District Department of the Environment (DDOE)

IN-SITU CHEMICAL OXIDATION (ISCO) INJECTION GUIDANCE FORM

(Please fill out as thoroughly as possible. Attach boring logs, site plan, injection map, any additional comments as necessary)

Site Information:

Address ________________________________________________________________

City, State, Zip _________________________________________________________

WARD _______________ LOT _______________ SQUARE _______________

Site Owner:

Name(s) ______________________________________________________________

Mailing Address __________________________________ City, State, Zip ______________

Phone (______)___________________________ E-mail ____________________________

Consultant:

Name(s) ______________________________________________________________

Mailing Address __________________________________ City, State, Zip ______________

Phone (______)___________________________ E-mail ____________________________

Agent for Permit:

Name(s) ______________________________________________________________

Mailing Address __________________________________ City, State, Zip ______________

Phone (______)___________________________ E-mail ____________________________

Driller / Company Responsible for Injection:

DCRA Business License No. ________________________________________________

Name(s) __________________________________ License State & No. ______________

Mailing Address __________________________________ City, State, Zip ______________

Phone (______)___________________________ E-mail ____________________________
Site Description:

Site Status:

☐ Operating as a gasoline station  ☐ Not operating, with tanks in place
☐ Temporarily out of service from ______________ to ______________
☐ Permanently out of service. Tanks permanently closed in ______________
☐ Tank/Release product_______________________________________________________
☐ Past uses_________________________  ☐ Current uses______________________________

Ground Surface Conditions:

☐ Unpaved  ☐ Paved  % area paved _____________ Materials ________________

Any visible cracks in the pavement?  ☐ YES  ☐ NO

Site Stratigraphy: (Please attach all available boring logs for the Site)

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Unified Soil Classification</th>
<th>Type of Soil and Description</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Bedrock encountered?  ☐ YES  ☐ NO  If yes, Depth _________________________
Bedrock description ___________________________________________________________________

Site Hydrogeology:

Type of aquifer?  ☐ Confined  ☐ Unconfined  ☐ Perched

Underlying predominant aquifer name: _________________________________________________

Range of groundwater level fluctuations [feet below grade (fbg)] _________________________

Average depth to water table/static water level (Attach groundwater elevation table) (fbg): __________

Flow direction (Attach groundwater contour map):________________________________________

Are there additional water bearing units in the planned ISCO area:  ☐ YES  ☐ NO
Please describe: ____________________________________________________________

Hydraulic gradient (feet/foot): ___________________________________________________________

Hydraulic conductivity (cm/year): _________________________________________________________

Hydraulic conductivity test method: □ Grain size/Sieve analysis □ Slug test

□ Pump test Duration (hours): □ Other (specify and attach literature)

Annual precipitation (average for last 30 years) [inches/year]:

**Saturated Zone Characteristics:**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Values/Range</th>
<th>Estimated/Measured</th>
<th>If Measured, Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet bulk density [g/cm³]</td>
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</tr>
<tr>
<td>Estimated porosity (cm³/cm³)</td>
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</tr>
<tr>
<td>Water content (cm³/cm³)</td>
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<tr>
<td>Fractional organic carbon content (g-C/g-soil)</td>
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</tbody>
</table>

**Receptors Information:**

<table>
<thead>
<tr>
<th>Receptors</th>
<th>Distance from Injection Area (feet)</th>
<th>Direction from Injection Area</th>
<th>Upgradient/Downgradient/ Cross-Gradient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nearest residential site:</td>
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<tr>
<td>Nearest commercial site:</td>
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<tr>
<td>Nearest surface water body:</td>
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<tr>
<td>Nearest wetland area:</td>
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<tr>
<td>Nearest potable well:</td>
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<tr>
<td>Nearest school/daycare:</td>
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<tr>
<td>If site vacant, nearest inhabited building:</td>
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<tr>
<td>Nearest basement:</td>
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<tr>
<td>Nearest below grade parking:</td>
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<td></td>
<td></td>
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<tr>
<td>Other:</td>
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</tbody>
</table>

Are there any sensitive receptors in the vicinity of the ISCO zone? □ Yes □ No

Are there vapor intrusion pathway(s) within the ISCO zone? □ Yes □ No
Does the presence of sensitive receptors preclude ISCO?  □ Yes  □ No

Will vapor intrusion pathway(s) preclude ISCO:  □ Yes  □ No

**Underground Utility Information:**

Are there any subsurface structures that could be affected?  □ Yes  □ No

<table>
<thead>
<tr>
<th>Utility</th>
<th>Distance from Injection Area (feet)</th>
<th>Depth below Grade (feet)</th>
<th>Direction from Injection Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water line:</td>
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<tr>
<td>Sanitary sewer:</td>
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<tr>
<td>Storm sewer:</td>
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<tr>
<td>Gas line:</td>
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<tr>
<td>Telephone line:</td>
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<tr>
<td>Electric line:</td>
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<tr>
<td>Cable line:</td>
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<tr>
<td>Metro tunnel:</td>
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<tr>
<td>Other:</td>
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</tbody>
</table>

* Please attach a utility map with the form.

Does the presence of underground utilities preclude ISCO?  □ Yes  □ No

**Chemicals of concern (COCs) and Oxidant(s) information:**

List site specific target COCs:  __________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

List Other COCs Detected at Site:  _______________________________________________________

Name and Chemical formula of the Oxidant(s):  _____________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

Oxidant(s) form:  □ Liquid  □ Solid  □ Gas

Is the oxidant a patent oxidant?  □ Yes  □ No
If yes, list the major chemical(s) with their respective percentage used in the oxidant: _______________
___________________________________________________________________________________
Name of the patent/oxidant manufacture: __________________________________________________
___________________________________________________________________________________

Material safety data sheet (MSDS) for the oxidant is attached? □ Yes □ No
(Please note that DDOE requires the MSDS for the selected oxidant)

Please list potential oxidant impurities provided by manufacture:
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

Chemical Reactions:

Type of reaction: □ Exothermic □ Endothermic

Any other chemicals such as acid (H₂SO₄), base (NaOH), chelating agents (EDTA) are used to activate
the oxidant? □ Yes □ No Name of the activator: ________________________________

Describe the activation process: ______________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

General chemical reactions among activator(s) [where applicable], COCs and oxidant(s): __________
___________________________________________________________________________________
___________________________________________________________________________________
What are the by-products of the above mentioned chemical reactions? ______________________________

___________________________________________________________________________________

___________________________________________________________________________________

Is there any impact of the by-products on the environment?  □ Yes  □ No

If yes, describe briefly:_________________________________________________________________

___________________________________________________________________________________

___________________________________________________________________________________

Half-life of the oxidant(s) or by-products: ______________________________________________

__________________________________________________________________________________

MSDS for any other chemical used in ISCO is attached?  □ Yes  □ No

(Please note that DDOE requires the MSDS not only for the selected oxidant(s) but also for any other chemical used during activation or other processes)

Note: Potable water is required for chemical mixing, cleaning of injection tools and other equipment.

**Site Background Concentrations:**
[Please include data from the source, up-gradient, down-gradient, and cross-gradient monitoring wells (MWs) from the Site]

<table>
<thead>
<tr>
<th>MWs</th>
<th>pH</th>
<th>Temp. (°C)</th>
<th>ORP (mV)</th>
<th>Cond. (mS/cm)</th>
<th>DO (mg/L)</th>
<th>Oxygen (%)</th>
<th>LEL (%)</th>
<th>VOC (ppm)</th>
<th>H₂S (ppm)</th>
<th>CO (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

(Temp. – Temperature; °C – Degree celsius; ORP – Oxidation reduction Potential; mV – Millivolt; Cond. – Conductivity; mS/cm – milliSiemens per centimeter; DO – Dissolved oxygen; mg/L – Milligrams per liter; % - Percentage; LEL – Lower explosive limit; VOC – Volatile organic compounds; ppm – Parts per million; H₂S – Hydrogen sulfide; and CO – Carbon monoxide)
**Groundwater Analytical Data for COCs** *(Please attach at least the last two years groundwater analytical data from the Site monitoring wells network with this form):*

**Soil Analytical Data for COCs** *(Please attach the soil analytical data from the various subsurface investigations conducted at the Site with this form):*

**Injection Information:**
*DDOE understands that ISCO injection is a dynamic process and need to be adjusted based on the field observations. However, please fill out the following information using best engineering judgments)*

Method of injection:  
- Geo-probe  
- Injection Wells  
- Existing Monitoring Wells

Total amount of oxidants (pounds): _________________________

Estimated treatment area length (ft):_______  Estimated treatment area width (ft): ________  Total Estimated area (ft²): _____________

*For Geo-probe Injection:*

Estimated treatment depth interval (ft):____________________________________________________

Estimated radius of influence (ft):____________________

(Note: Where feasible an injection pilot test is required to determine a more accurate radius of influence; if pilot test findings indicate a significant difference from the estimated radius of influence, the number of injection points and locations will require re-evaluation.)

---

<table>
<thead>
<tr>
<th>MWs</th>
<th>Sulfate (mg/L)</th>
<th>Nitrate (mg/L)</th>
<th>Dissolved Iron (mg/L)</th>
<th>Total Iron (mg/L)</th>
<th>Carbonate (mg/L)</th>
<th>Arsenic (mg/L)</th>
<th>Chromium (mg/L)</th>
<th>Lead (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Standards</td>
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<tr>
<td>EPA Standards</td>
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</tbody>
</table>
No. of injection points: ______________________________________________________________
(Note: Injection points cannot be added outside of the original DCRA permit conditions. If a potential exists for additional injection points, please include these points as part of the original DCRA permit, or submit permit modifications for approval prior to installation.)

Injection Approach:

- □ Bottom-up
- □ Top-down
- □ Single point
- □ Multiple-points
- □ Both
- □ Grid pattern
- □ Circular pattern
- □ Random
- □ Other:

Oxidant Injection Intervals (feet): □ < 1 □ 1 - 2 □ 2 – 3 □ 3 – 4 □ 4 - 5 □ > 5

Injection Pressure (pound/inch²): ___________________________________________________________________

For Injection Wells (IW) and Existing Monitoring Wells (MW):
(Note: Existing MWs shall not be utilized as IWs without the prior approval of modifications to the original MW permit’s intended use)

Monitoring /injection well depth (ft): __________ Screen intervals (ft): ___________________________
Estimated radius of influence (ft): ____________ No. of injection/monitoring wells: _________________

Injection Approach:

- □ Gravity-feed
- □ Mechanical-feed
- □ Single well
- □ Multiple-wells
- □ Both

Approximate Injection Pressure (pound/inch²): ___________________________________________________________________

Please describe surfacing management process:
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

Page 8
Injection Monitoring:
(Note: Monitoring activities shall be conducted before injection for background information, during injection, and after injection. Post injection frequency and monitoring period must be based on oxidant selection)

In addition to COCs, following parameters are required to monitor prior and after the injection at the source, up-gradient, down-gradient, and cross-gradient monitoring wells:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile organic compounds</td>
<td>Dissolved oxygen</td>
</tr>
<tr>
<td>Lower explosive limits</td>
<td>Temperature</td>
</tr>
<tr>
<td>Oxidation-reduction potential</td>
<td>pH</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>Sulfate</td>
</tr>
<tr>
<td>Dissolved iron</td>
<td>Total iron</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Chromium</td>
</tr>
</tbody>
</table>

*Note: Analysis for potential oxidant impurities shall be included as part of all injection monitoring activities.

On-site and surrounding utility manholes must be monitored prior to, during and after the injection for VOCs, H2S, CO, LEL, Temperature, and O2 with an interval of (hour):

☐ 0.5 ☐ 1 ☐ 1.5 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Describe post injection monitoring frequency and period:
[Note: Post injection monitoring frequency is required to be completed from hourly to weekly in the beginning followed by weekly to monthly depending on selected oxidant(s)]

___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

Additional Notes:
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
Case Study:

Has this type of ISCO injection been completed in DC prior to this proposed event?  ☐ Yes  ☐ No

If not, please provide approvals for the proposed ICSO event from regulatory agencies other than DDOE. If approvals from outside regulatory agencies are not available, please provide actual case studies completed in the past. List the information and any attachments here:

___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

If yes, list the DC sites where it was applied: __________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

List of Attachments:
(Attach all associated documents and list them here)
I declare that the information provided is accurate, true and complete to the best of my knowledge and belief. I agree to comply with all applicable laws and regulations of the District of Columbia.

Owner:

Name (Print): _________________________ Signature: _____________________ Date: __________

Owner Authorized Consultant:

Name (Print): _________________________ Signature: _____________________ Date: __________

Agent for Permit:

Name (Print): _________________________ Signature: _____________________ Date: __________
District Department of the Environment (DDOE)

IN-SITU CHEMICAL OXIDATION (ISCO) INJECTION GUIDANCE FORM

(Please fill out as thoroughly as possible. Attach boring logs, site plan, injection map, any additional comments as necessary)

DDOE APPROVAL:

Underground Storage Tank Branch:

Name (Print): _________________________ Signature: _____________________ Date: ____________

Air Quality Division:

Name (Print): _________________________ Signature: _____________________ Date: ____________

Water Quality Division:

Name (Print): _________________________ Signature: _____________________ Date: ____________
Terms and Conditions:

1. Completion of this Injection Guidance Form will serve as Pre-approval of the ISCO CAP or Work Plan proposed for any specific site located in Washington, DC. However, all associated documents (i.e. CAP, Work Plan, etc.) as well as this pre-approved Injection guidance form need to be submitted for the Final Approval.
2. Additional information may be required for the approval of the injection points. In addition, for any modification/deviation (i.e. changes in number of injection points, location of injection points, etc.) from the approved CAP and/or Work Plan, DDOE must be notified.
3. A decision will be notified within 30 calendar days of submission of this form.
4. By applying for the permit to perform in-situ injections the permittee agrees to comply with all District permit requirements, directives and regulations.
5. Responsible parties are liable for all operations and maintenance costs associated with the injection.
6. Responsible parties are liable for any exacerbation, or disruption of existing contamination caused by the injection process.
7. Responsible parties are liable for the chemicals injected and their bi-products that may cause negative impacts on environment.

For Additional Information or Clarifications please contact:

District of Columbia Department of the Environment
Toxic Substances Division
Underground Storage Tank Branch
Attention: Branch Chief
1200 First Street, NE, 5th Floor, Washington, DC 20002.
Tel: (202) 535-2600 Fax: (202) 535-1383
Website: www.green.dc.gov, Email: ust.ddoe@dc.gov