Clothianidin: Prospective Groundwater Study

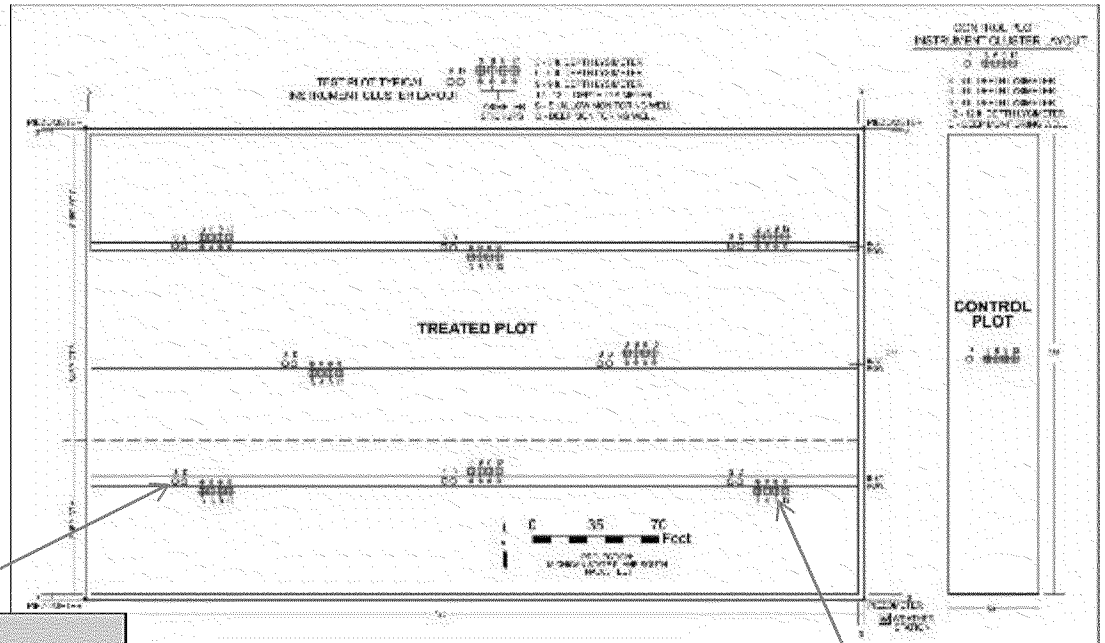
Andrew Newcombe (Arcadis)

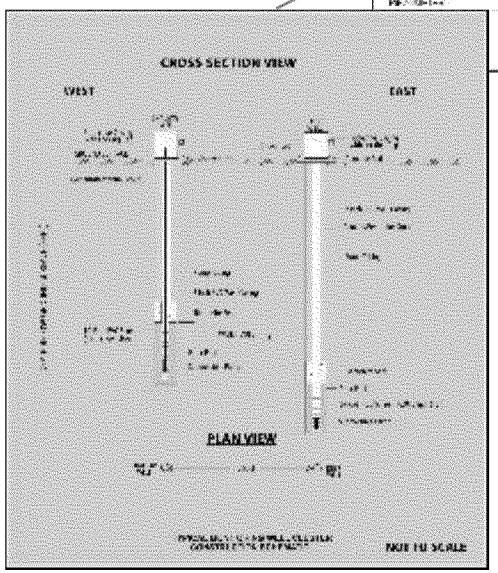
Clothianidin PGW Study

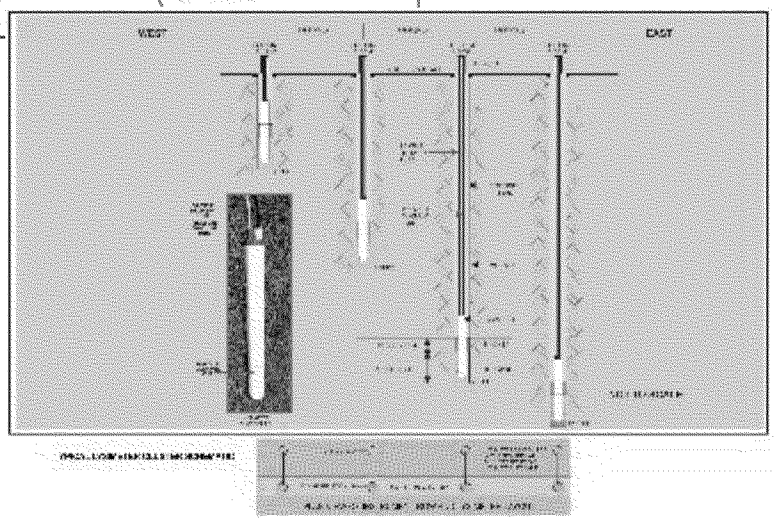
Clothianidin PGW Study – Site Identification

- The PGW study is being conducted to fulfill the requirements of a Data Call-in request.
- Health Canada Pest Management Regulatory Agency (PMRA) accepted a PGW study in lieu of the data requirement for the conduct of a lysimeter study.
- To satisfy both regulatory agencies, the study should be located in a common ecoregion.
- A GIS site identification refinement phase was conducted to identify potential areas of interest in the States of Michigan and Wisconsin.
  - 90th percentile vulnerability (low slope, coarse soil texture, low organic matter, soil group)
  - USGS Groundwater Watch database (water depth > 10 < 30 ft.)
  - USDA National Agricultural Statistics Service (NASS) Cropland (turf & non-neonicotinoid use)
  - Common ecoregion
- 25 turf farms / 110 sites identified as candidates for further evaluation and telephone interviews.
- 3 sites met screening criteria, and detailed soil and aquifer characterization activities conducted.
- Site TPP-MI-003 (Three Rivers, St. Joseph County) selected.

Clothianidin PGW Study – Site Instrumentation







Clothianidin PGW Study – Site Characteristics

Properties	Result
Topography	Flat, < 0.5% slope
NRCS Soil Series	Oshtemo sandy loam
Surface Soil USDA texture	Sandy loam
Surface Soil pH	6.1
Surface Soil Organic Matter (%)	0.8
Subsoil Properties	sandy loam / loamy sand with coarse-textured sand below 30 in. No restrictive layers present
Depth to Groundwater (ft.)	13.5 – 16.5
Aquifer Porosity (%)	39 (loamy sands, sands, gravel)
Aquifer Hydraulic Conductivity (ft./day)	174 -254 (transmissive aquifer)

Clothianidin: A Small-Scale Prospective Groundwater Monitoring Study following Application of ARENA® 50 WDG to Turf in an Eco-Region Common to the United States and Canada: (1st Interim Report - Characterization and Instrumentation Report)

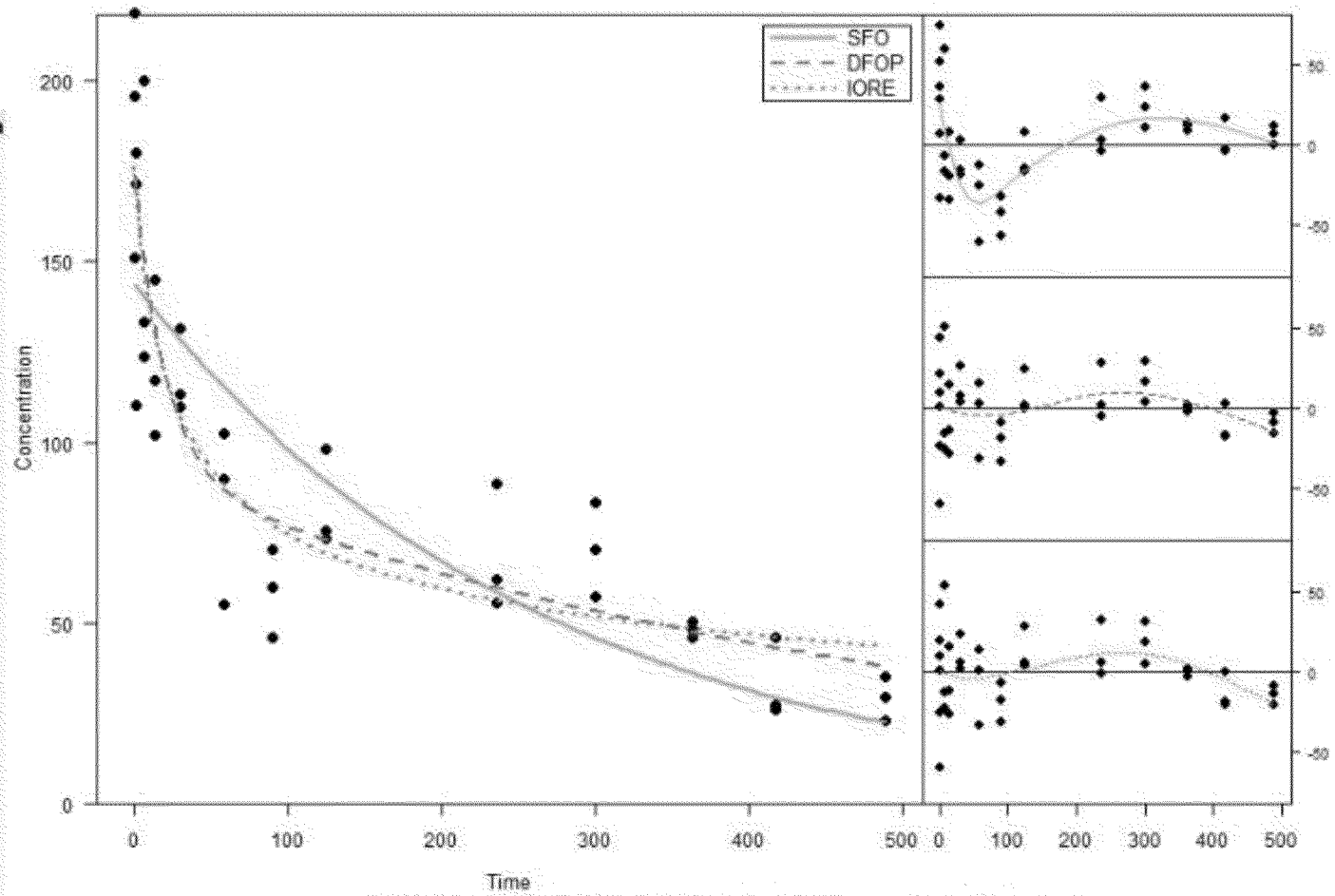
Clothianidin PGW Study – Application

- On July 30, 2014, clothianidin (ARENA® 50 WDG), applied as a single broadcast-type application to established Kentucky Bluegrass turf.
- Clothianidin applied at the maximum seasonal rate of 0.4 lb. ai/A.
- Following the clothianidin application, a single broadcast application of potassium bromide was made to the treated plot.
- Potassium bromide applied at approximately 89.1 lb. per acre.
- Applications made using conventional ground-spraying equipment and no mechanical incorporation was performed.

Clothianidin Soil Results

NA

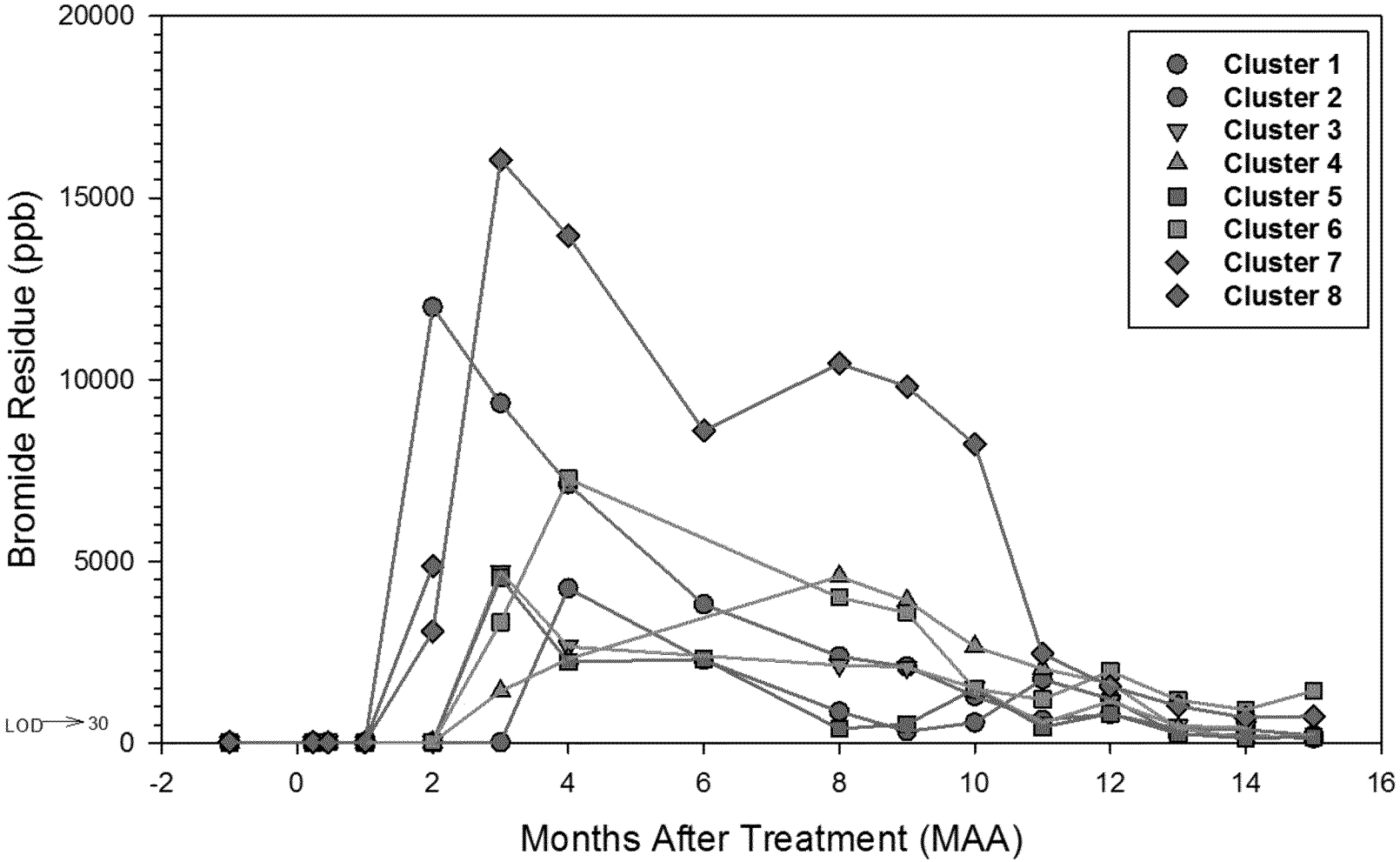
DA1A	Sum_g-ha
0	219
0	151
0	196
1	172
1	180
1	110
7	124
7	200
7	133
14	117
14	145
14	102
30	113
30	110
30	131
59	90
59	103
59	55.0
90	46.1
90	60
90	70.2
125	97.9
125	73.2
125	75.6
236	62.2
236	55.7
236	88.7
300	57.3
300	70.2
300	83.2
363	50.3
363	45.9
363	48.2
418	27.3
418	26.1
418	46.2
489	23.2
489	29.7
489	35.2



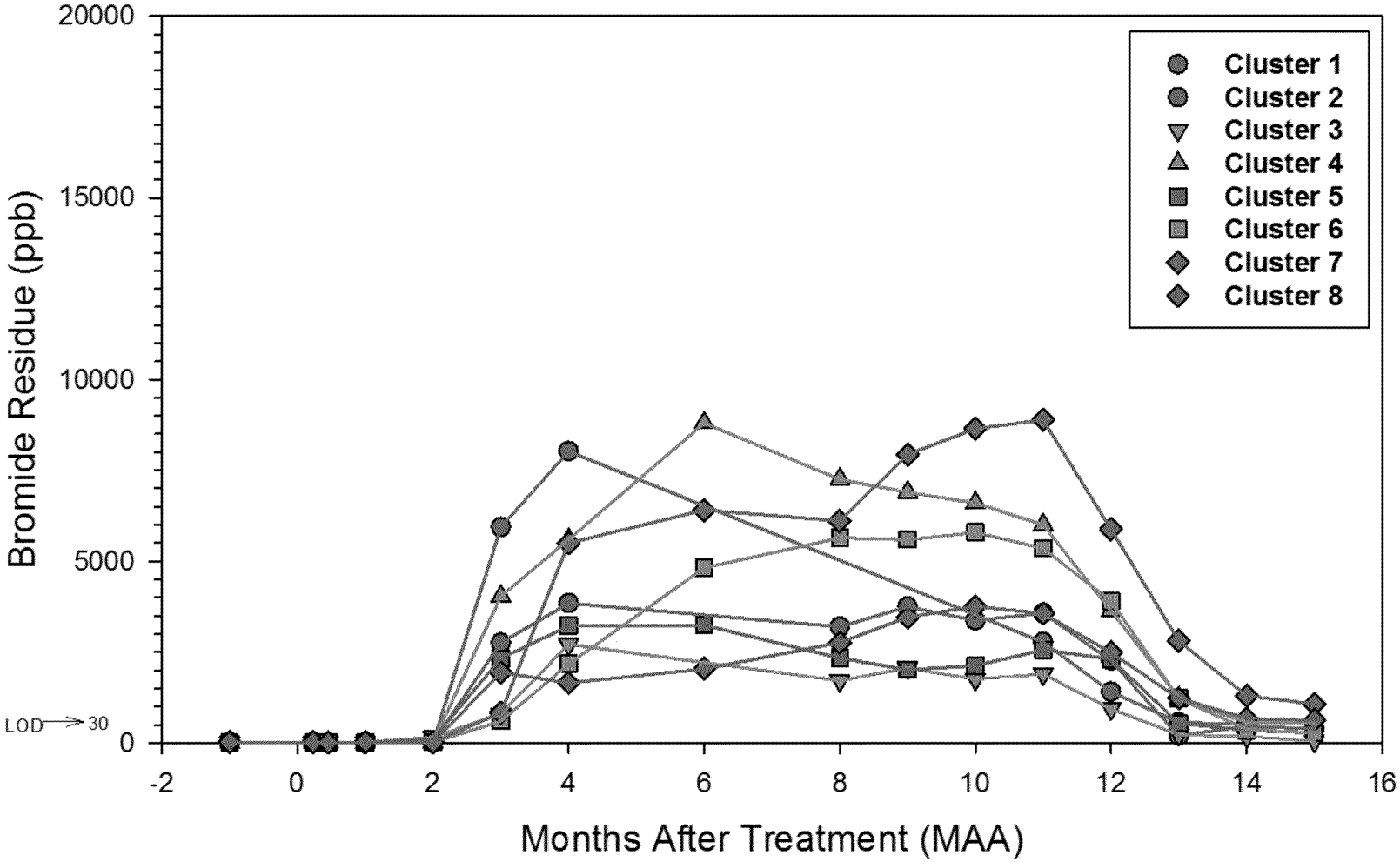
	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	183	607	20	144	k = 0.00379
DFOP	57.7	930	11	174	f = 0.475, k_0 = 0.0498, k_1 = 0.00178
IORE	59.5	6302	11	176	N = 3.8, k = 1.83e-08

S_C	2.06e+04
S_{SFO}	3.25e+04
Slow $t_{1/2}$	389
$t_{R\ IORE}$	1.9e+03

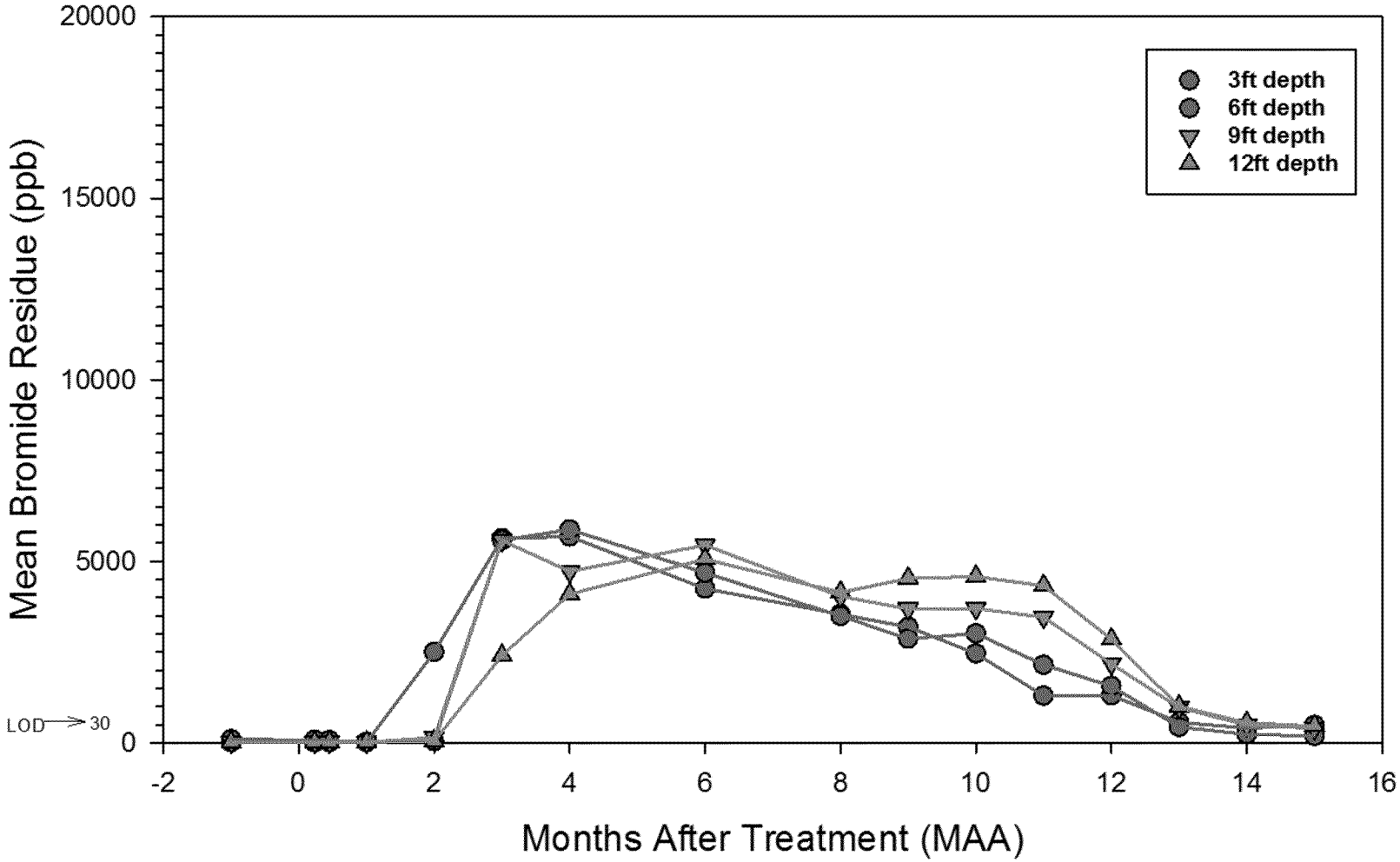
Bromide Lysimeter Results (3 ft. depth)



Bromide Lysimeter Results (12 ft. depth)

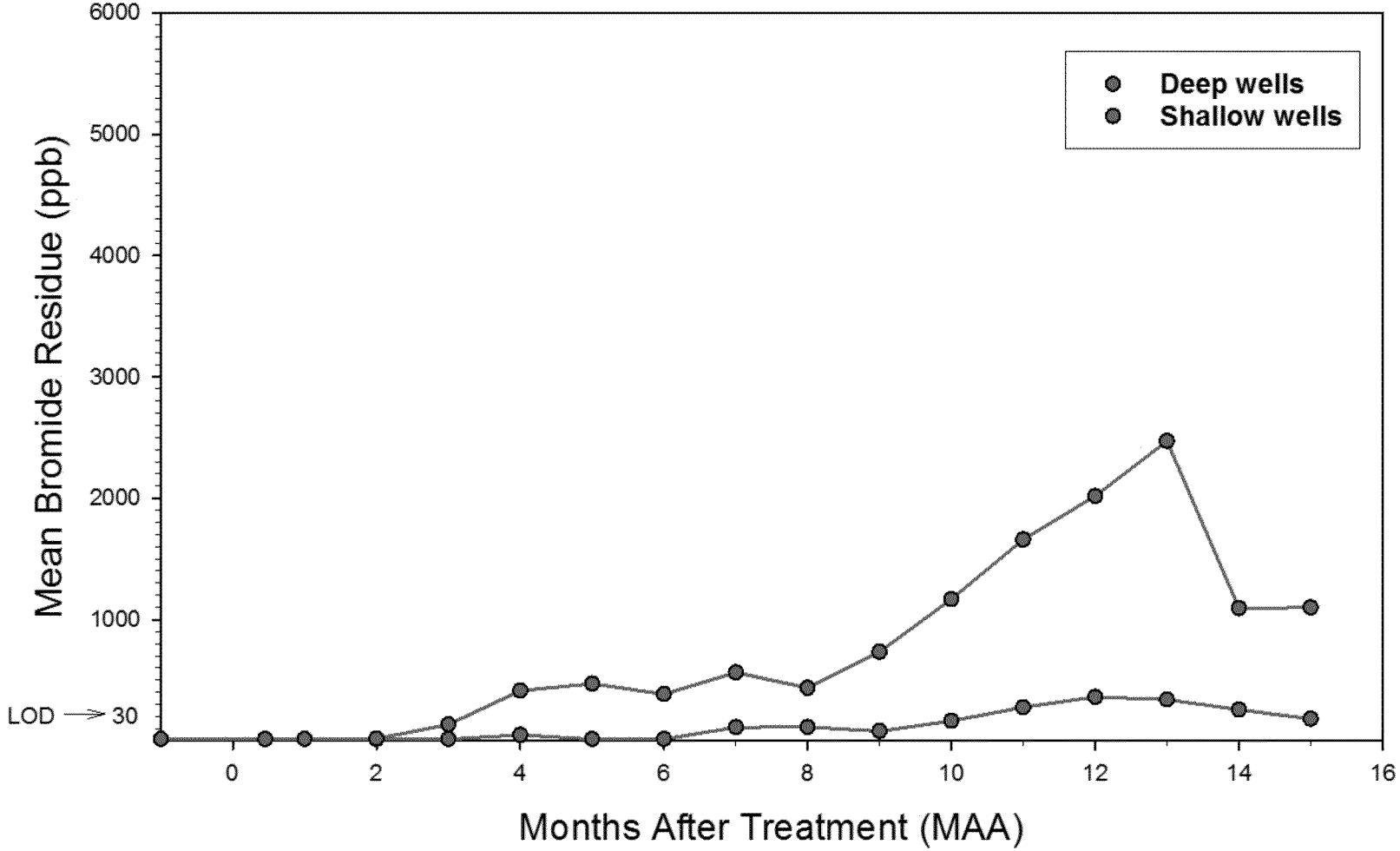


Bromide Lysimeter Results (All Depths)

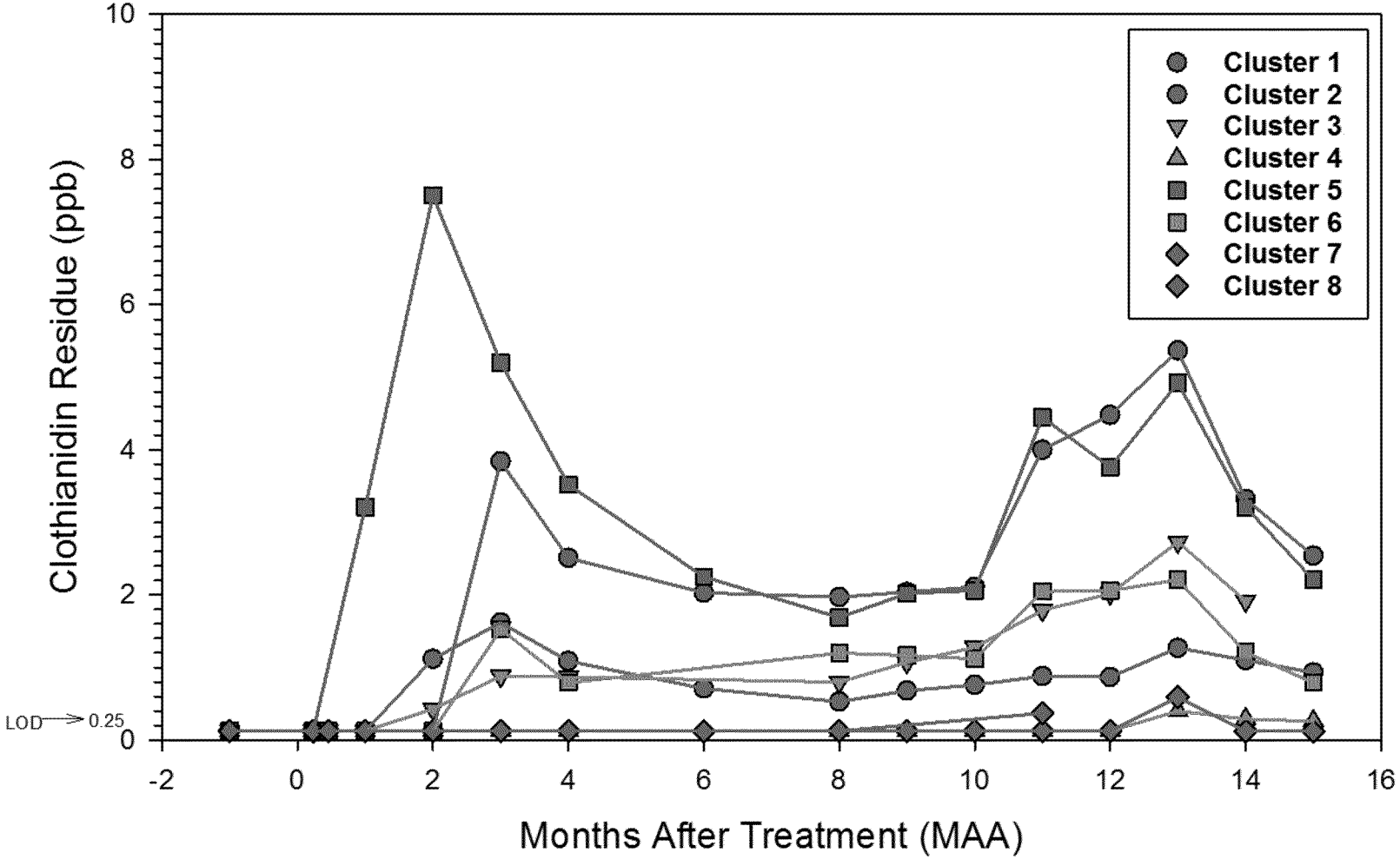


Bromide Groundwater Results

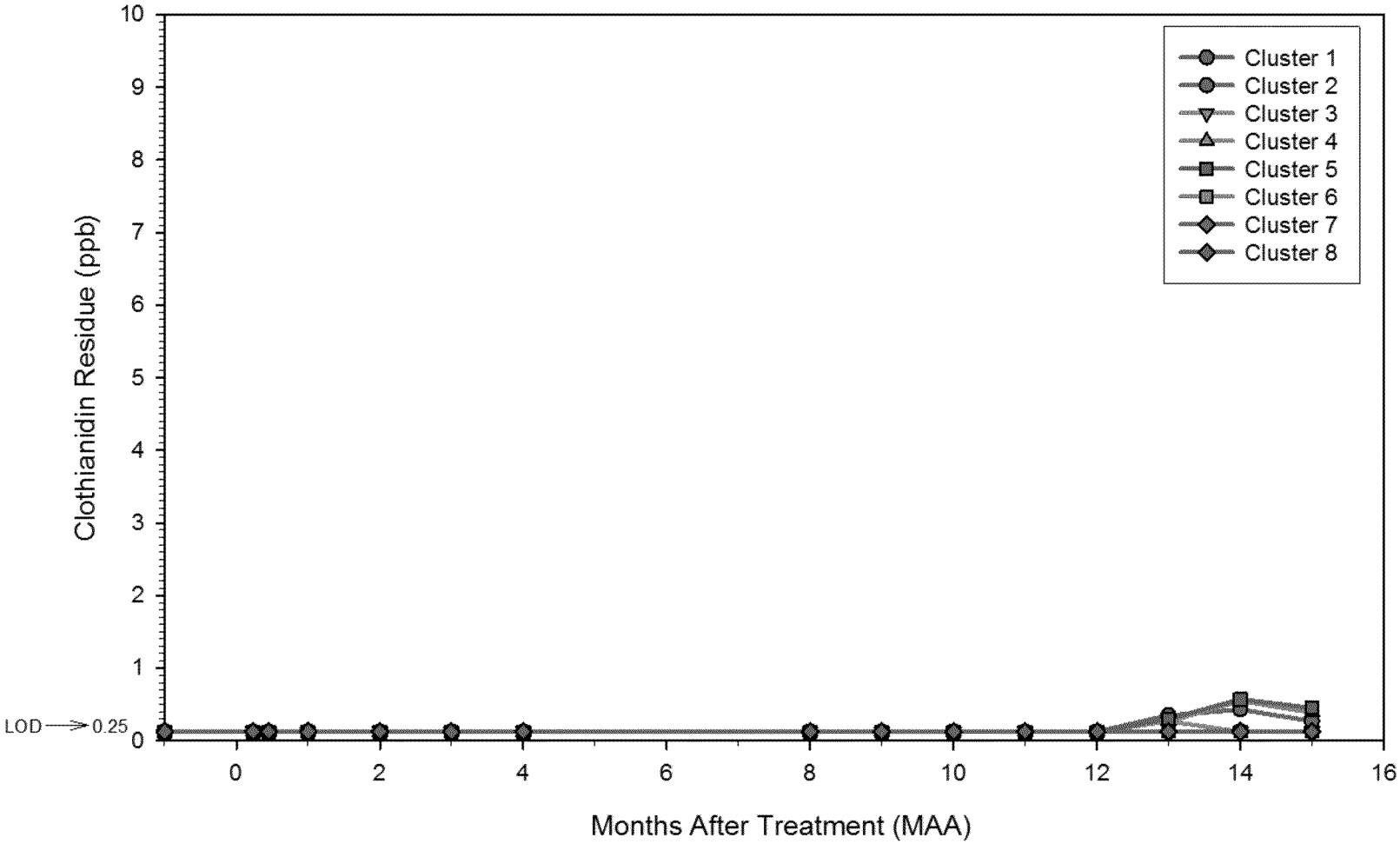
Note scale change



Clothianidin Lysimeter Results (3 ft. Depth)

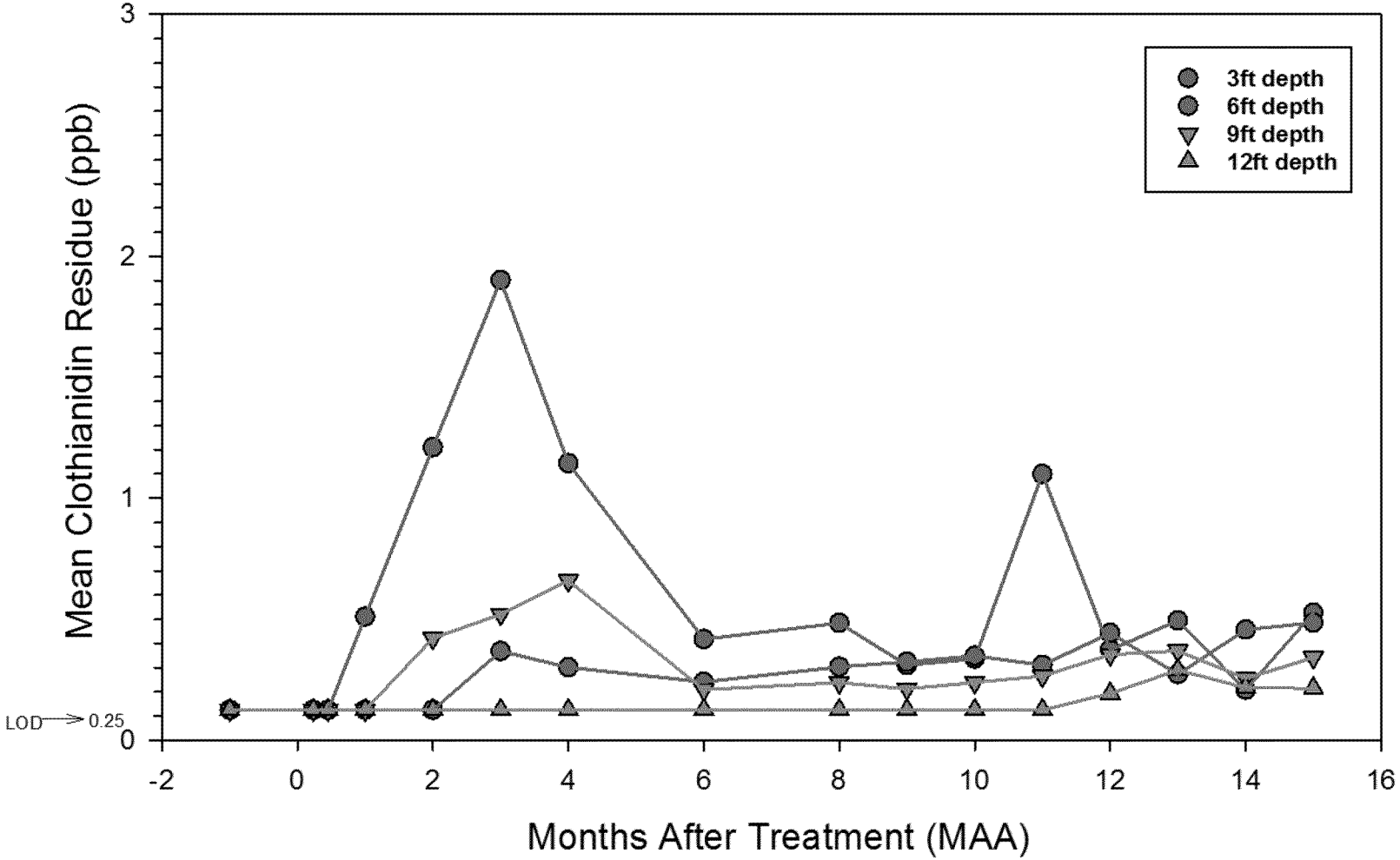


Clothianidin Lysimeter Results (12 ft. Depth)



Clothianidin Lysimeter Results (All Depths)

Note scale change



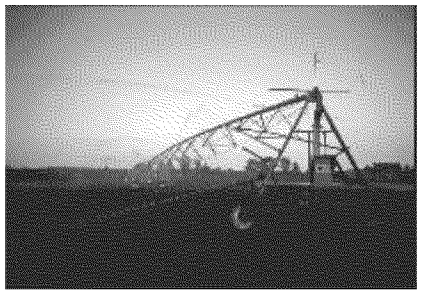
Results Through 15 MAA

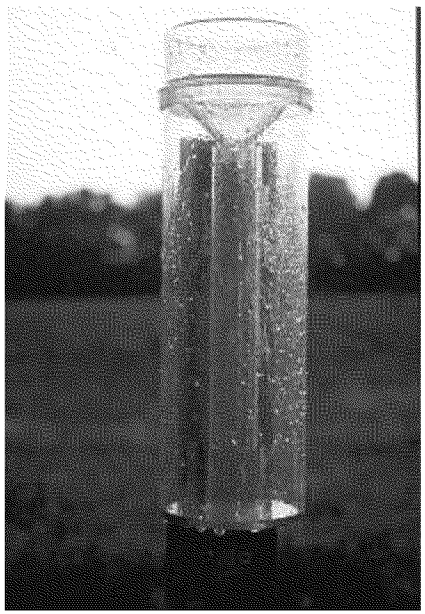
Matrix	Analyte	Result
Soil	Clothianidin	256 ppb (0 DAA) – 28.2 ppb (14 MAA) DT50 = 389 days
Soil Pore Water	Bromide	• First breakthrough observed at 3 MAA • The bromide peak has moved through the lysimeter sampling profile
Groundwater	Bromide	• Recharge observed in shallow wells at 4 MAA • Bromide residues have peaked in shallow wells
Soil Pore	Clothianidin	• First detection at 1 MAA (3.21 ppb) at 3-ft. • Max. residue = 7.51 ppb at 2MAA (3 ft. depth) • No residues > LOQ observed in any of the 12-foot lysimeter units.
Groundwater	Clothianidin	No detectable residues observed

EPA-HQ-2016-007648_00000620

Moisture Input Through 15 MAA

- The study moisture input target is 120% of the local historical monthly precipitation average or the turf moisture requirement, whichever is greater.
- Forty six irrigation events totaling ~27.5 inches have been applied to the treated plot.
- Approximately 43.4 inches of snowfall has been recorded at the nearest NOAA weather station.
- Total moisture input (precipitation and irrigation) is approximately 75.6 inches; 15% more than the study target.





Clothianidin PGW: Next steps

- Continue regular soil-pore water and groundwater sampling activities through 24 MAA (July 2016).
- Continue regular submittal of quarterly reports summarizing field and analytical data through 24 MAA.
- Assuming current analytical data trend continues through 24 MAA prepare a summary report requesting study termination.
- After 24 MAA, propose reducing sampling frequency to quarterly until US EPA has reviewed termination report. Samples collected will not be analyzed but will be stored frozen awaiting termination request.

EPA-HQ-2016-007648_00000622

Clothianidin PGW: Reports submitted to EPA, PMRA and CDPR

Date	MRID#	Report Title	Comments
May 2015	49627501	1st Interim	Site characterization and Instrumentation
May 2015	49627502	2nd Interim	Application and analytical results 0-3 MAA
July 2015	49675001	3rd Interim	Application and analytical results 0-6 MAA
July 2015	49675002	Geospatial Vulnerability Assessment	Leaching vulnerability of the study site. Shown to be representative of vulnerable locations where clothianidin may be used on turf within the United States and Canada.
Oct 2015	49733301	4th Interim	Application and analytical results 0-9 MAA
Dec 2015	49803201	5th Interim	Application and analytical results 0-12 MAA
Feb 2016		6th Interim	Application and analytical results 0-15 MAA