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MK-FERGUSON
A MORRISON KNUDSEN COMPANY

U.S. DEPARTMENT OF ENERGY
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WELDON SPRING SITE REMEDIAL ACTION PROJECT

DESIGN CRITERIA DOCUMENT APPROVALS

DOCUMENT TITLE: In-Situ Chemical Oxidation of TCE in Groundwater at the Chemical Plant – WP 550 Design Criteria, Rev. 0

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WELDON SPRING SITE REMEDIAL ACTION PROJECT

In Situ Chemical Oxidation of TCE in Groundwater
Work Package 550
Design Criteria
October 2000
Revision 0

Prepared by

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In Situ Chemical Oxidation of TCE in Groundwater
Work Package 550
Design Criteria
Off Site Engineering – Task 900
October 2000
Revision 0

1.0 INTRODUCTION

The Project Management Contractor (PMC), under contract to The U.S. Department of Energy (DOE), is subcontracting the design and operation of an in situ chemical oxidation process for the treatment of TCE contaminated groundwater at the chemical plant site at the Weldon Spring Site Remedial Action Project (WSSRAP). Development of performance-based specifications for the above-mentioned design work will be performed under Task 900 (Account # L393-84500). Design, testing, construction, and operation of the in situ chemical oxidation system will be performed by others under WP 550, *In-Situ Chemical Oxidation of TCE in Groundwater*.

This document identifies design criteria and functional requirements to be used in the preparation of performance-based specifications and bid documents for Work Package WP 550, *In situ Chemical Oxidation of TCE in Groundwater*. This task involves the identification of project requirements to aid the subcontractor in the design of an in situ chemical oxidation system for the treatment of TCE in groundwater. The performance-based criteria shall be for the design of a complete system consisting of bench-scale and pilot-scale testing phase and a full-scale system, including oxidant delivery system, injection locations, instrumentation, electrical systems, and temporary facilities.

2.0 BASIS OF DESIGN

The in situ process shall be performed as part of the remedial action to address TCE groundwater contamination and restore the aquifer to the MCL of 5 µg/l. This remedial action is being performed to comply with the *Interim Record of Decision (ROD) for Remedial Action for the Groundwater Operation Unit* (DOE, 2000).

3.0 DESIGN CRITERIA

3.1 Siting Criteria

The in situ chemical oxidation process shall be performed in the area of TCE impact at the chemical plant; primarily Zones 1 and 2 at the chemical plant site (Figure 1). The treatment shall be performed in the shallow aquifer, which is comprised of saturated overburden and/or weathered Burlington-Keokuk Limestone.

3.2 Delivery System

The delivery system (i.e., wells, probes, injection points) shall be located in the weathered portion of the Burlington-Keokuk Limestone. Efforts will be made to limit drilling into the unweathered portions of this unit to prevent downward migration of contaminants. The delivery system shall be constructed to facilitate introduction of oxidant into the saturated thickness of the weathered unit. The system shall provide complete coverage of the area of TCE-impact in groundwater. However, it should be optimally located to intersect the permeable portion of the shallow aquifer to provide rapid delivery of oxidant into the aquifer system. Injection points shall be placed at sufficient spacing to allow sufficient delivery of oxidant into the whole area of groundwater impact. Materials used for the construction of the delivery system shall be compatible with the oxidant used.

3.3 System Operation

The oxidant concentration and dose shall be of sufficient levels and sufficient duration (the equivalent of at least two doses) as to reach the target performance goal of 5 ppb within a reasonable timeframe (i.e., less than 1 year). The concentration of oxidant and the rate of delivery shall be set high enough to deliver sufficient oxidant to satisfy the target contaminant (TCE) demand and natural oxidant demand of the aquifer to preclude insufficient degradation of TCE and create undesirable breakdown products (i.e., vinyl chloride). The testing and operation of the system shall not cause excessive migration of TCE beyond the boundaries of known contamination or cause conditions within the aquifer that may cause migration of other contaminants. The actual dose and rate of oxidant delivery shall be determined from bench-scale and pilot-scale testing.

Operation of the system shall not result in excessive residual reagents or otherwise adversely affect the water chemistry of the aquifer in a way that would make conventional water treatment more difficult. Modifications to the oxidant concentration and delivery rate shall be made to optimize treatment or to prevent the migration of oxidant beyond the area of impact.

3.4 Monitoring

The oxidant delivery system shall be monitored to assure adequate operation. Operation of the system shall limit the production of off-gasses or the creation of hazardous conditions for workers and the environment. System maintenance will be performed to ensure efficient operation.

Sampling and analysis of the groundwater shall be performed by the subcontractor to monitor the effectiveness of the treatment system during and after oxidant delivery. Sampling may be made using the existing monitoring system, injection points, or new sampling points. Final determination of the effectiveness of the treatment of TCE by the subcontractor shall be determined by the PMC.

4.0 REFERENCES

4.1 Regulations, Codes, and Standards

40 CFR 300 – National Oil and Hazardous Substances Pollution Contingency Plan, *Federal Register* 55(46):8666-8865, March 1990.
40 CFR 262 – Resource Conservation and Recovery Act
10 CSR 23 – Missouri Well Construction Rules
10 CSR 50 – Underground Injection Control Rules

4.2 Applicable or Relevant and Appropriate Regulations

40 CFR 141.11 – Safe Drinking Water Act

4.3 Compliance Documents

U.S. Department of Energy and U.S. Department of the Army, 1998. *Feasibility Study for Remedial Action for the Groundwater Operable Units at the Chemical Plant Area and the Ordnance Works Area at the Weldon Spring Site, Weldon Spring, Missouri*, DOE/OR/21548-569, December.

U.S. Department of Energy, 1999. *Supplemental Feasibility Study for Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site, Weldon Spring, Missouri*, DOE/OR/21548-783, March.

U.S. Department of Energy, 1999. *Proposed Plan for Remedial Action for the Groundwater Operable Units at the Chemical Plant of the Weldon Spring Site*, DOE/OR/21548-733, June.

U.S. Department of Energy, 2000. *Interim Record of Decision for Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site, Weldon Spring, Missouri*, DOE/OR/21548-798, September.

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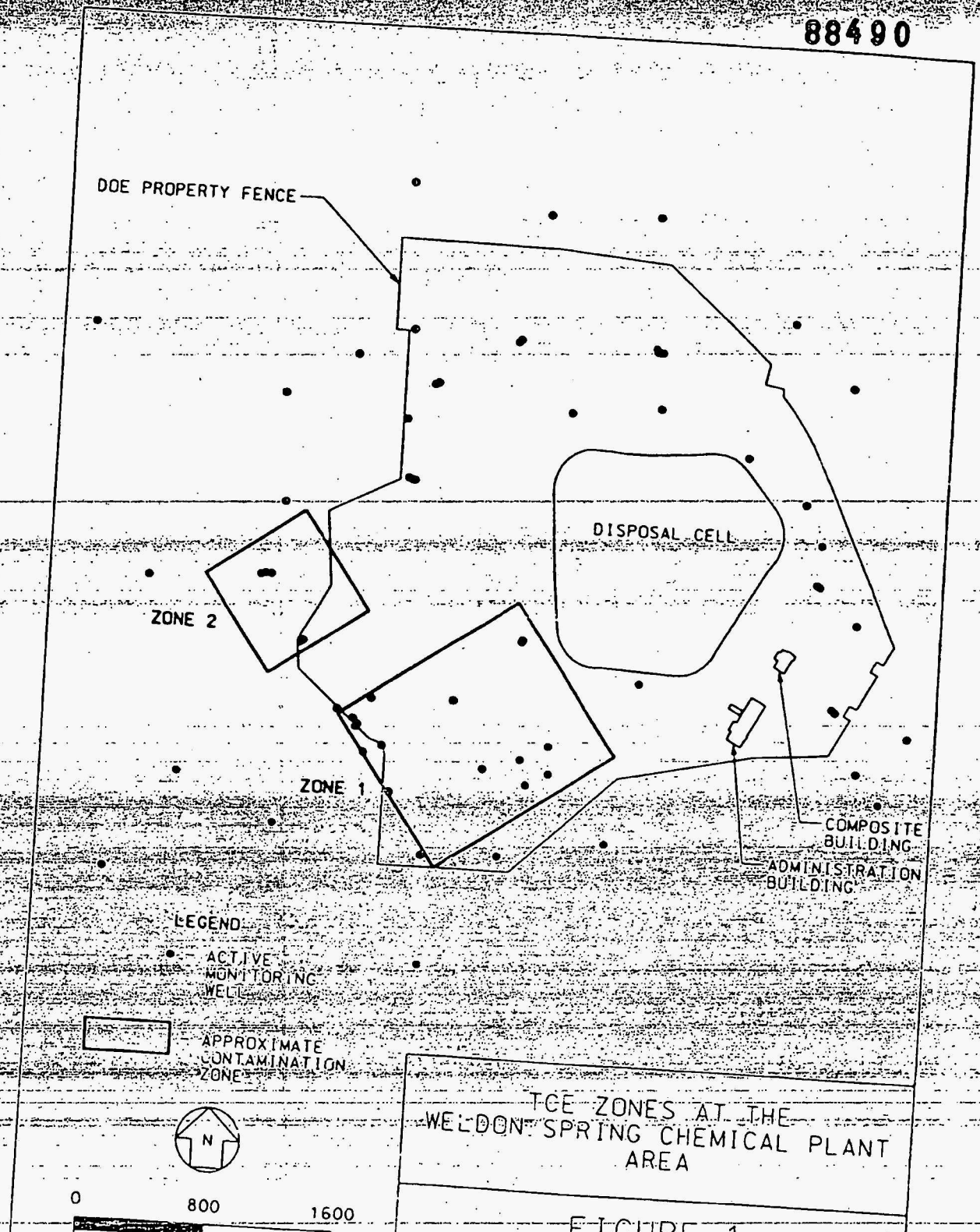

TCE ZONES AT THE WELDON SPRING CHEMICAL PLANT AREA

FIGURE 1

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