

ELEVENTH ANNUAL
STUDENT SHOWCASE

 **VIRTUAL**

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DEPARTMENT:

Physical and Environmental Sciences

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PROJECT TITLE:

Using Solar-Powered Algal Turf Scrubber to Reduce Selenium Concentration

Background

- Algal turf scrubbers (ATSTTM) are a technology that utilizes the natural processes of algae for water treatment
- Specifically used for nutrients
- Western Colorado soils have high Selenium (Se) concentrations, which can run off into bodies of water.
- Se is especially prominent in irrigation runoff.
- Problems from Se:
 - Bioaccumulation in the food chain cause many issues in large predatory fish and waterfowl, which include, liver necrosis, white muscle disease, multiple organ degenerations and cancer, noticeable birth defects in fish and waterfowl populations where Se bioaccumulates.
- Little to no research has been conducted on ability of ATS to remove Se.
- Successful implementation would provide a cost-effective and efficient method for Se treatment in the region.

Objectives

- Design/build pilot scale ATSTTM
- Determine appropriate site
- Install
- Determine the ability of ATS in removing Se

Methods (Design)

- Preliminary water sample analysis from several sites was conducted.
- Inductively coupled plasma mass spectrophotometry (ICP) was used to determine Se concentration.
- Pilot-scale ATS was constructed using a large aqua-tank (4' x 6' x 1') with a rubber liner covered by 4 mm mesh screen to allow algal growth (Figure 1).
- Tipping bucket implementation for even flow
- The ATS was installed at a local irrigation return flow that has elevated levels of Se.
- Naturally-occurring algae samples located upstream of the site was introduced onto the mesh screen to speed up the algae growth process.
- A solar-powered pump pumps water from the ditch into the ATS system where the algae can begin to remove Se.



Fig 1. Picture showing pilot-scale (ATSTTM) system in place running water. Water is pumped and returned in to a continuously flowing irrigation outflow.



Fig. 2 Overhead view of the system



Fig. 3 Setting up system



Fig. 4 Full Size (ATSTTM) tipping bucket

Preliminary Results

Location Source	Selenium Concentration (µg/L)
EPA recommended limit	4.6
Irrigation inflow	1.6
Irrigation outflow	25
Canal with water from Gunnison River	3.7
Gravel pit near CO River	1.4

Future studies

- Continuous monitoring of our system will determine efficiency of algae to remove Se
- Potential construction of larger scale ATS
- Determine if ATS can help with voluntary nutrient reduction requirements
- Potential for other metals removal
- Conduct a cost-benefit analysis.

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