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**From:** Sygo, Jim (DEQ)  
**Sent:** Tuesday, October 20, 2015 8:43 AM  
**To:** Shaler, Karen (DEQ)  
**Subject:** FW: Flint  
**Attachments:** DelToral\_etal\_EST\_2013.pdf; DelToral\_etal\_EST\_2013\_SI.pdf

When you get a chance can you try to open and print these papers

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**From:** Dykema, Linda D. (DHHS)  
**Sent:** Tuesday, October 20, 2015 8:04 AM  
**To:** Krisztian, George (DEQ); Edgerton, Shelly (LARA); Sygo, Jim (DEQ)  
**Subject:** FW: Flint

Del Toral paper attached with supporting data

## Detection and Evaluation of Elevated Lead Release from Service Lines: A Field Study

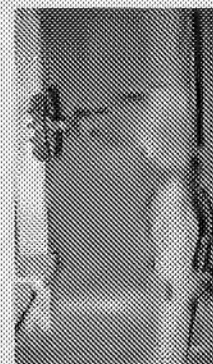
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### Supporting Information

**ABSTRACT:** Comparative stagnation sampling conducted in 32 homes in Chicago, Illinois with lead service lines demonstrated that the existing regulatory sampling protocol under the U.S. Lead and Copper Rule systematically misses the high lead levels and potential human exposure. Lead levels measured with sequential sampling were highest within the lead service lines, with maximum values more than four times higher than Chicago's regulatory compliance results using a first-draw sampling protocol. There was significant variability in lead values from different points within individual lead service lines and among different lead service line sites across the city. Although other factors could also influence lead levels, the highest lead results most often were associated with sites having known disturbances to the lead service lines. This study underscores the importance and interdependence of sample site selection, sampling protocol, and other factors in assessing lead levels in a public water system.



### INTRODUCTION

**Background.** Most lead in drinking water comes from premise plumbing materials and lead service lines (LSLs). LSLs are generally the largest source of lead in drinking water when they are present in public water systems.<sup>1</sup> The 1986 Safe Drinking Water Act Amendments banned new lead pipes in the potable water network, but a legacy of millions of partial or whole LSLs remains in many public water systems.<sup>2</sup> Where the term "lead corrosion" is used, it refers to the corrosion of lead plumbing materials that result in the transfer of dissolved or particulate lead into the drinking water.

The Lead and Copper Rule (LCR) sampling is intended to measure the lead levels in drinking water to assess the effectiveness of corrosion control treatment utilized by public water systems (PWSs) to minimize lead in drinking water. PWSs are required to use sampling sites that are presumed to be the highest-risk sites for lead release, and to optimize corrosion control to minimize lead levels at consumers' taps. Most published sampling studies typically focus on systems having high lead levels or systems that have experienced challenges in attempting to balance LCR compliance with various other treatment or water quality objectives. Except for LCR compliance data, little published data exists or is available for systems that are considered to be operating with optimal corrosion control and meeting the lead action level (AL) in the LCR. This study focuses on a system that is considered to have optimized corrosion control using a blended phosphate, with a relatively stable water quality, and compliance results historically well below the lead AL. This situation is representative of a large percentage of systems serving 100,000 or more people that utilize orthophosphate or blended phosphates for corrosion control and the vast majority of

systems are meeting the lead AL based on the current sampling protocol in the LCR. Additional information on the LCR and study is available in the Supporting Information (SI). This study focused on whether (1) the current LCR compliance sampling protocol adequately captures the peak lead levels in a water system; (2) "preflushing" (PF) results in capturing lower lead levels in samples compared to samples collected under normal household usage (NHU) conditions; (3) a first-draw sampling protocol appropriately determines the adequacy of optimal lead corrosion control in water systems with LSLs; and (4) there is seasonal variability in the sampling results using the different sampling protocols.

**System Information.** The Chicago Department of Water Management (CDWM) operates two similar conventional surface water filtration treatment plants serving approximately 5.4 million residents, including those in 125 suburbs. Lake Michigan is the sole water source, with relatively stable water quality leaving the treatment plants and in the distribution system (Table 1). Before the LCR, CDWM utilized pH/alkalinity adjustment for corrosion control. CDWM switched to a proprietary blended phosphate at both plants between 1993 and 1994 which is still used as the primary corrosion control treatment.

The LCR requires public water systems to collect lead samples using a first-draw (FD) sampling protocol, and samples were collected almost exclusively from single-family homes with LSLs as required by the LCR sample site selection require-

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