



## Paducah Citizens Advisory Board

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## **Recommendation No 16-02: C-400 Interim Remedial Action Phase IIb Steam Injection with Sampling Under the Building**

March 17, 2016

### **Background**

The C-400 Building on the PGDP site was where many of the large components used in the gaseous diffusion process were periodically cleaned. The building contained large vats where the components were dipped for cleaning. Trichloroethylene (TCE) was the degreaser used to clean many of these components. A large tank was located on the southeast side of C-400 to store the quantities of TCE that would be needed for the various cleaning operations. Use of TCE was discontinued by 1993 once it was determined to be a carcinogen and was found in dangerous quantities in the aquifer under and surrounding the PGDP plant. Investigations into the source of the TCE revealed leaks from piping connecting the outside storage tank, which was subsequently removed. An extensive series of water sampling wells helped identify the approximate profiles of TCE concentration in the aquifer. The TCE profiles in the aquifer suggest there were likely several sources of TCE discharge around the plant, but the peak concentrations point to the area around C-400 as source for the highest TCE concentrations. It is impossible to accurately estimate how much TCE may have been released around C-400 due to the piping leaks over the many years of use. It should be noted that TCE was considered a safe cleaning agent at the time it was used as a degreasing cleaner, and was commonly used in many industrial applications around the world.

The Department of Energy has implemented a number of activities to address the health risks associated with the TCE in the aquifer. Water wells used in private residences around the PGDP plant site were capped and a safe potable water supply was provided. Once the scope of the TCE concentration in the aquifer was determined, various remediation methods were developed to protect human health. These remediation methods were limited to what would not interfere with the ongoing uranium enrichment operations that continued at the PGDP site until 2013. Large scale well water pump-and-treat systems were installed at the plant perimeter to remove the TCE from the groundwater. In 2005, an electrical resistance heating (ERH) system was developed that would heat the groundwater at depths up to 60 feet to separate out the more volatile TCE. Three ERH arrays were installed around the C-400 Building and removed over 1700 gallons of TCE, but were limited to relatively small footprints around the building.

Another method to heat the aquifer water using steam to separate out the TCE was tested in mid-2015. Steam generated by a conventional package boiler was injected down a well while temperatures were monitored at various points around the injection well. The results of the tests allowed DOE to assess the site specific performance of this system so they could model its effectiveness for a large scale application. The DOE, EPA, and Kentucky are evaluating the effectiveness of the steam and in the planning stage for a large scale implementation of this steam injection remediation system for the area around the southeast corner of the C-400 Building.

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The Paducah Citizens Advisory Board (CAB) is encouraged by the progress that has been made in this steam injection remediation process. The C-400 Building prevents a good understanding of the TCE concentrations underneath the footprint of the building, however, as it essentially sits on top of the peak TCE concentrations in the aquifer below. While leakage from the external TCE storage tank was known to be a major contributor to the TCE in the aquifer, it is not known if there may have been similar leaks from piping under the building or from the large vats inside. Ongoing usage of the building during enrichment operations prevented drilling through the slab or immediately adjacent to the C-400 building, so there is no direct knowledge of TCE concentrations in that region. Without a clear understanding of the TCE that may be located under C-400, the steam injection remediation process may not be as effective as desired, or may even produce unforeseen detrimental results.

The CAB does not want to disrupt the DOE schedule for evaluation of the large scale steam injection project. Also, it recognizes that there is no funding currently allocated for further exploratory wells under C-400. Better characterization of TCE directly under C-400 is critical to future remediation of the TCE at this major source location.

**Recommendation**

**The CAB recommends:**

- **That DOE develop an accelerated plan for sampling of TCE underneath the C-400 building footprint. Drilling for such sampling may involve penetrations through the building slab, angled drilling around the building perimeter, or a combination of both as local conditions and safety considerations permit.**
- **That DOE review their funding allocations to determine if the cost of this TCE sampling project can be absorbed within their near term future budgets that have already been approved, or are currently in the approval process. If current budgets do not allow that flexibility, the CAB strongly encourages Paducah DOE personnel to pursue all appropriate channels to obtain additional funding for this project.**
- **That DOE make every effort to conduct this TCE sampling project without disrupting or delaying their full scale steam injection remediation schedule.**