturally occurring chemical constituents above the greater of three times the expectable background concentration, three times the analytical reporting limit, or fifty percent (50%) of established water criteria identified in section 5(d)(5)(A) of this general permit and such pollution has not previously been reported to the department.

(7) **Field Parameter Results Show Change Outside the Zone of Influence**

If post-baseline monitoring of discharge monitoring wells outside the zone of influence determines there is: a substantial change in oxidation reduction potential (Eh greater than 100 mv change from baseline conditions), a change in pH of more than two (2) standard units (in comparison to baseline conditions), or a change in water level of two feet that is not associated with a site-wide water level trend exhibited in other monitoring wells, such change, unless documented to be reasonably explained by the variability of groundwater quality described in the monitoring plan, shall be reported verbally to the department within forty-eight (48) hours of field sampling. Also, a confirmation sample shall be obtained within forty-eight (48) hours at the location exhibiting the change that requires notification, and, if the field condition is confirmed and a sample for chemical analysis was not taken during the triggering monitoring event, a sample shall also be taken for the chemical analyses specified in the project-specific monitoring parameter list.

(8) **Chemical Monitoring Results Show Change Outside the Zone of Influence**

If post-baseline monitoring of discharge monitoring wells outside the zone of influence determines there is an increase in the concentration of: any discharged substance being monitored, an increase in any monitored project-specific constituent of concern, or an increase in any inorganic or organic chemical greater than twenty-five percent (25%) over baseline conditions (or greater than 10 ug/l if the measured baseline is less than 20 ug/l or not detected); or, for a site in an area where water supply wells are present within 500 feet downgradient or 200 feet in any direction, or the groundwater classification is

GA or GAA, any detection of such parameters above standards in appendix C to sections 22a-133k-1 to 3 of the Regulations of Connecticut State Agencies, such increase or detection shall, unless documented to be reasonably explained by the variability of groundwater quality described in the monitoring plan or otherwise specified by the commissioner in writing, be reported verbally to the department within forty-eight (48) hours of receipt of the analytical results by the permittee or the permittee's consultant or engineer.

(9) **Other Notifications**

If monitoring of authorized activities determines the limits specified in Section 5(a)(10) of this general permit have been exceeded, or if monitoring determines that surface water, indoor air quality, or other monitored receptors, including storm-water management drains, are impacted by the authorized discharge, or if activity monitoring within the area of authorized activity and zone of influence determines the limits specified in Section 5(a)(10) of this general permit or the zone of influence identified in the registration may become exceeded or a potable water supply well or other receptor may become affected with continued discharge, the discharge, if active, shall immediately be discontinued and, within two (2) hours after this determination, the commissioner shall be verbally notified of this determination and action.

The commissioner shall be notified immediately if there is an uncontrolled release of the substance being discharged, or if conditions indicate the need to implement contingency measures in the work plan intended to protect human health or the environment.

(10) **Response Actions for Notifications**

If the permittee determines that notification to the commissioner of a condition pursuant to sections 5(d)(7) through 5(d)(9) of this general permit is necessary, the permittee shall immediately implement appropriate contingent measures as described in the work plan and take any other actions necessary to limit migration of pollutants or specified by the commissioner in response to such notification. The permittee shall, within five (5) days of the initial notification, provide follow-up written notification to the department, including a summary of the monitoring data and the initial actions taken, or an explanation why no actions were necessary, in accordance with Section 6(e) of this general permit. The permittee or the permittee's consultant or engineer shall, within fourteen (14) days of such determination, submit to the commissioner for review and approval a written evaluation of the condition with recommended changes to the work plan and additional measures to assess, monitor, and mitigate impact beyond the authorized zone of influence, or an evaluation determining that no work plan changes or additional measures are necessary. If no actions are necessary, this evaluation and report may be combined with the written notification submitted within five days. Any such additional mitigation measures shall be implemented not later than seven (7) days after approval by the commissioner.

(11) Notifications and reports required by Sections 5(d)(5), 5(d)(6), 5(d)(8), and 5(d)(10) of this general permit may, as applicable, be identified as notifications or other submittals required under section 22a-6u of the Connecticut General Statutes. They shall not meet the requirements of section 22a-6u of the Connecticut General Statutes unless they are specifically so identified and meet all requirements of section 22a-6u of the Connecticut General Statutes regarding notifying party and notification, plan, or report content.

(12) Reports of discharges, spills, or other releases shall independently be made as required pursuant to section 22a-450 of the Connecticut General Statutes and all associated regulations.

(e) ***No Remediation Assurance***

No provision of this general permit and no action or inaction by the commissioner shall be construed to constitute an assurance by the commissioner that any actions taken pursuant to this general permit will achieve remediation goals, result in compliance, or prevent or abate pollution; that monitoring approved for compliance with the requirements of this general permit will be sufficient to demonstrate that a release at a site has been remediated; or that monitoring results from wells located within the zone of influence will be accepted as representative samples for other uses of the monitoring data.

(f) ***No Product Endorsement***

No mention in Appendix I of this general permit, and no action or inaction by the commissioner, shall be construed to constitute an endorsement of specific brand-named, trademarked or proprietary chemicals or processes or a certification of their performance or full effectiveness and appropriateness for achieving the specific remediation goals of a proposed project.

Section 6. General Conditions

(a) ***Prevention of Pollution***

- (1) All substance handling and other implementation activities associated with the authorized discharge shall be conducted following best management practices.
- (2) Best management practices shall be implemented to ensure that no litter, debris, building materials or similar materials are discharged to the waters of the state or to the ground.
- (3) If activities authorized by this general permit create a potential for pollution due to the tracking or erosion of soil, erosion and sediment control measures shall be installed and maintained in compliance with the standards set forth in the “2002 Connecticut Guidelines for Soil Erosion and Sediment Control”, as revised, established pursuant to section 22a-328 of the Connecticut General Statutes.
- (4) All monitoring and discharge wells used or installed for the purpose of conducting activities under this general permit shall be properly abandoned in accordance with prevailing standards and guidelines and applicable State requirements when their use, including use for activities other than those conducted pursuant to this general permit, is no longer necessary.

(b) ***Waste Management***

Solid waste, including but not limited to contaminated soils or sludges, that may be generated as a result of the activities authorized by this general permit must be disposed of in accordance with applicable federal, state, and local law. Some or all of these wastes may be hazardous waste identified in accordance with Section 3001 of the Federal Resource Conservation and Recovery Act of 1976 (42 USC 6901 et seq.) or other wastes of special concern requiring department approval prior to disposal. It is the responsibility of the permittee to ensure that all wastes generated are properly identified and that all necessary department approvals are secured prior to disposal of such wastes.

(c) ***Regulations of Connecticut State Agencies Incorporated into this General Permit***

The permittee shall comply with all applicable law, including without limitation the following Regulations of Connecticut State Agencies:

- (1) **Section 22a-430-3**
 - Subsection (b) General
 - subparagraph (1)(D) and subdivisions (2), (3), (4) and (5)
 - Subsection (c) Inspection and entry
 - Subsection (d) Effect of a permit
 - subdivisions (1) and (4)
 - Subsection (e) Duty to comply
 - Subsection (f) Proper operation and maintenance
 - Subsection (g) Sludge disposal
 - Subsection (h) Duty to mitigate
 - Subsection (i) Facility modifications; notification
 - subdivisions (1) and (4)
 - Subsection (j) Monitoring, records and reporting requirements
 - subdivisions (1), (5), (6), (8), (9), and (11)
 - (except subparagraphs (9)(A)(10 and 11), (9)(B), (9)(C), and 11(B))
 - Subsection (n) Enforcement
 - Subsection (o) Resource conservation
 - Subsection (p) Spill prevention and control
 - Subsection (q) Instrumentation, alarms, flow recorders
- (2) **Section 22a-430-4**
 - Subsection (p) Permit revocation, denial or modification
 - Appendices
- (3) **Section 22a-430-8**
 - Subsection (c) (regarding Class V injection wells)
 - Subsection (e) (regarding underground sources of drinking water)

(d) ***Reliance on Registration***

In evaluating a registration, the commissioner relies on information provided by the registrant. If such information proves to be false or incomplete, an authorization pursuant to this general permit may be suspended or revoked in accordance with law, and the commissioner may take any other legal action provided by law.

(e) ***Duty to Correct and Report Violations***

Upon learning of a violation of a condition of this general permit, a permittee shall immediately take all reasonable action to determine the cause of such violation, correct such violation and mitigate its results, prevent further such violation, and report in writing such violation and such corrective action to the commissioner within five (5) days of the permittee's learning of such violation. Such report shall be certified in accordance with Section 6(g) of this general permit.

(f) ***Duty to Provide Information***

If the commissioner requests any information pertinent to the authorized activities or to determine compliance with this general permit or with any approval of registration pursuant to this general permit, the permittee shall provide such information in writing within thirty (30) days of such request. Such information shall be certified in accordance with Section 6(g) of this general permit.

(g) ***Certification of Documents***

Any document, including but not limited to any notice, which is submitted to the commissioner under this general permit shall be signed by, as applicable, the registrant or the permittee in accordance with section 22a-430-3(b)(2) of the Regulations of Connecticut State Agencies, and

by the individual or individuals responsible for actually preparing such document, each of whom shall certify in writing as follows:

“I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement made in the submitted information may be punishable as a criminal offense, in accordance with section 22a-6 of the Connecticut General Statutes, pursuant to section 53a-157b of the Connecticut General Statutes, and in accordance with any other applicable statute.”

(h) *Dates of Filing, Deadlines and Actions*

For purposes of this general permit, the date of filing with the commissioner of any document is the date such document is received by the commissioner. If any date specified in this general permit falls on a Saturday, Sunday, or legal holiday, such deadline shall be the next business day thereafter. The date of any notice by the Commissioner under this general permit, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is personally delivered or the date three days after it is mailed by the Commissioner, whichever is earlier.

(i) *False Statements*

Any false statement in any information submitted pursuant to this general permit may be punishable as a criminal offense, under section 22a-438 of the Connecticut General Statutes or, in accordance with section 22a-6 of the Connecticut General Statutes, pursuant to section 53a-157b of the Connecticut General Statutes, and in accordance with any other applicable statute.

(j) *Correction of Inaccuracies*

Within fifteen (15) days after the date a permittee becomes aware of a change in any of the information submitted pursuant to this general permit, or becomes aware that any such information is inaccurate or misleading, or that any relevant information has been omitted, such permittee shall correct the inaccurate or misleading information or supply the omitted information in writing to the commissioner. Such information shall be certified in accordance with Section 6(g) of this general permit. The provisions of this subsection shall apply both while a request for authorization under this general permit is pending and after such authorization becomes effective pursuant to Section 3(e) of this general permit.

(k) *Transfer of Authorization*

An authorization under this general permit is transferable only in accordance with the provisions of section 22a-60 of the Connecticut General Statutes.

(l) *Other Applicable Law*

Nothing in this general permit shall relieve the permittee of the obligation to comply with any other applicable federal, state, and local law, including but not limited to the obligation to obtain any other authorizations required by such law.

(m) *Other Rights*

This general permit is subject to and does not derogate any present or future rights or powers of the State of Connecticut and conveys no rights in real or personal property nor any exclusive privileges, and is subject to all public and private rights and to any federal, state, and local laws

pertinent to the property or activity affected by such general permit. In conducting any activity authorized hereunder, the permittee may not cause pollution, impairment, or destruction of the air, water, or other natural resources of this state. The issuance of this general permit shall not create any presumption that this general permit should or will be renewed.

Section 7. Commissioner's Powers

(a) *Abatement of Violations*

The commissioner may take any action provided by law to abate a violation of this general permit, including the commencement of proceedings to collect penalties for such violation. The commissioner may, by summary proceedings or otherwise and for any reason provided by law, including violation of this general permit, revoke a permittee's authorization hereunder in accordance with sections 22a-3a-2 through 22a-3a-6, inclusive, of the Regulations of Connecticut State Agencies. Nothing herein shall be construed to affect any remedy available to the commissioner by law.

(b) *General Permit Revocation, Suspension, or Modification*

The commissioner may, for any reason provided by law, by summary proceedings or otherwise, revoke or suspend this general permit or modify it to establish any appropriate conditions, schedules of compliance, or other provisions which may be necessary to protect human health or the environment.

(c) *Filing of an Individual Permit Application*

If the commissioner notifies a permittee in writing that such permittee must obtain an individual permit to continue lawfully conducting the activity authorized by this general permit, the permittee may continue conducting such activity only if the permittee files an application for an individual permit within sixty (60) days of receiving the commissioner's notice. While such application is pending before the commissioner, the permittee shall comply with the terms and conditions of this general permit and also those specified in any approval of registration. Nothing herein shall affect the commissioner's power to revoke a permittee's authorization under this general permit at any time.

Issued: 6/30/2014

MACKY MCCLEARY
Macky McCleary, Deputy Commissioner

This is a true and accurate copy of the general permit executed on June 30, 2014 by the Deputy Commissioner of the Department of Energy and Environmental Protection.

General Permit for
In Situ Remediation: Chemical Oxidation

Appendix I
Chemical-Specific Technical Specifications

Issued: June 30, 2014

General Permit for In Situ Remediation: Chemical Oxidation

Appendix I Chemical-Specific Technical Specifications

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COMBINED TECHNOLOGIES

Combinations of two in situ oxidation remedial technologies must ensure the specific requirements for each technology are addressed.

In addition, the registration work plan must evaluate unique issues associated with using two technologies, and identify any specific design considerations that are due to the combined effects of using two technologies. Such an evaluation may be different if the technologies are used simultaneously or sequentially and is highly dependent on the pollutants and site conditions and the technologies selected. A registration for a combined technology remediation may be evaluated on a site specific basis for approval.

Common combinations of in situ oxidation technologies are:

- Persulfate combined with or activated by Metal Peroxide
- Persulfate combined with or activated by Hydrogen Peroxide
- Ozone combined with Hydrogen Peroxide
- At least one vendor may combine ozone, hydrogen peroxide, and persulfate

Several vendors may select from several oxidants and other additives, alone or in combination, using a proprietary methodology that depends on the specifics of the job. It is incumbent on the applicant to explicitly identify all substances that will be in the discharge actually proposed for the site and address the specific requirements for each substance in the registration. Additional information is required in the registration if the substances are not included in this appendix, as provided in section 4(c)(3) of the general permit.

In some cases a remediation may initially use in-situ oxidation to remove a significant mass of pollutant from a source area and then follow this with an enhanced biological remediation technology or monitored natural attenuation.

- Aerobic degradation is a compatible technology, and the department has a general permit that separately may be used to authorize a continuing addition of oxygen to enhance biodegradation.
- Anaerobic degradation or co-metabolism is a technology that depends on an absence of oxygen, and the prior use of in situ chemical oxidation as an initial pollutant mass reduction phase may increase the substrate required to establish favorable anaerobic conditions. The department recommends a careful review of oxidant dosage to limit excess oxygen, and a careful design of the sequence timing for this suite of successive remedial technologies. Such an evaluation will be necessary to support a subsequent application for a permit to discharge substrate or other compounds to enhance anaerobic degradation.
- High oxidant levels in an aquifer can temporarily suppress bacterial populations and thus affect the timeframe for establishment of sustainable biological degradation, but rarely are wide volumes of an aquifer sterilized. The suppression must be taken into account when estimating the timeline for enhanced biodegradation or monitored natural attenuation.

PERMANGANATES

Substances

- Sodium [NaMnO₄] or potassium [KMnO₄] permanganate
- Researchers have added surfactants or chelants or adjusted pH (see “Ancillary Substances”).

Applicability

- Can be effective on organic chemicals that contain double carbon bonds, such as ethylenes; ineffective on TCA and often ineffective on benzene and PCBs.
- Persistent, and thus sometimes used in low permeable horizons, and in fractured bedrock.
- Potassium permanganate has been used as a solid or slurry to treat vadose zone soil.

Characterization Requirements (chemical specific)

- Natural Oxidant Demand (NOD) must be evaluated to design dosage.
- The potential for mobilization, from both co-disposed material and the aquifer matrix, of metals, notably aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, and selenium, must be evaluated, both due to oxidation and pH changes (manganese mobilization is minimal in comparison to the manganese introduced).
- Aquifer buffering capacity should also be evaluated as it can affect reactivity and attenuation of pH effects.
- Manganese dioxide in the aquifer matrix may affect decomposition rate and should be considered when characterizing the aquifer.
- Baseline manganese and metals concentrations must be established.

Design Requirements (chemical specific)

- Higher concentrations of sodium permanganate can be designed to incorporate density driven distribution within the aquifer, and, if so, the specifics of this design must be described.
- Dosage for subsequent phases must incorporate an adjustment for first phase depletion of NOD.
- Use of a single high dosage rather than lower iterative repeat dosages may bring higher risk of displacement of pollution beyond the existing plume limit, and may mobilize more metals or have higher potential to migrate on preferential pathways; and these issues must be evaluated.
- High dosage amount in conjunction with high pollutant concentration may result in a significant exothermic reaction and this potential must be evaluated if applicable due to site conditions.
- Evaluate significance of potential clogging of aquifer or coating of NAPL residuals by manganese oxide precipitate, especially if a heterogeneous aquifer could foster non-uniform deposition.
- Evaluate significance of potential issues associated with ion substitution on cation exchange sites in the aquifer matrix.
- Consider potential screen clogging in injection wells by residual solids (undissolved chemical or silica) if potassium permanganate is injected, and what corrective measures may need to be undertaken; ensure the work plan incorporates details of any expected restoration treatments.
- In determining appropriateness include evaluation of significance of potential adverse effects on effectiveness of bioremediation as a polishing step, especially for anaerobic degradation due to potential inhibition of *Dehalococcoides* species.
- Persistence of chemical activity can lead to high radius of influence in permeable formations or fractured bedrock, and this must be taken into account in determining ZOI.

Operational Requirements (chemical specific)

- Applicability of Federal security requirements (6 CFR Part 27) must be evaluated for higher potassium permanganate volumes.
- Potassium permanganate requires consideration for dust management during mixing.

Discharge Limit (chemical specific)

- Mercury must not be present in the discharged solution at any level above 0.4 ug/l.

Monitoring Requirements (chemical specific)

- Colorimetric analysis may be added as a field parameter to indicate extent of discharge.
- pH is a required field monitoring parameter, and monitoring must continue until post-remediation pH is within two standard units of the pre-discharge conditions at all locations.
- Commercial grade permanganates may contain associated heavy metals, especially arsenic, chromium, cadmium, lead, and mercury; the absence of heavy metals must be confirmed or they must be monitored:
 - Monitoring of metals (other than those with monitoring required due to potential mobilization by the discharge) is not needed if the discharged solution is tested and contains concentrations less than the lower of the groundwater protection criterion or surface water protection criterion established in the remediation standard regulations;
 - A manufacturer's certification of metals concentration, if reported with appropriate detection limits, may be used as a basis for calculating a solution concentration based on the dilution specified in the work plan.
- Metals from the aquifer matrix, or from co-disposed wastes that contain heavy metals, may be mobilized by changes in pH, or redox state for multivalent metals; the mobilization potential must be evaluated through the conceptual site model, and often by using a bench scale test on aquifer material. Monitoring is required for a metal if evaluation determines it can be mobilized by aquifer conditions resulting from the discharge or if bench scale or field testing results show it exceeds one half of the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations.
- Monitored metals must be less than the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations, or pre-discharge background if higher, at all monitored locations for four quarters after discharge termination before monitoring pursuant to this permit may be terminated.
- Monitoring of drinking water supply wells must include color, sodium or potassium as appropriate for the discharge, manganese, and any metals for which the discharge exceeds twice the groundwater protection criteria; the tabulated class GA performance criteria or class GA groundwater protection criteria apply for evaluation of results, even in class GB locations.
- For substances in the following table, that do not have adopted RSR criteria for groundwater and surface water protection, monitoring is required, the zone of influence exists, and permit requirements remain in effect, until within-ZOI post-remedial conditions at all monitored locations are less than the tabulated performance criteria or pre-discharge background, whichever is higher, for four quarters:

Chemical	Performance criteria
Chloride (if chlorinated solvents present)	Class GA 250 mg/l; Class GB 860 mg/l
Aluminum (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.75 mg/l
Iron (if mobilization potential)	Class GA 0.3 mg/l; Class GB 3.0 mg/l
Manganese (dissolved)	Class GA 0.05 mg/l; Class GB 0.5 mg/l
Potassium (if component of discharge)*	Class GA 250 mg/l; Class GB 2500 mg/l
Sodium (if component of discharge)*	Class GA 20 mg/l; Class GB 200 mg/l
Total Dissolved Solids (TDS) (if used as non-target indicator parameter)	Class GA shall use 500 mg/l as a maximum value to trigger further evaluation
Color	Class GA 15 color units; class GB same

* monitoring not required if discharged concentration is below applicable performance criterion

HYDROGEN PEROXIDE

Fenton's reagent uses hydrogen peroxide catalyzed by iron under acidic conditions to generate hydroxyl radicals that are powerful oxidants; "Modified" Fenton-type systems use pH-neutral or basic conditions along with hydrogen or metal peroxides and metallic or organo-metallic catalysts.

Substances

- Usually 8-20% H₂O₂ and 92-80% water.
- May have a tin, organic, or phosphate based stabilizer or inhibitor, often proprietary, to increase persistence and therefore distribution. (see also "Ancillary Substances")
- May include acidification to a pH of 2-4 using HCl, H₂SO₄, acetic or other acid.
- May be catalyzed by addition of iron, which may be chelated using a variety of complexing agents including carboxyl groups of inorganic acids (oxalic, citric), EDTA (ethylenediamine tetra-acetic acid), NTA (nitrilotriacetic acid), STPP (sodium tripolyphosphate), or HEDPA (hydroxide ethidene dual phosphoric acid) see also "Ancillary Substances".
- Ferrous sulfate [FeSO₄] may be used to introduce both iron and acidity.
- May be combined with ozone injection; if so, see also "Ozone" and "Combined Technologies".
- May be used as an activator for persulfate injection; if so, see also "Persulfate" and "Combined Technologies".

Applicability

- Applicable to oxidation of a wide range of pollutants, although may not be appropriate for sites with large amounts of petroleum NAPL without careful design for safety.
- Exothermic reaction fosters heat generation which aids in mobilizing volatile organic compounds and highly viscous organic substances for capture in active or passive recovery systems.
- High reactivity and short persistence time is a disadvantage for use of this chemistry to address pollution trapped in low-permeability zones; however use of metal peroxides in a modified Fenton's reaction may be a consideration.

Characterization Requirement (chemical specific)

- Baseline iron and alkalinity must be determined to design dosage.
- Areas of concentrated NAPL, especially if flammable petroleum, must be determined to ensure they are considered in design.
- Any areas of petroleum management infrastructure, including underground lines, that are within the ZOI must be documented to ensure design can be protective.
- Subsurface infrastructure that may be sensitive to elevated temperatures must be documented to ensure design can be protective. (PVC may begin to lose integrity above 140°F (60°C).)
- Subsurface utilities, basements and other spaces that may be vapor collection points must be documented for consideration in design.
- Preferential pathways for gas migration must be identified.
- The potential for mobilization, from both co-disposed material and the aquifer matrix, of metals, notably aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, and selenium, must be evaluated, both due to oxidation and any pH changes that occur.

Design Requirements (chemical specific)

- Exothermic reaction with significant gas and steam generation and volume increase which must be considered in design to ensure protection of site infrastructure.
- Acidity associated with the classic Fenton's reaction may also affect infrastructure and requires evaluation.
- Design must evaluate potential aquifer clogging by iron precipitates, or transient evolved gas.

- Temperature effects and gas pressure may cause volatiles to migrate. Vapor control must be included or a specific evaluation of why it is not needed must be provided.
- Pressures and volumes may cause groundwater to mound or migrate outward; injection design must minimize potential spread of pollution or groundwater controls must be included.
- Thermal effects may mobilize highly viscous organic substances, and the design must evaluate such mobilization and incorporate design for contemporaneously operated physical capture or control systems for such migration as necessary to protect human health and the environment.
- Concentration greater than 12 ½ % or combined with ozone is subject to full DEEP review and approval of the registration.

“When higher concentrations of hydrogen peroxide are used, the exothermic decomposition of the peroxide generates heat, water vapor, and oxygen that tend to volatilize contaminants from the soil and/or groundwater. This rapid decomposition reaction could foreseeably create an explosive condition if used for treatment of flammable or combustible compounds due to the resulting mixture of heat, oxygen, and flammable compound. EPA has advised caution before approving the use of hydrogen peroxide for in situ chemical oxidation of flammable compounds such as for gasoline remediation.” ITRC, 2005, *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*, Second Edition, page 34.

Operational Requirements (chemical specific)

- Work plan must incorporate trigger values and contingency provisions to identify and respond to excessive temperatures and pressures and their effects that may develop during injection.
- Peroxide is a dangerous oxidant, especially at higher concentrations, and onsite handling must be carefully designed and operated to ensure no fire or explosion risk is created; it is recommended that the local fire marshal be consulted.
- Applicability of enhanced Federal security requirements (6 CFR Part 27) must be evaluated, especially for higher concentrations or volumes of feedstock chemicals.
- It is recommended that the work plan define a decision path for determining when active vapor control or groundwater control may be discontinued.

Monitoring Requirements (chemical specific)

- Increases in pressure, temperature, and gas generation must be monitored in real time during active injection, especially initially, and used to adjust application rate to ensure there is no excessive reaction or gas generation.
- Oxidizing gasses must be monitored in the area above active injection, especially if no vapor control is used, to ensure there is no excessive oxygen buildup.
- Oxidizing gasses, explosive volatile gasses, and LEL must be monitored in nearby enclosed spaces and utility vaults to ensure there is no explosion risk; real time monitoring using PID/FID and explosimeter is recommended during the initial active injection phase, especially if there is no vapor control system.
- Monitoring must include explicit design to ensure it can detect any volatile pollution migration driven by pressure or temperature effects, or associated with migration of evolved gasses.
- If a vapor control system is installed its effectiveness must be periodically evaluated and its discharge must be monitored, permitted and treated as necessary.
- If a groundwater control system is installed its effectiveness must be periodically evaluated; and its discharge must be permitted as a remediation groundwater discharge, and monitored and treated as necessary.

- Metals from the aquifer matrix, or from co-disposed wastes that contain heavy metals, may be mobilized by changes in pH, or redox state for multivalent metals; the mobilization potential must be evaluated through the conceptual site model, and often by using a bench scale test on aquifer material. Monitoring is required for a metal if evaluation determines it can be mobilized by aquifer conditions resulting from the discharge or if bench scale or field testing results show it exceeds one half of the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations.
- Monitored metals must be less than the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations, or pre-discharge background if higher, at all monitored locations for four quarters after discharge termination before monitoring pursuant to this permit may be terminated.
- pH is a required field monitoring parameter, and monitoring must continue until post-remediation pH is within two standard units of the pre-discharge conditions at all locations.
- Monitoring for the anion associated with any inorganic pH lowering chemicals is required. (See “Ancillary Substances” if organic acids are used for pH adjustment.)
- Monitoring for iron is required if natural iron levels are supplemented.
- Sulfate monitoring is required if ferrous sulfate or sulfuric acid are components of the discharge.
- If a stabilizer or inhibitor containing tin or phosphorous is used, monitoring is required for tin or phosphate respectively unless the injected solution is determined, by analysis or by review of manufacturer specifications coupled with dilution rates specified in the work plan, to have an initial concentration that is below the tabulated performance criterion. (See “Ancillary Substances” if organic stabilizers are used.)
- Monitoring of drinking water supply wells must include volatile organic compounds associated with the target pollutant, iron, and, if sulfate is discharged, sulfate; tabulated class GA performance criteria or class GA groundwater protection criteria apply for evaluation of results, even in class GB locations.
- For substances in the following table, that do not have adopted RSR criteria for groundwater and surface water protection, monitoring is required, the zone of influence exists, and permit requirements remain in effect, until within-ZOI post-remedial conditions at all monitored locations are less than the tabulated performance criteria, or pre-discharge background, whichever is higher, for four quarters:

Chemical	Performance criteria
Chloride (if chlorinated solvents present) or (if a component of discharge*)	Class GA 250 mg/l; Class GB 860 mg/l
Sulfate (if component of discharge)*	Class GA 250 mg/l; Class GB 500 mg/l
Aluminum (if mobilization potential)	Class GA 0.05 mg/l; class GB 0.75 mg/l
Iron	Class GA 0.3 mg/l; Class GB 3.0 mg/l
Manganese	Class GA 0.05 mg/l; Class GB 0.5 mg/l
Tin (if component of discharge)*	0.180 mg/l
Phosphate (if component of discharge)*	0.1 mg/l as total P
Total Dissolved Solids (TDS) (if used as non-target indicator parameter)	Class GA shall use 500 mg/l as a maximum value to trigger further evaluation

* monitoring not required if discharged concentration below applicable performance criterion

OZONE

Substances

- Ozone [O₃]; may be mixed with oxygen or air, or delivered dissolved in water.
- May be applied in an elevated pH environment to increase hydroxyl radical creation; with the pH established through introduction of sodium or potassium hydroxides [NaOH or KOH].
- If combined with hydrogen peroxide see “Hydrogen Peroxide” and “Combined Technologies”.

Applicability

- Potentially treats a wide range of pollutants. Reaction rates are low for some pollutants, including chlorinated ethylenes and benzene, and can limit effectiveness.
- Usually applied as a gas, typically at less than 12 percent concentration in a gas stream (either air or oxygen), or dissolved in water, at up to 30mg/l.
- May be used in unsaturated soil or in sparging applications, where mass transfer and gas transport complement oxidative destruction.

Characterization Requirement (chemical specific)

- Natural Oxidant Demand for ozone must be determined to design dosage.
- The potential for short circuiting and preferential pathways must be evaluated.
- Soil gas permeability and moisture content are necessary characterization elements.
- Permeability of soil should be evaluated to ensure that highly reactive ozone will not be depleted before diffusion to target zone is achieved.
- The potential for mobilization, from both co-disposed material and the aquifer matrix, of metals, notably aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, magnesium and selenium, must be evaluated, due to oxidation, and, if applicable, pH modifications.

Design Requirements (chemical specific)

- Very reactive in subsurface, but may not completely react before it outgases to the surface or enclosed spaces, and design must address this possibility.
- Temperature effects and gas pressure may cause volatiles to migrate. Vapor control must be included or a specific evaluation of why it is not needed must be provided.
- Sparging or reactive pressures may cause groundwater to migrate outward; injection design and sequencing must minimize potential spread of pollution or a groundwater control system design that takes into account the effects of injected and evolved gasses must be included.
- SVE systems must be designed to ensure they do not release residual ozone.
- The O₃ concentration in the injected gas stream, the gas composition (air or oxygen) and flow rate, and the injection pressures must be included when specifying the O₃ mass delivery rate.
- Design must include evaluation of potential short circuiting.
- Determination of soil permeability, moisture content, and NOD as ozone must be considered in design; and natural radical scavengers may affect effectiveness of treatment and should be also evaluated in developing the design.
- Evaluate significance of potential issues associated with ion substitution on cation exchange sites in the aquifer matrix if pH is adjusted with hydroxides.
- Concentration greater than 7% ozone or combined with hydrogen peroxide is subject to full DEEP review and approval of the registration.

Operational Requirements (chemical specific)

- If pulsed delivery is to be used it must be clearly described in detail in the application work plan.
- Onsite ozone generation and gaseous oxygen handling must be carefully designed and operated to ensure no oxidizer buildup occurs; it is recommended that the local fire marshal be consulted

- Local permits may be necessary if oxygen will be housed in a structure.
- It is recommended that the work plan define a decision path for determining when active vapor control or groundwater control may be discontinued.

Monitoring Requirements (chemical specific)

- Pressure and temperature must be monitored in real time during active injection, especially initially, and used to adjust application rate to avoid excessive reaction or gas generation.
- Oxidizing gasses must be monitored in the area above active injection, especially if no vapor control is used, to ensure there is no excessive oxidizer buildup.
- Oxidizing gasses and LEL must be monitored in nearby enclosed spaces and utility vaults to ensure there is no adverse impact.
- Monitoring must include explicit design to ensure detection of any volatile pollutant vapor migration driven by pressure or temperature effects, gas evolution or gas flow transport.
- If a vapor control system is installed its effectiveness must be periodically evaluated; and its discharge must be monitored, permitted, and treated as necessary.
- Monitoring must include explicit design to ensure it can detect any groundwater pollution migration driven by sparging or reactive pressure or their effects on groundwater levels.
- If a groundwater control system is installed its effectiveness must be periodically evaluated; and its discharge must be permitted, monitored and treated as necessary.
- Monitoring must be designed to determine if any short circuiting of gas flow occurs.
- Metals from the aquifer matrix, or from co-disposed wastes that contain heavy metals, may be mobilized by changes in pH, or redox state for multivalent metals; the mobilization potential must be evaluated through the conceptual site model, and often by using a bench scale test on aquifer material. Monitoring is required for a metal if evaluation determines it can be mobilized by aquifer conditions resulting from the discharge or if bench scale or field testing results show it exceeds one half of the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations.
- Monitored metals must be less than the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations, or pre-discharge background if higher, at all monitored locations for four quarters after discharge termination before monitoring pursuant to this permit may be terminated.
- Monitoring must include cations associated with any inorganic pH-increasing additives.
- Monitoring of drinking water supply wells must include volatile organic chemicals associated with the target pollutant.
- For substances in the following table, that do not have adopted RSR criteria for groundwater and surface water protection, monitoring is required, the zone of influence exists, and permit requirements remain in effect, until within-ZOI post-remedial conditions at all monitored locations are less than the tabulated performance criteria, or pre-discharge background, whichever is higher, for four quarters:

Chemical	Performance criteria
Chloride (if chlorinated solvents present)	Class GA 250 mg/l; Class GB 860 mg/l
Aluminum (if mobilization potential)	Class GA 0.05 mg/l; class GB 0.75 mg/l
Iron (if mobilization potential)	Class GA 0.3 mg/l; Class GB 3.0 mg/l
Manganese (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.5 mg/l
Potassium (if component of discharge)*	Class GA 250 mg/l; Class GB 2500 mg/l
Sodium (if component of discharge)*	Class GA 20 mg/l; Class GB 200 mg/l

* monitoring not required if discharged concentration is below applicable performance criterion

PERSULFATE

Substances

- Ionic persulfate salts, usually sodium persulfate [NaS₂O₈] (potassium salt is relatively insoluble and ammonium salt produces byproduct ammonia).
- Activation strategies include use of heat, ultraviolet light, H₂O₂, elevated pH, or metals.
- pH based activation may be achieved by adding lime, or sodium or potassium hydroxide.
- Natural or added iron is a common activator, but other metals also can cause activation.
- To increase iron persistence in solution the system may be acidified or more commonly the iron may be chelated using a variety of complexing agents including carboxyl groups of inorganic acids (oxalic, citric), EDTA (ethylenediamine tetra-acetic acid), NTA (nitrilotriacetic acid), STPP (sodium tripolyphosphate), or HEDPA (hydroxide ethidene dual phosphoric acid). (see also "Ancillary Substances")
- Activation may also be accomplished using Sodium Metasilicate [Na₂SiO₃] and Amorphous Silicon Dioxide [SiO₂] or Zero valent iron. (see also "Ancillary Substances")
- Sodium carbonate may be added as a buffering agent to elevate pH and accomplish activation.
- May be combined with calcium peroxide to provide elevated pH and H₂O₂, if so, see also "Metal Peroxides" and "Combined Technologies"
- May be combined with hydrogen peroxide for activation; if so, see also "Hydrogen Peroxide" and "Combined Technologies"

Applicability

- Can address a wide range of pollutants, but effectiveness may depend on activation method; iron activation may not degrade ethanes.
- Persistence facilitates use in low-permeability settings, and is sometimes used for bedrock settings.
- Sometimes used in areas beneath buildings because it generates few gaseous byproducts.
- Less sensitive to natural oxidant demand associated with organic matter than other chemicals.

Characterization Requirement (chemical specific)

- The Fe balance in the hydrochemical system is critical in design, and must be evaluated.
- Although insensitive to soil organic matter the Natural Oxidant Demand associated with metals in the aquifer must be evaluated to determine dosage.
- Soil buffering capacity should be evaluated to determine the potential amount of pH reduction that may occur as a result of the discharge.
- May degrade soft metals, including copper used as water lines or UST lines, and the presence or absence of these must be documented to ensure they are considered in design.
- Site specific evaluation of appropriateness of the selected activator is required.
- It is recommended that baseline iron, sodium and sulfate concentrations be determined.
- The potential for mobilization, from both co-disposed material and the aquifer matrix, of metals, notably aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese and selenium, must be evaluated, both due to oxidation and pH changes.
- Evaluate significance of potential issues associated with ion substitution on cation exchange sites in the aquifer matrix.

Design Requirements (chemical specific)

- Higher concentrations of sodium persulfate can be designed to incorporate density driven distribution within the aquifer, and if so, the specifics of this design must be described.

- If using heat or H₂O₂ activation the design must include vapor control or an evaluation of why vapor controls are not necessary to protect human health and the environment.
- Design must identify how it protects any soft metal utilities present in the ZOI or document their absence.
- Design must include evaluation of the potential for iron precipitate to clog the aquifer especially if a heterogeneous aquifer could foster non-uniform deposition.

Operational Requirements (chemical specific)

- Fugitive dust must be controlled when mixing chemicals.

Discharge Limit (chemical specific)

- Ammonium persulfate shall not be discharged.

Monitoring Requirements (chemical specific)

- To confirm ZOI iron, pH, or persulfate can be measured in monitoring wells
- If a metal other than iron is used as an activator, it must be monitored.
- Commercial grade persulfates may contain associated heavy metals, especially chromium, but often they are “reported as lead”; their absence must be confirmed or they must be monitored
 - Monitoring is not needed if the discharged solution is tested and contains measured concentrations less than the lower of the groundwater protection criterion or surface water protection criterion established in the remediation standard regulations;
 - A manufacturer’s certification of metals concentration, if speciated with appropriate detection limits, may be used as a basis for calculating a solution concentration based on the dilution specified in the work plan.
- Metals from the aquifer matrix, or from co-disposed wastes that contain heavy metals, may be mobilized by changes in pH, or redox state for multivalent metals; the mobilization potential must be evaluated through the conceptual site model, and often by using a bench scale test on aquifer material. Monitoring is required for a metal if evaluation determines it can be mobilized by aquifer conditions resulting from the discharge or if bench scale or field testing results show it exceeds one half of the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations.
- Monitored metals must be less than the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations, or pre-discharge background if higher, at all monitored locations for four quarters after discharge termination before monitoring pursuant to this permit may be terminated.
- Sodium, sulfate, and iron must be monitored, and if pH is modified using potassium hydroxide, potassium must be monitored.
- pH is a required field monitoring parameter, and monitoring must continue until post-remediation pH is within two standard units of the pre-discharge conditions at all locations.
- Monitoring of drinking water supply wells must include sodium or potassium, as appropriate for the injected chemical, sulfate, iron, if added for activation, and any metals for which the discharge exceeds twice the groundwater protection criteria; tabulated class GA performance criteria or class GA groundwater protection criteria apply for evaluation of results, even in class GB locations.
- For substances in the following table, that do not have adopted RSR criteria for groundwater and surface water protection, monitoring is required, the zone of influence exists, and permit requirements remain in effect, until within-ZOI post-remedial conditions at all monitored locations are less than the tabulated performance criteria, or pre-discharge background, whichever is higher, for four quarters:

Chemical	Performance criteria
Chloride (if chlorinated solvents present & GA)	Class GA 250 mg/l; Class GB 860 mg/l
Sulfate	Class GA 250 mg/l; Class GB 500 mg/l
Aluminum (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.75 mg/l
Iron (if mobilization potential or a component of discharge)	Class GA 0.3 mg/l; Class GB 3.0 mg/l
Manganese (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.5 mg/l
Potassium (if component of discharge)*	Class GA 250 mg/l; Class GB 2500 mg/l
Sodium	Class GA 20 mg/l; Class GB 200 mg/l
Total Dissolved Solids (TDS) (if used as non-target indicator parameter)	Class GA shall use 500 mg/l as a maximum value to trigger further evaluation

* monitoring not required if discharged concentration is below applicable performance criterion

METAL PEROXIDES

(overlaps existing General Permit: In Situ Groundwater Remediation: Enhanced Aerobic Biodegradation)

Substances

- calcium [CaO₂] or magnesium [MgO₂] peroxide which may have associated oxides or hydroxides
- may contain Dipotassium Phosphate [HK₂O₄P] Monopotassium Phosphate [H₂KO₄P] and Ammonium Phosphate Dibasic [(NH₄)HPO₄] (see also “Ancillary Substances”)

Applicability

- Typically provides low level release of oxygen to foster aerobic degradation, with release rate determined in part by formulation and lattice structure.
- May be combined with persulfate to provide activation by elevated pH and H₂O₂, if so, see also “Persulfates” and “Combined Technologies”

Characterization Requirement (chemical specific), when used at strengths fostering chemical oxidation

- Natural Oxidant Demand (NOD) should be determined to design dosage.
- The potential for mobilization, from both co-disposed material and the aquifer matrix, of metals, notably aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, and selenium, must be evaluated, both due to oxidation and pH changes.

Design Requirements (chemical specific)

- Evaluate significance of potential clogging of aquifer by reaction residues, especially if a heterogeneous aquifer could foster non-uniform deposition.
- Dosage for subsequent phases must incorporate an adjustment for first phase depletion of NOD.

Operational Requirements (chemical specific)

- Fugitive dust must be controlled when mixing chemicals.

Monitoring Requirements (chemical specific)

- Metals from the aquifer matrix, or from co-disposed wastes that contain heavy metals, may be mobilized by changes in pH, or redox state for multivalent metals; the mobilization potential must be evaluated through the conceptual site model, and often by using a bench scale test on aquifer material. Monitoring is required for a metal if evaluation determines it can be mobilized by aquifer conditions resulting from the discharge or if bench scale or field testing results show it exceeds one half of the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations.
- Monitored metals must be less than the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations, or pre-discharge background if higher, at all monitored locations for four quarters after discharge termination before monitoring pursuant to this permit may be terminated.
- pH is a required field monitoring parameter, and monitoring must continue until post-remediation pH is within two standard units of the pre-discharge conditions at all locations.
- For substances in the following table, that do not have adopted RSR criteria for groundwater and surface water protection, monitoring is required, the zone of influence exists, and permit requirements remain in effect, until within-ZOI post-remedial conditions at all monitored locations are less than the tabulated performance criteria, or pre-discharge background, whichever is higher, for four quarters:

Chemical	Performance criteria
Chloride (if chlorinated solvents present)	Class GA 250 mg/l; Class GB 860 mg/l
Aluminum (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.75 mg/l

Chemical	Performance criteria
Iron (if mobilization potential)	Class GA 0.3 mg/l; Class GB 3.0 mg/l
Manganese (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.5 mg/l
Phosphate (if component of discharge)*	0.1 mg/l as total P
Total Dissolved Solids (TDS) (if used as non-target indicator parameter)	Class GA shall use 500 mg/l as a maximum value to trigger further evaluation

* monitoring not required if discharged concentration is below applicable performance criterion

PERCARBONATE

Substances

- “Sodium percarbonate”, commonly as sodium carbonate sesquiperhydrate [$2\text{Na}_2\text{CO}_3 \cdot 3\text{H}_2\text{O}_2$]
- May also contain sodium carbonate [Na_2CO_3], sodium silicate and silica gel.
- Activation using iron, typically chelated iron or ferrous sulfate [FeSO_4], which results in a Fenton’s type reaction. (see “Ancillary Substances”)
- One vendor achieves activation using a mixture of sodium silicate solution, silica gel and ferrous sulfate [FeSO_4]. (see “Ancillary Substances”)
- One vendor uses an alternative activation formula of sodium silicate and ferrous sulfate [FeSO_4] that also includes sodium hydroxide and sodium tripolyphosphate. (see “Ancillary Substances”)

Applicability

- Without catalysis typically provides low level release of oxygen to foster aerobic degradation, with release rate determined by natural iron content of aquifer.
- Iron catalysis results in a Fenton’s-like reaction providing sufficient oxygen for in-situ oxidation, but with only moderate increases in temperature and pressure.
- Potentially suitable for use in both saturated and unsaturated zone soils.
- Activator application preceding oxidant, especially when using one vendor’s alternative activation formulation, functions to enhance dissolved pollution phase for increased availability for reactions; commissioner approval is required under section 3(e)(1)(B)(ii) of the general permit. See also ‘Ancillary Substances’.

Characterization Requirement (chemical specific)

- Natural Oxidant Demand (NOD) must be determined to design dosage.
- The hydrochemical iron balance must be evaluated to estimate reaction rates and potential oxygen concentrations if supplemental activation chemistry is not used.
- Site alkalinity must be evaluated.
- The potential for mobilization, from both co-disposed material and the aquifer matrix, of metals, notably aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, and selenium, must be evaluated, both due to oxidation and pH changes.

Design Requirements (chemical specific)

- Dosage for subsequent phases must incorporate an adjustment for first phase depletion of NOD.
- Evaluate significance of potential issues associated with ion substitution on cation exchange sites in the aquifer matrix.

Operational Requirements (chemical specific)

- Fugitive dust must be controlled when mixing chemicals.

Monitoring Requirements (chemical specific)

- Metals from the aquifer matrix, or from co-disposed wastes that contain heavy metals, may be mobilized by changes in pH, or redox state for multivalent metals; the mobilization potential must be evaluated through the conceptual site model, and often by using a bench scale test on aquifer material. Monitoring is required for a metal if evaluation determines it can be mobilized by aquifer conditions resulting from the discharge or if bench scale or field testing results show it exceeds one half of the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations.

- Monitored metals must be less than the lower of the groundwater protection criterion (GA) or surface water protection criterion established in the remediation standard regulations, or pre-discharge background if higher, at all monitored locations for four quarters after discharge termination before monitoring pursuant to this permit may be terminated.
- Sodium, sulfate, and iron must be monitored.
- pH is a required field monitoring parameter, and monitoring must continue until post-remediation pH is within two standard units of the pre-discharge conditions at all monitored locations.
- Monitoring of drinking water supply wells must include sodium, sulfate, and iron; tabulated class GA performance criteria or class GA groundwater protection criteria apply for evaluation of results, even in class GB locations.
- For substances in the following table, that do not have adopted RSR criteria for groundwater and surface water protection, monitoring is required, the zone of influence exists, and permit requirements remain in effect, until within-ZOI post-remedial conditions at all monitored locations are less than the tabulated performance criteria, or pre-discharge background, whichever is higher, for four quarters:

Chemical	Performance criteria
Chloride (if chlorinated solvents present)	Class GA 250 mg/l; Class GB 860 mg/l
Sulfate	Class GA 250 mg/l; Class GB 500 mg/l
Aluminum (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.75 mg/l
Iron	Class GA 0.3 mg/l; Class GB 3.0 mg/l
Manganese (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.5 mg/l
Sodium	Class GA 20 mg/l; Class GB 200 mg/l
Total Dissolved Solids (TDS) (if used as non-target indicator parameter)	Class GA shall use 500 mg/l as a maximum value to trigger further evaluation

ANCILLARY SUBSTANCES

In the event that additional substances are a component of a proprietary chemical mixture, separately part of the remedial discharge, or used for secondary purposes, the following requirements apply:

pH ADJUSTING CHEMICALS

If pH adjusting chemicals are used, pH must be monitored to identify any excursions beyond the zone of influence or to wells or other receptors, and also within the zone of influence until the pH levels have stabilized within 2 standard units of the pre-discharge baseline levels. The potential for mobilization of metals from the aquifer matrix must also be evaluated, and monitored as appropriate.

If inorganic acids are used for pH adjustment, the acid's anion must be monitored at the perimeter of the zone of influence, within the zone of influence, and at drinking water wells and other receptors. Monitoring is not required if the discharged fluid is below tabulated performance criteria; and monitoring must continue post-discharge until the concentration is below the tabulated criteria at all monitoring points within the ZOI for four consecutive quarters.

Acidification by nitric acid is prohibited unless explicitly approved by the commissioner.

If inorganic bases are used for pH adjustment, the base's cation must be monitored at the perimeter of the zone of influence, within the zone of influence, and at drinking water wells and other receptors. Monitoring is not required if the discharged fluid is below tabulated performance criteria; and monitoring must continue post-discharge until the concentration is below the tabulated criteria at all monitoring points within the ZOI for four consecutive quarters.

Discharge of ammonium hydroxide is prohibited unless explicitly approved by the commissioner.

If organic acids or ammonia are used for pH adjustment, the characterization must evaluate potential organic byproducts, especially if discharge will be to a soil with high organic content or if authorization is sought under 3(a)(4). If the safety data sheet for a chemical indicates potential toxicity, or if any potential byproducts are not readily biodegradable, the work plan must identify the constituents, evaluate their potential toxicity, and recommend a monitoring strategy, or provide a rationale for why no monitoring is necessary.

Substance/Ion	Performance criteria
Chloride*	Class GA 250 mg/l; Class GB 860 mg/l
Sulfate*	Class GA 250 mg/l; Class GB 500 mg/l
Phosphate (from phosphoric acid)*	0.1 mg/l as total P
Aluminum (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.75 mg/l
Iron (if mobilization potential)	Class GA 0.3 mg/l; Class GB 3.0 mg/l
Manganese (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.5 mg/l
Sodium*	Class GA 20 mg/l; Class GB 200 mg/l
Potassium*	Class GA 250 mg/l; Class GB 2500 mg/l
Other Metals	Lower of RSR GWPC or SWPC; consult DEEP if a metal not listed in RSRs is present.
Total Dissolved Solids (TDS) (if used as non-target indicator parameter)	Class GA shall use 500 mg/l as a maximum value to trigger further evaluation
Toxic chemical or by product compounds or non-biodegradable components	Work plan must propose performance criteria as applicable

* monitoring not required if discharged concentration is less than performance criterion

STABILIZERS, MODIFIERS, AMMENDMENTS, AND OTHER CONSTITUENTS

A variety of chemicals are used in many different discharge formulations to optimize the implementation of an in situ remedy. In some cases organic stabilizers, such as citrate, nalonate, phytate, nitrilotriacetate, and N-(2-hydroxyethyl) iminodiacetate may be used for treatment chemicals that otherwise degrade at inappropriate rates. In other cases constituents may be added to modify fluid properties such as viscosity. The need for specific monitoring must be determined as described below.

Metals that function as catalysts may be chelated using a variety of complexing agents including carboxyl groups of inorganic acids (oxalic, citric), EDTA (ethylenediamine tetra-acetic acid), NTA (nitrilotriacetic acid), STPP (sodium tripolyphosphate), or HEDPA (hydroxide ethidene dual phosphoric acid). The complexed metal must be monitored at the perimeter of the zone of influence, within the zone of influence, and at drinking water wells and other receptors. Monitoring is not required if the discharged fluid is below tabulated performance criteria. If monitored, monitoring must continue post-discharge until the concentration is below the tabulated criteria at all monitoring points within the ZOI for four consecutive quarters. Toxicity of the complexing agent itself should also be evaluated.

In many cases the stabilizer, fluid modifier, chelant or other constituents are substances that are Generally Recognized as Safe (GRAS) by the Food and Drug Administration, and they may also be very biodegradable. If any of these constituents are *neither* GRAS nor biodegradable, the work plan must include an identification of the constituents, an evaluation of their potential toxicity, and a recommendation for monitoring of them or an indicator, or a rationale as why no monitoring is necessary. Even if GRAS or biodegradable, an evaluation of potential toxicity and monitoring recommendation must be included with the registration if the material safety data sheet indicates there may be environmental toxicity.

Some discharges can contain amendments that also serve as nutrient sources by introducing phosphorous or nitrogen in various forms. For example, one vendor's product can contain Dipotassium Phosphate [HK₂O₄P], Monopotassium Phosphate [H₂KO₄P], and Ammonium Phosphate Dibasic [(NH₄)HPO₄]. If a discharge contains phosphorus or nitrogen, phosphate or nitrogen species, respectively, must be monitored at the perimeter of the zone of influence, within the zone of influence, and at drinking water wells and other receptors. Monitoring is not required if the discharged fluid is below tabulated performance criteria; and monitoring must continue post-discharge until the concentration is below the tabulated criteria at all monitoring points within the ZOI for four consecutive quarters. The registration must also identify the total nutrient load to be discharged, and evaluate the potential effect on the nearest surface water body; and DEEP may impose a limit on this amount if it could affect a surface water body.

Substance/Ion	Performance criteria
Phosphate (if discharge component)*	0.1 mg/l as total P
Nitrate (if discharge component)*	Class GA 10 mg/l; Class GB 100 mg/l
Nitrogen species (if discharge component)*	10.0 mg/l as total N
Surfactant/chelant (if discharge component)*	0.5 mg/l as foaming agent
Sodium*	Class GA 20 mg/l; Class GB 200 mg/l
Potassium*	Class GA 250 mg/l; Class GB 2500 mg/l
Other Metals	Lower of RSR GWPC or SWPC; consult DEEP if a metal not listed in RSRs is present.
Other compounds not GRAS or biodegradable, if identified as having potential aquatic toxicity	Work plan must propose performance criteria as applicable

* monitoring not required if discharged concentration is below applicable performance criterion

SURFACTANTS

If surfactants or other chemicals, including activators containing surfactant-like chemicals, are used in a manner that by intent or effect desorbs, solubilizes or otherwise mobilizes non aqueous phase product, often to enhance chemical availability to an oxidant, the registration must include an evaluation of the balance of the rate at which product is made available and the rate at which it is oxidized, as a basis for the dosage design. The work plan must incorporate a proposed process monitoring mechanism to ensure the optimum rate balance is maintained throughout the discharge cycle, to ensure destruction of material that is desorbed or otherwise introduced to the aqueous phase. If the surfactant and the oxidant are discharged at separate discrete times or locations, an evaluation of the timing and geometry of the discharge suite must also be conducted to ensure the potential for mobilization beyond the zone of influence is minimized. The monitoring plan must ensure product constituents do not migrate beyond the zone of influence at concentrations greater than pre-discharge baseline levels; ZOI perimeter monitoring and receptor monitoring for the full range of target pollutants is required. An outside-in remedial approach is recommended to minimize potential spread of pollution, or groundwater controls must be included.

Intermediate chemical breakdown products that may be produced must be identified, especially for activity conducted under section 3(a)(4) of the general permit, and the work plan must include an evaluation of their potential toxicity, and a recommendation for monitoring of them or an indicator; monitoring may be required.

If a surfactant is a specific chemical component in the discharge the type of surfactant must be identified, its potential aquatic toxicity must be evaluated, and monitoring must be included until the concentration is below any published toxicity value or tabulated performance criteria. Foaming agents include surfactants, which may be of either the anionic, cationic, or nonionic type, although not all surfactants create foam. Method SM 5540 is a recognized laboratory method for the measurement of their concentration in water and is published in standard methods for the examination of water and wastewater, SM5540 B, surfactant separation by sublation, isolates all surfactants, C is for anionic and D is for nonionic.

Substance/Ion	Performance criteria
Chloride	Class GA 250 mg/l; Class GB 860 mg/l
Sulfate	Class GA 250 mg/l; Class GB 500 mg/l
Phosphate (from phosphoric acid)	0.1 mg/l as total P
Aluminum (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.75mg/l
Iron (if mobilization potential)	Class GA 0.3 mg/l; Class GB 3.0 mg/l
Manganese (if mobilization potential)	Class GA 0.05 mg/l; Class GB 0.5 mg/l
Sodium	Class GA 20 mg/l; Class GB 200 mg/l
Potassium	Class GA 250 mg/l; Class GB 2500 mg/l
Surfactant/chelant (if component of discharge)*	0.5 mg/l as foaming agent; Total surfactant as proposed in work plan
Total Dissolved Solids (TDS) (if used as non-target indicator parameter)	Class GA shall use 500 mg/l as a maximum value to trigger further evaluation
Toxic chemical or by product compounds or non-biodegradable components	Work plan must propose performance criteria as applicable

* monitoring not required if discharged concentration is less than performance criterion