

**INJECTION PLAN FOR  
(CLIENT NAME AND FACILITY NAME)**

(date)

*Prepared by:*

**(Company name and  
address)**

*Prepared for:*

**(Client name and  
address)**

## **GENERAL INFORMATION\***

\*(All information in any injection plan will vary with the site and circumstances surrounding the injection. The verbiage used in this plan is given only as an example.)

This injection plan is for the placement of Remediation Products Inc. BOS 200<sup>®</sup> within the delineated plume. (See attached Injection Diagram.) Toluene, ethylbenzene, and xylenes (TEX) have been found in the soil and groundwater at the site, presumably released from an underground storage tank that was used to store petroleum based thinners and finishes.

Injections at the site are planned to commence on or around (date). Barring equipment problems and severe weather, completion of planned operations will take around 5 to 7 days. Work will begin each day at 7:00 AM and end at 6:00 PM. Approximately one-half hour is required at the end of each day for cleaning of equipment, maintenance and storage. Additional information on equipment cleaning and storage is described in the *Equipment Maintenance* section in this document.

Upon the conclusion of each workday, the field manager will provide a field form to be signed by personnel from both companies. Daily field activities and the total injected pounds of BOS 200<sup>®</sup> will be documented on the form. See attached Daily Production & Invoicing Form.

Prior to commencing the injection work, all project personnel must review the health and safety plan prepared specifically for the work detailed herein.

## **SITE PREPARATION**

Certain steps must be performed to ensure a smooth commencement of fieldwork. All staging operations will be completed on the first day and arrangements for water and site security will be completed the week before injections are scheduled to begin.

### **Staging of Operations and Equipment**

During the set up of the site, selected equipment and key operations will be staged onsite. Equipment may include a covered trailer containing all essential supplies (pumps, hoses, generators, spare fittings, etc.), the injection pump trailer, a drill rig, and a bulk storage water tank. Factors affecting the selection of staging areas include the location of water, power, the general suitability of the selected area to planned work activities, and interference with routine plant operations. Since the remediation area is adjacent to an active train track, special care will be taken to assure all equipment is kept a safe distance from the tracks.

Equipment will be staged in the following places (see Injection Diagram on page 4):

The Primary Staging Area will be located in the parking lot northeast of the current building.

The Secondary Staging Area will be located at the northwest edge of the treatment area.

All stationary equipment and any equipment that is not needed on a daily basis will be stored in the Primary Staging Area. These items will include, but are not limited to, generators, trash pumps, pallets of material, and an extra water tank. All injections will be performed from the Secondary Staging Area. Due to the location of the tracks, the injection trailer may need to be moved to the Primary Staging Area at night.

## **Water Source**

We estimate that 15,000 gallons of water will be used over the 5 to 7 days of planned injections.

Water can be obtained from an outside tap, water main, or a water tank can be provided for the work to be done. Use of a water main (hydrant) will require approval from the City. If a water tank will need to be provided, a 10,000-gallon tank would be adequate. The tank would need to be filled twice and must be configured with at least one discharge outlet fitted with a shut-off valve and with a 2-inch or 3-inch female camlock hose connection.

The tank should either be a new tank or have been dedicated to the storage of potable water. If the tank has been used to store wastes or byproducts such as produced water, then water subsequently stored in the tank will become contaminated. Based on experience with such tanks, commercial cleaning procedures (even steam cleaning) fail to prevent, the subsequent impact to stored water.

(The options delineated above are presented for reference only. In an actual Injection Plan, the water source should already be chosen at this point, and it would be presented in detail here. Sometimes the Client will take responsibility for locating the water source and will require detailed information to make an adequate selection.)

## **Power Source**

Generators will be utilized to power all injection equipment. No land power is expected to be required.

## **Site Security**

It is imperative that certain equipment be left onsite. All vehicles and storage trailers will be locked each night, and our personnel will keep the keys to the equipment. As mentioned above in the Staging of Operations section, equipment will be left in the parking lot on the northwest side of the building at night.

## **PLANNED INJECTIONS**

BOS 200<sup>®</sup> will be injected within the TEX plume at the grid points shown on the attached Injection Diagram (on page 4). The plume is approximately 7,000 square feet with 3,200 square feet located inside the building.

## **Site Layout**

The beginning layout point for the boreholes on the outside of the building will be located approximately 3½ feet east and 1½ feet north of the northeast corner of the building, and remaining points will be located using a 10-foot center-to-center triangular grid pattern. The 42 injection points are depicted on the Injection Diagram (on page 4). The injection point east of MW-5 will be located at least 5 feet from the monitoring well.

The starting layout point for the boreholes on the inside of the building will be located approximately 8½ feet south and 7 feet west of the northeast corner of the building. The remaining 14 points on the inside of the building will be located using a 15-foot center-to-center triangular grid pattern (see Injection Diagram on page 4). The plant site

representative will check all proposed borehole locations, prior to beginning injections, to be sure no injection will inadvertently hit any subsurface power, water or gas lines. The treatment area has been divided into two injection areas: Area A and Area B. Area A is located inside the building and Area B is located outside the building. Area B has been split into three areas, B1, B2, and B3, to distinguish boreholes requiring different loadings of BOS 200®. In both Areas A and B, boreholes will receive injections at three levels, approximately 8, 10, and 12 feet in one borehole and approximately 7, 9, and 11 feet in adjacent boreholes. The alternating depths are designed to give the best possible coverage of the injection material so the greatest amount of contamination will be affected.

The contamination lies within a 5-foot zone directly above the bedrock layer. Bedrock starts at approximately 12 feet in the area of planned remediation. Injection depths will be determined in the field by the bedrock layer. Injections will be performed in a top-down manner beginning at approximately 7 or 8 feet bgs, depending on location, performing an injection, lowering the rod 2 feet and performing the next injection until the process is complete. The deepest injection depth in all boreholes will be either at the bedrock layer or one-foot above it. This process will result in a total of three injections per borehole.

Relevant information for each area is displayed in the following table.

**Summary Table of Planned Injections**

Area	Location	Approximate Depth of Injections	# of Boreholes	Injections per Borehole	lbs/ Borehole	Total lbs.
<b>A</b>	Inside of Building	8', 10', 12' or 7', 9', 11'	15	3	175	2,625
<b>B1</b>	Outside of Building	8', 10', 12' or 7', 9', 11'	37	3	75	2,775
<b>B2</b>	Outside of Building – surrounding MW-5	8', 10', 12' or 7', 9', 11'	4	3	125	500
<b>B3</b>	Outside of Building – north of MW-5	8', 10', 12' or 7', 9', 11'	1	3	100	100
<b>Totals:</b>			57			6,000

Slurry ratios will be approximately 2 pounds of BOS 200® per gallon of water. To make sure contamination is contained within the treatment area, injections will begin in the northeast section of Area B and proceed west and south towards the building. After all injections have been completed outside the building, injections will begin in Area A (inside the building).

Once inside the building, injection points will be laid out and the locations checked by the plant site representative, as mentioned in the Site Layout section. To prevent plant employees from accidentally infringing upon the work area (Area A), cones and caution tape will be used to mark the area. Injections will begin at the southeast corner of Area A and

proceed west and north toward the north wall of the building. This injection pattern has been chosen with the intent of making certain contamination under the building is pushed toward previously treated areas outside the building.

The location of injection points shown on the Injection Diagram (below) is approximate; some adjustment is always required in the field to account for subsurface pipelines, utilities, or other structures.

### EQUIPMENT MAINTENANCE

As stated previously, equipment will be cleaned at the conclusion of each day. These cleaning procedures may include the flushing of injection lines and mixing tank lines with between 50 and 100 gallons of water used daily for this purpose. The flush water may be injected at a point within the the plume rather than pumped out onto the ground. Some water will be needed at the end of the project to clean all debris from the trailer and pump surfaces. A dedicated area will be established, during initial site set-up, for this task.

All holes in the concrete floor of the facility will be sealed with bentonite and patched with concrete so that the holes will become invisible in time. In addition, any repairs to the grass and clean up of any injectate that surfaced during the treatment will be addressed prior to demobilizing from the project.

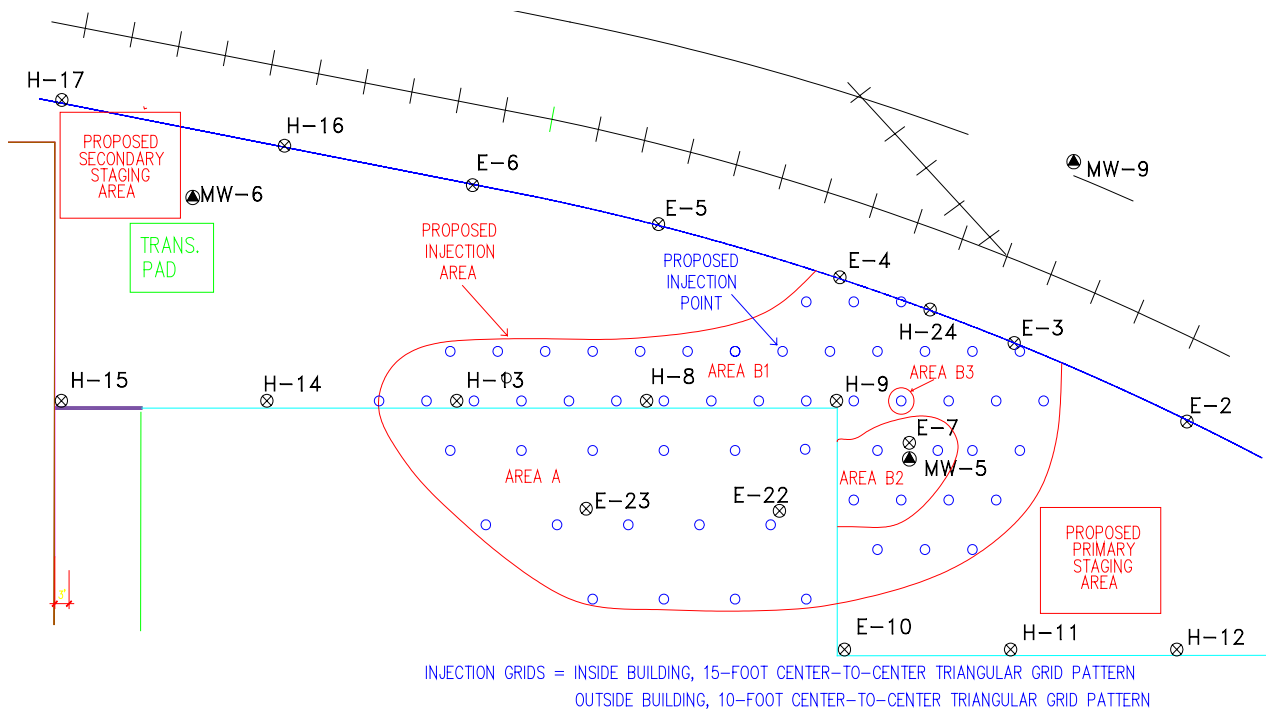


Figure 1: Site Injection Diagram

**DAILY PRODUCTION FORM**

**DATE:** \_\_\_\_\_

**SITE:** \_\_\_\_\_

**TASK:** \_\_\_\_\_

**MATERIAL:** \_\_\_\_\_

**RATE:** \_\_\_\_\_ **PER TON/POUND**

\_\_\_\_\_ **TONS / POUNDS @ PER TON / POUND= (to be invoiced)**

**CLIENT REMARKS:**  
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**COMPANY REMARKS:**  
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**CLIENT SIGNATURE**

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**COMPANY SIGNATURE**