

# QUARTERLY PROGRESS REPORT

April 1, 2001 - June 30, 2001

**PROJECT TITLE: Environmental Impacts of Lead Pellets at Shooting Ranges in Florida**

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## WORK ACCOMPLISHED DURING THIS REPORTING PERIOD:

1. Based on the project milestones (Table 1) and to better evaluate best management practices (BMPs) for shooting ranges, additional soil, plant, and water samples were collected from one shooting range in south Florida.
2. Physicochemical properties of the soil samples were determined
3. Soil samples were characterized in laboratory. Leachability tests were conducted using the EPA Method 1311 (TCLP). Plant and surface water samples were also analyzed.
4. Mineralogical properties of lead in bullet crust were compared with those in soils using x-ray diffraction (XRD) technique.

## SIGNIFICANT RESULTS ACHIEVED:

1. Soil samples in this range contained higher pH (6.73-7.62), organic matter (3.78-41.3%) and CEC compared to other shooting range soils.
2. Most surface soils contained more than 1,000 mg kg<sup>-1</sup> total Pb, exceeding EPA critical level of 400 mg kg<sup>-1</sup>. As expected, the highest Pb concentration (4.84%) was observed in the berm soil.
3. Although the total Pb is high, the adsorption of lead by CaCO<sub>3</sub>, exchange of Pb<sup>2+</sup> with Ca<sup>2+</sup> and the formation of lead hydroxide resulted in low ratios of TCLP-Pb/total Pb.
4. Significant downward migration of lead occurred in the soil profile due to enhanced solubilization of soil organic matter at alkaline pH.
5. Surface water showed a low level of total lead concentration.
6. Lead concentrations in grasses were positively correlated with soil Pb concentrations, and a considerable amount of lead was transported into the aboveground parts.
7. XRD analyses showed hydrocerussite Pb<sub>5</sub>(CO<sub>3</sub>)<sub>3</sub>(OH)<sub>2</sub> was predominant in both bullet crust and berm soil. In addition, a small amount of lead hydroxide was found in the berm soil.

**Table 1 Project milestones**

| <b>Tasks</b>      | <b>1st quarter</b> | <b>2nd quarter</b> | <b>3rd quarter</b> | <b>4th quarter</b> |
|-------------------|--------------------|--------------------|--------------------|--------------------|
| Sample Collection | ⊗                  | ×                  |                    |                    |
| Sample analysis   | ⊗                  | ×                  | ×                  |                    |
| Mobilization test |                    | ×                  | ×                  | ×                  |
| Remediation test  |                    |                    | ×                  | ×                  |
| Quarterly report  | ⊗                  | ×                  | ×                  | ×                  |
| Annual report     |                    |                    |                    | ×                  |

⊗: Task has been accomplished according to the originally proposed timetable.

×: Task needs to be accomplished in accordance with the proposal.

**INFORMATION DISSEMINATION ACTIVITIES:**

- ◆ A paper titled “Characterization of lead in a rifle/pistol shooting range in central Florida” was accepted for publication in Soil and Sediment Contamination
- ◆ A manuscript titled “Lead and As concentrations in a shooting range in Central Florida” was published in the Soil and Crop Science Society of Florida Proc., Vol. 60, 2001”

**TAG MEETINGS:**

- ◆ The research team is contacting the technical advisory group members for this project and scheduling a half-day TAG meeting at the University of Florida, Gainesville, FL. based on the time availability of all TAG members in the second quarter.

**WORKS TO BE ACCOMPLISHED DURING THE NEXT THREE MONTHS:**

- ◆ Effects of soil property on mobilization and retention of lead in shooting range soils.
- ◆ Lab tests on the effects of phosphate rock application on Pb immobilization in shooting range soils.
- ◆ Determine if bullet abrasion, as it passes through berm soil in shooting ranges, is a significant contributor to soil contamination and downward migration of lead in shooting range soils.