BIOLOGICAL PERFORMANCE OF MICRONIZED COPPER WOOD PRESERVATIVE FORMULATIONS IN FIELD AND LABORATORY TESTS

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Objectives

Evaluate the biological performance of different micronized copper wood preservative systems in laboratory and field tests

Bridge and compare the data from the different tests in order to develop a broader context for the biological performance of the studied micronized copper wood preservative systems

Outline

- **Preservative Systems**
- **Soil Block Decay Test (Laboratory)**
- **Ground Contact Decay Test** (Field – Hawaii)
- **Data Bridging**
- **Conclusions**

Wood Preservative Systems

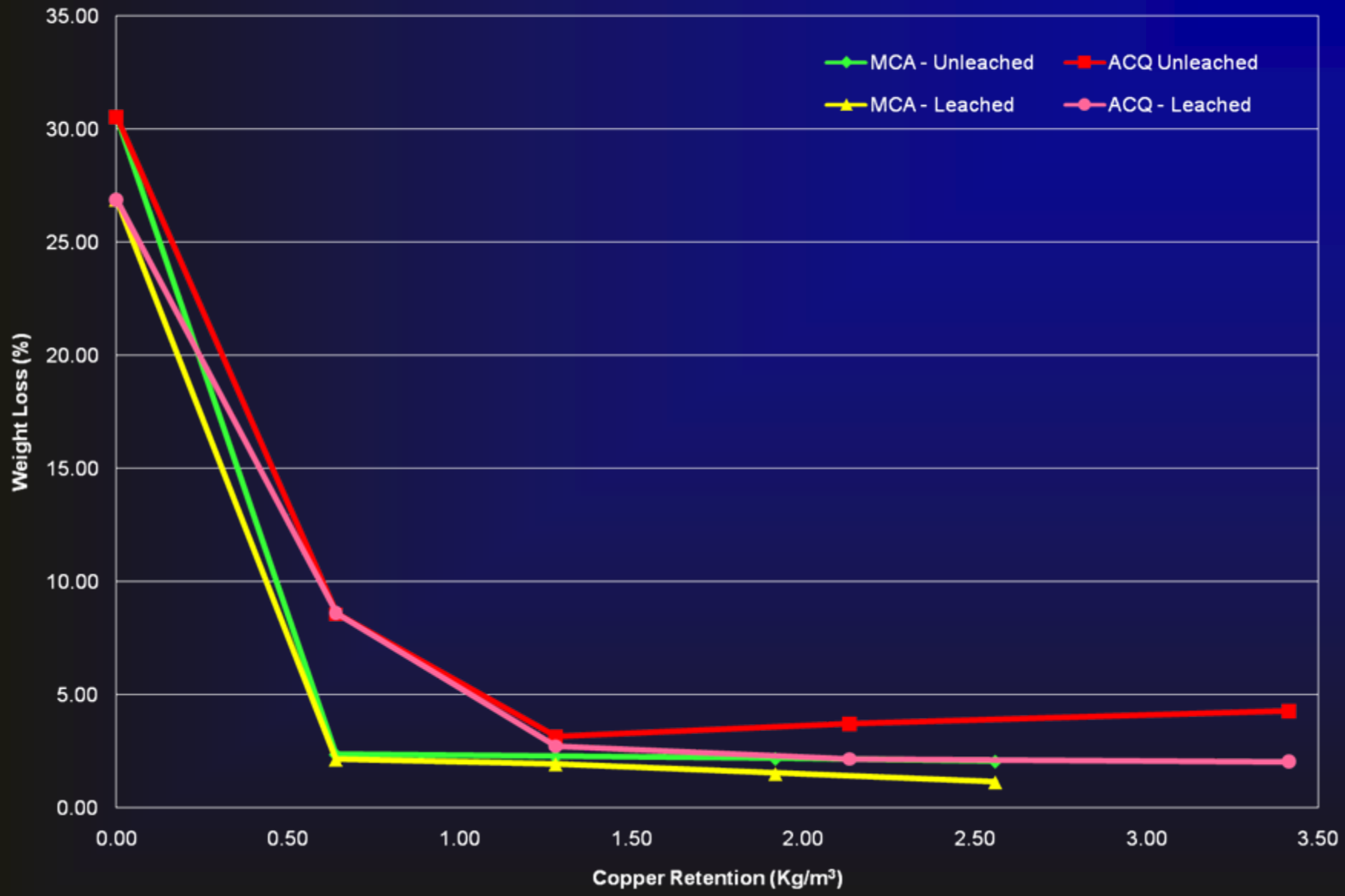
(Expressed as Cu)

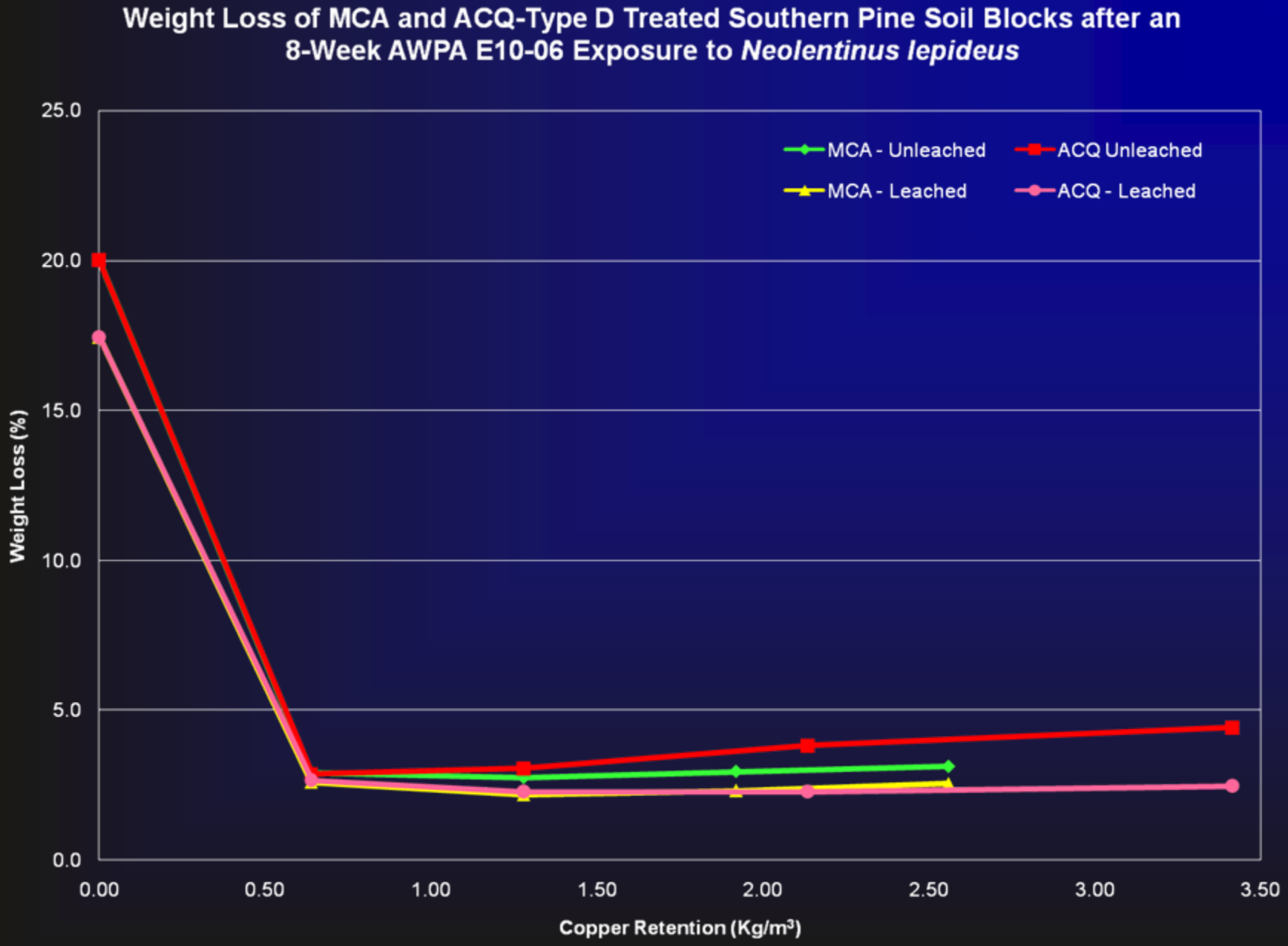
Preservative System	Abbreviation	Component 1	Component 2	Ratio (1:2)
Micronized Copper Azole	MCA	Micronized Copper	Tebuconazole	25:1
Micronized Copper Quat	MCQ	Micronized Copper	DDAC*	1.6:1
Alkaline Copper Quat (Type D)	ACQ-D	Copper Oxide	DDAC*	1.6:1

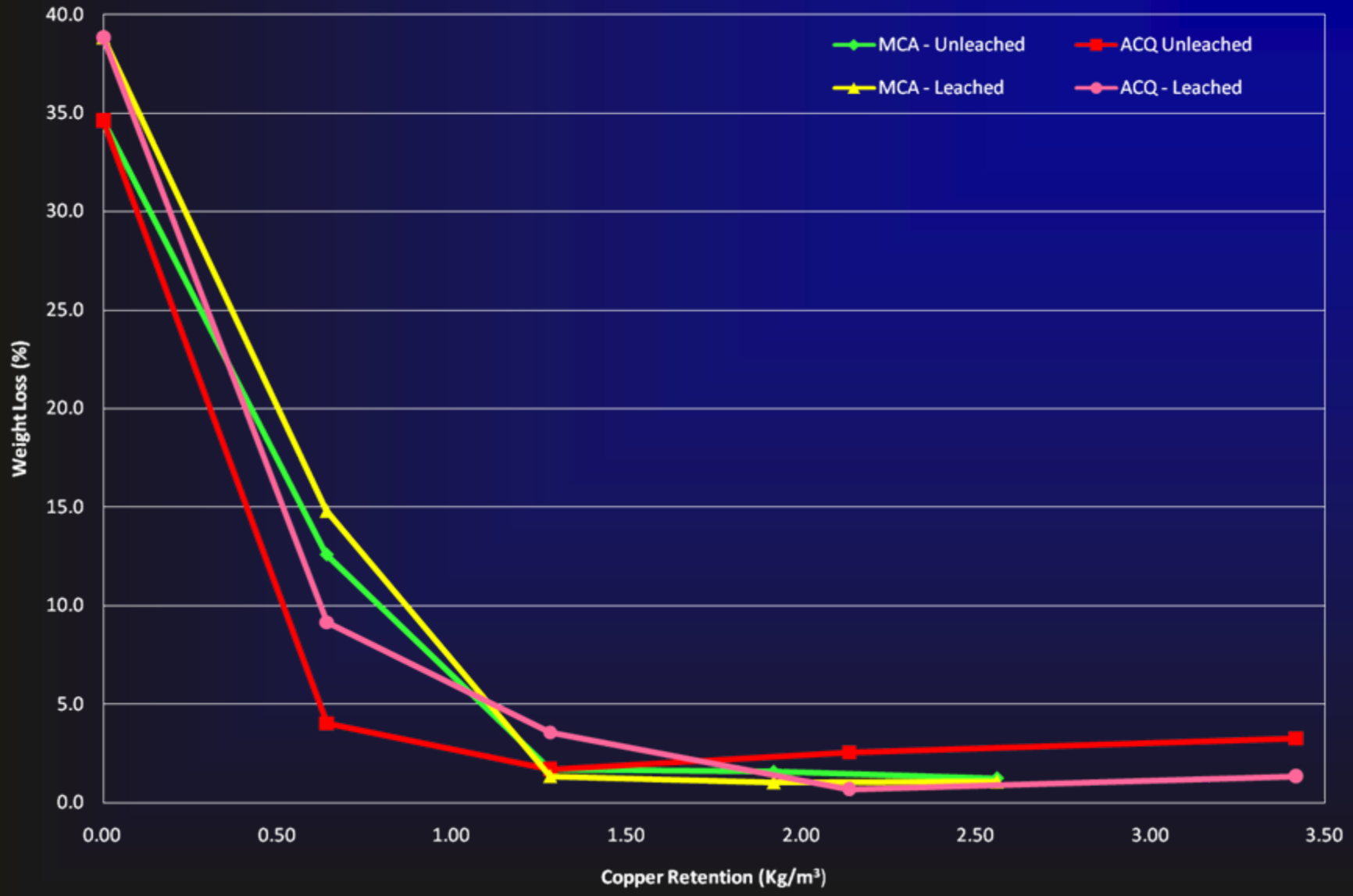
* DDAC = DDA Carbonate/Bicarbonate

Soil Block Decay Test

- AWPA E10-06 (8-Week Exposure)
- MCA -*vs*- ACQ-D
- Three Brown Rot Fungi
  - ✓ *Gloeophyllum trabeum* ATTC11539x
  - ✓ *Neolentinus lepideus* ATTC12653
  - ✓ *Postia placenta* MAD 698 (copper tolerant)
- Unleached and Leached
- Specimens treated by Michigan Tech with preservative formulations provided by Osmose


Weight Loss of MCA and ACQ-Type D Treated Southern Pine Soil Blocks after an 8-Week AWPA E10-06 Exposure to *Gloeophyllum trabeum*
MCA - Unleached
ACQ Unleached
MCA - Leached
ACQ - Leached
Weight Loss (%)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
Copper Retention (Kg/m³)


Weight Loss of MCA and ACQ-Type D Treated Southern Pine Soil Blocks after an 8-Week AWPA E10-06 Exposure to Neolentinus lepideus
MCA - Unleached
ACQ Unleached
MCA - Leached
ACQ - Leached
Weight Loss (%)
25.0
20.0
15.0
10.0
5.0
0.0
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
Copper Retention (Kg/m3)


Weight Loss of MCA and ACQ-Type D Treated Southern Pine Soil Blocks after an 8-Week AWPA E10-06 Exposure to *Postia placenta*
MCA - Unleached
ACQ Unleached
MCA - Leached
ACQ - Leached
Weight Loss (%)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
Copper Retention (Kg/m³)

Soil Block Decay Test Results

- MCA and ACQ effectively controlled decay by all three test fungi at most of the retentions studied.

- Estimated Activity Threshold (Kg/m^3 Cu) of MCA and ACQ-Type D after an 8-Week AWPA E10-06 Decay Test

Fungus	MCA	ACQ - D
Gloeophyllum trabeum	< 0.64	0.64 – 1.28
Neolentinus lepideus	< 0.64	< 0.64
Postia placenta	0.64 – 1.28	0.64 – 1.28

Ground Contact Decay Tests

- AWPA E7

- Hawaii (2 Sites)
  - ✓ MTU Mountain View Field Test Site
  - ✓ MTU Maunawili Field Test Site

- Two Tests
  1. 52 Months
  2. 40 Months

- Specimens treated by Michigan Tech with preservative formulations provided by Osmose

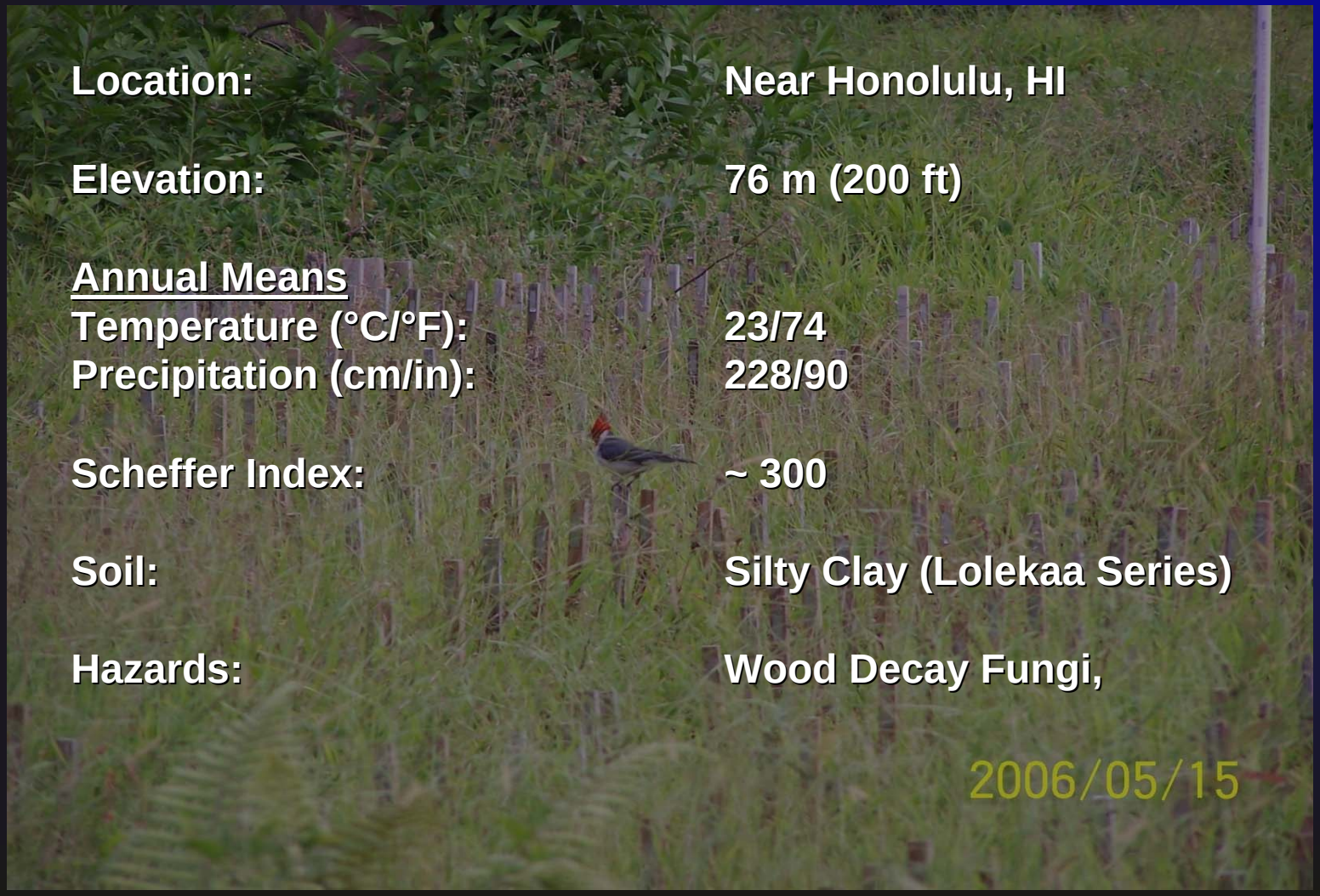
MTU Mountain View Field Test Site

(Exposure: November 2003-November 2005)

[1] T.C. Scheffer. For. Prod. J. 21(10):25-31.

MTU Maunawili Field Test Site

(Exposure: February 2006 - Present)



Location: Near Honolulu, HI

Elevation: 76 m (200 ft)

Annual Means

Temperature (°C/°F): 23/74

Precipitation (cm/in): 228/90

Scheffer Index: ~ 300

Soil: Silty Clay (Lolekaa Series)

Hazards: Wood Decay Fungi,

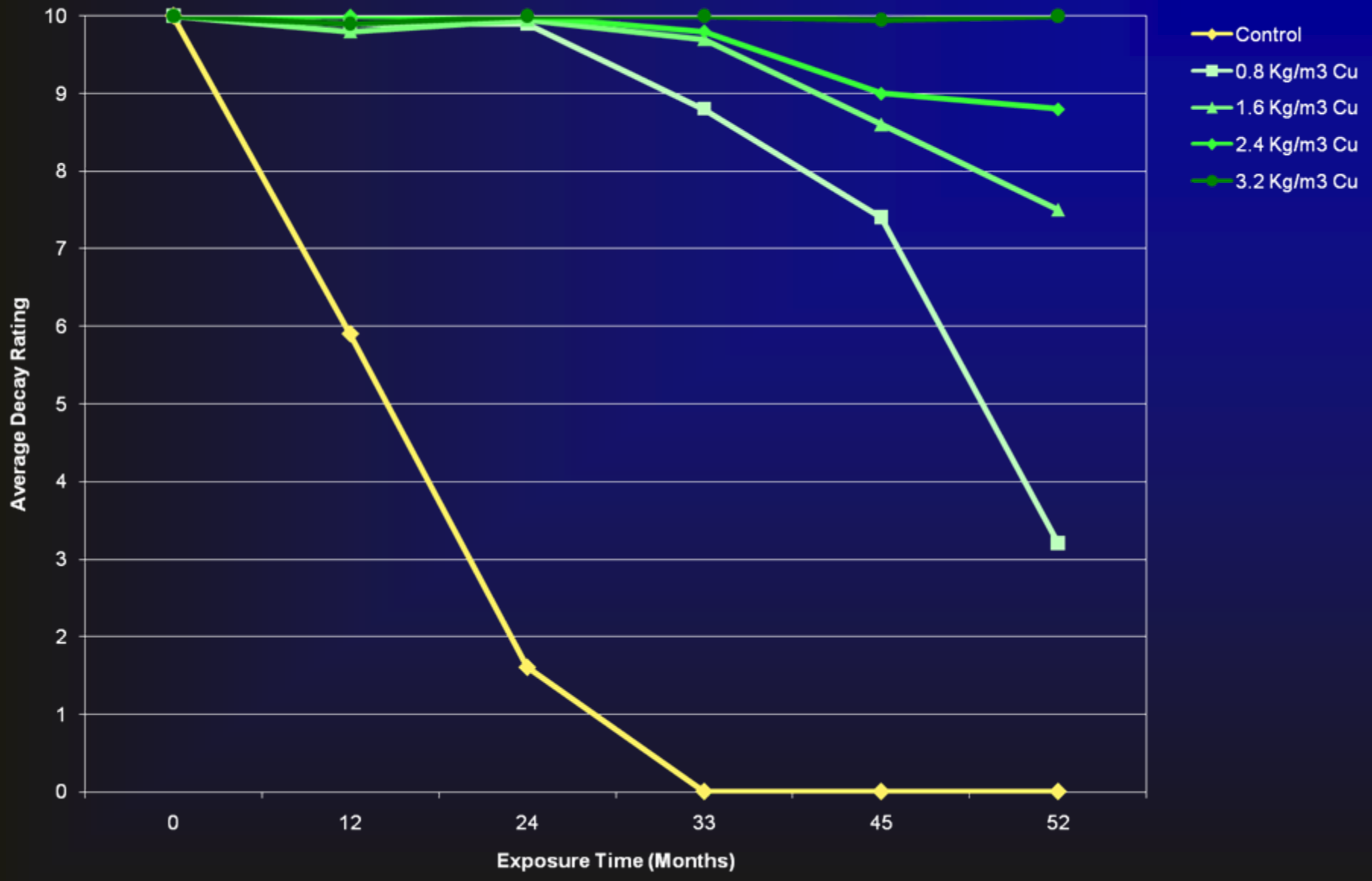
Ground Contact Decay Test 1

- MCQ
- Recommended Retentions* (as Kg/m^3 Cu)

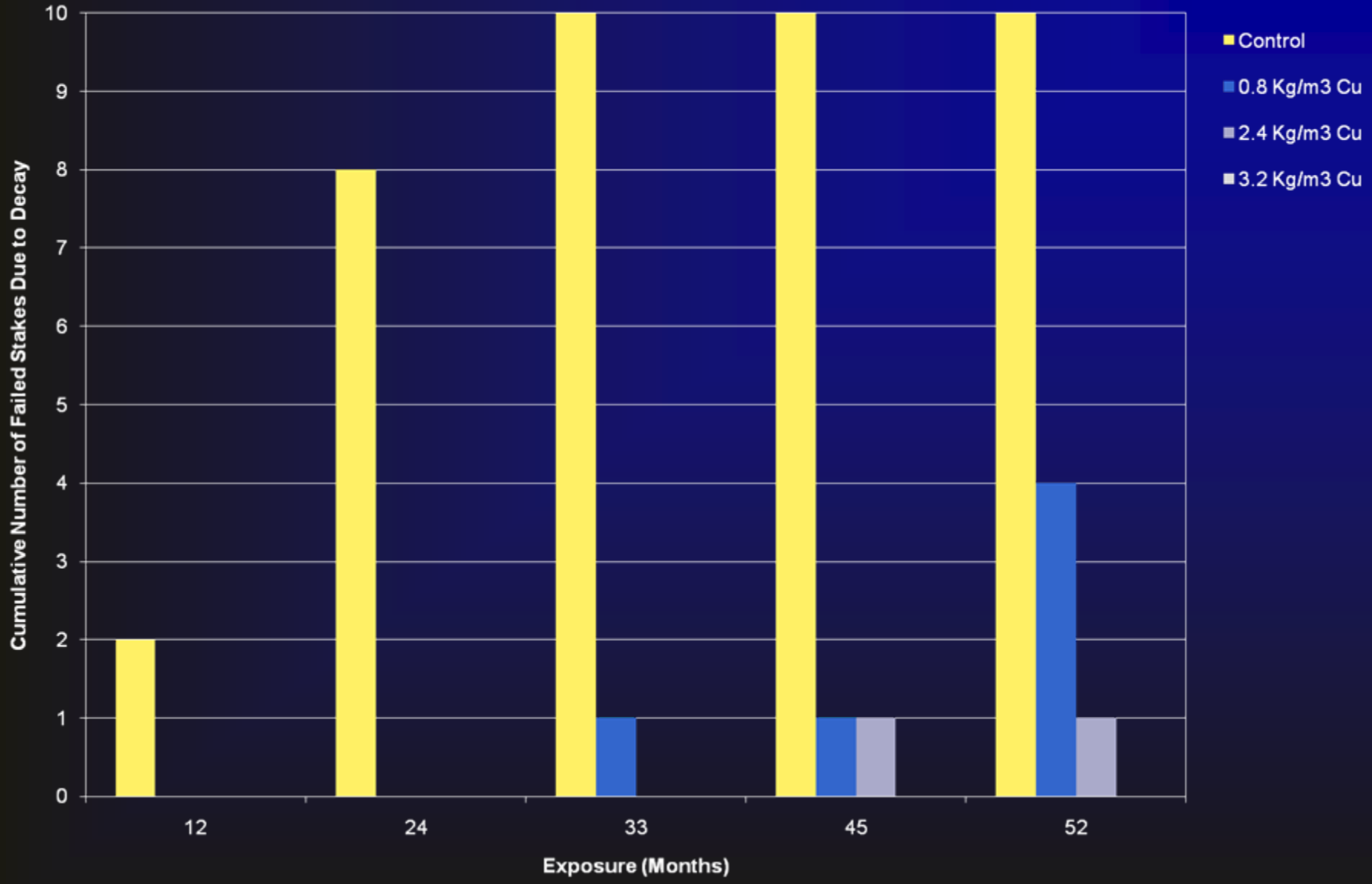
Preservative	UC3	UC4A	UC4B
MCQ	1.28	2.8	5.1

* Retentions shown are from ICC-ES : ESR-1980

Average Decay Ratings of MCQ Exposed in Ground-Contact in Hawaii



Cumulative Stake Failures after 52 Months of Ground-Contact Decay Test 1 Exposure in Hawaii



Ground-Contact Decay Test 1 Results

- All untreated controls failed by 33 months (most failed by 24 months).
- After 52 months, MCQ treated stakes are performing well against decay at the 3.2 Kg/m^3 Cu retention (Total Retention CuO + DDAC = 6.0).
- There is a clear dose response for MCQ treated stake decay performance.

Ground Contact Decay Test 2

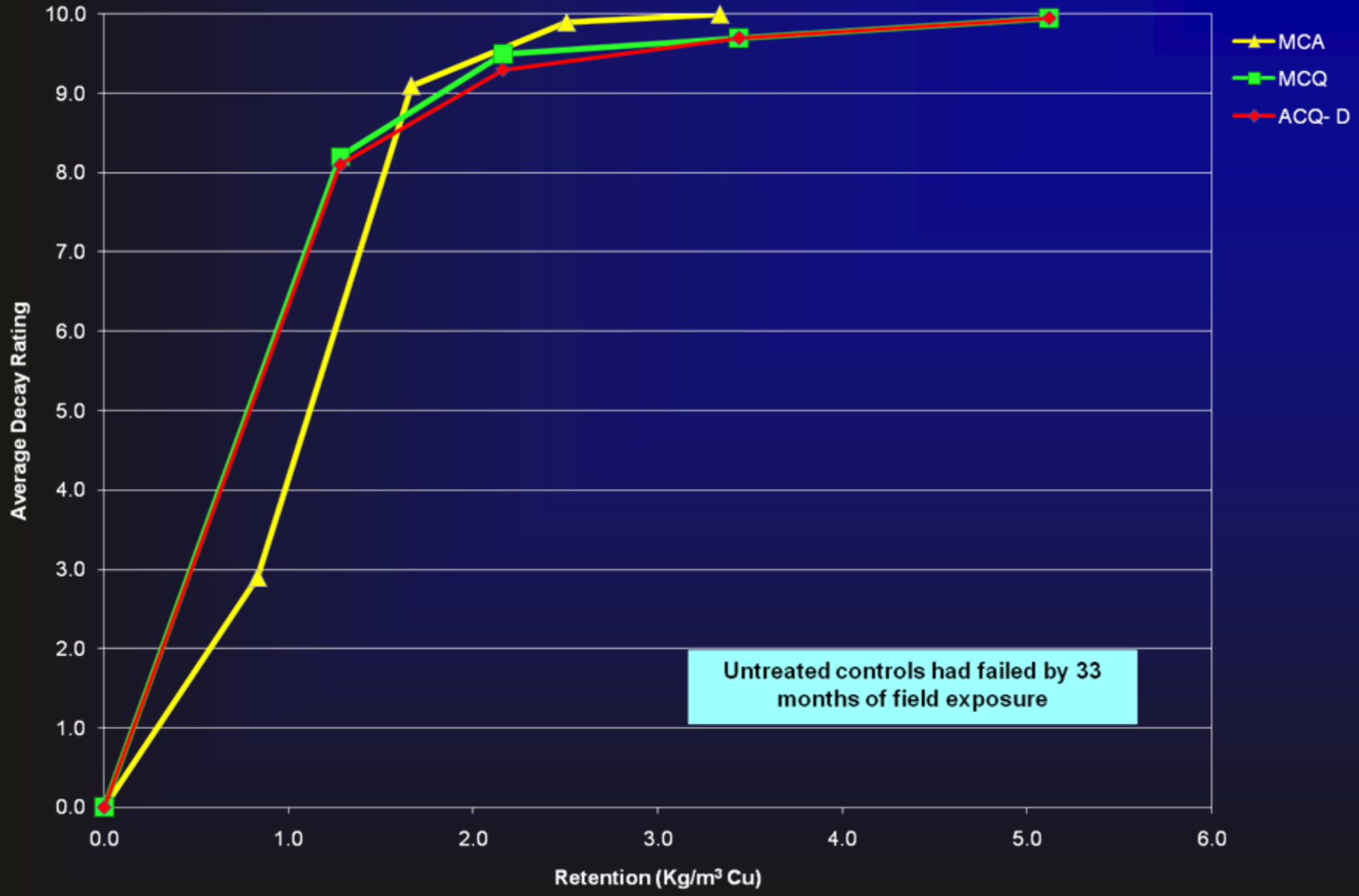
- MCA -*vs*- MCQ -*vs*- ACQ-D

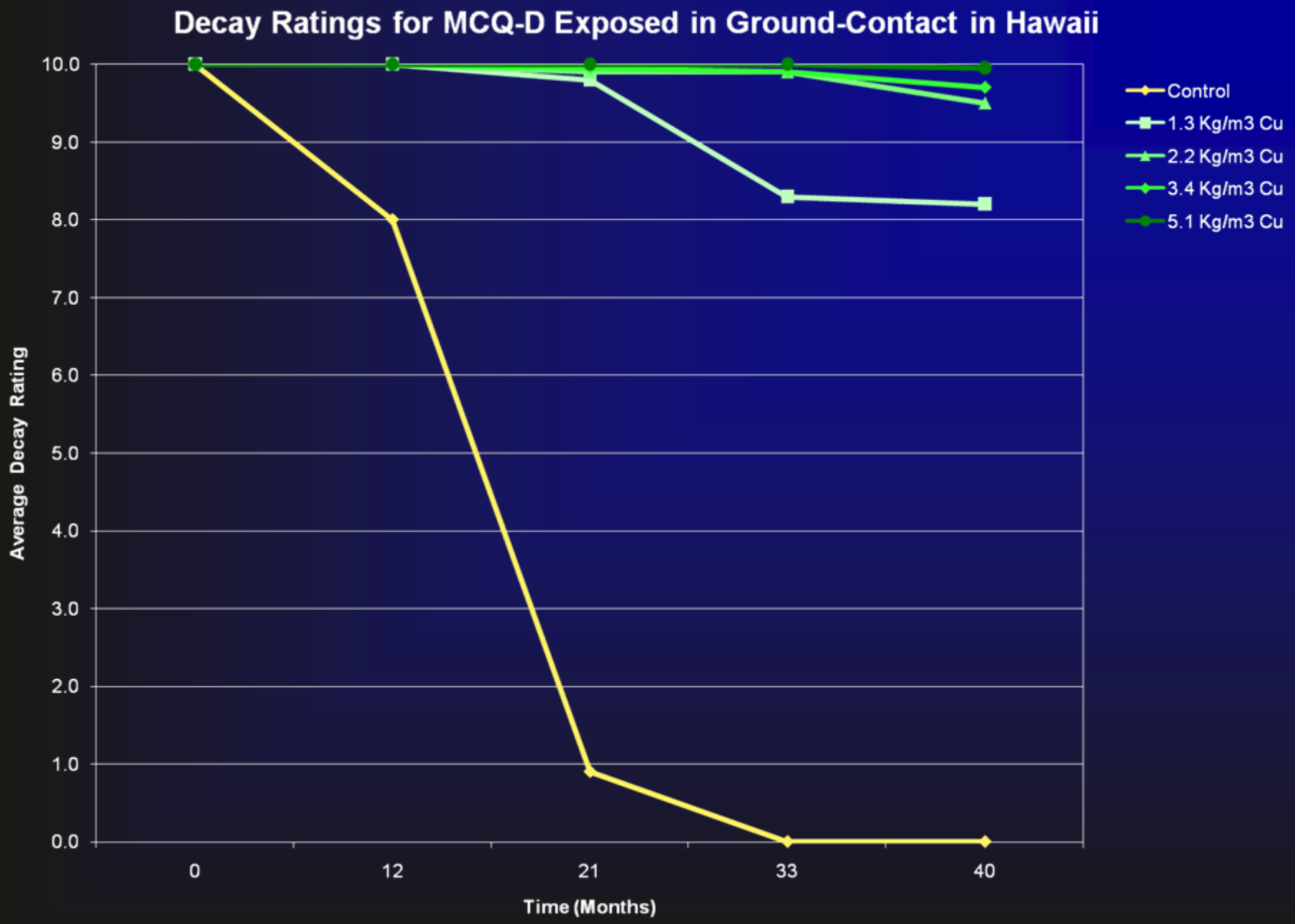
- Recommended Retentions* (as Kg/m^3 Cu)

Preservative	UC3	UC4A	UC4B
MCA	0.92	2.3	3.6
MCQ	1.28	2.8	5.1
ACQ-D	1.67	3.3	5.1

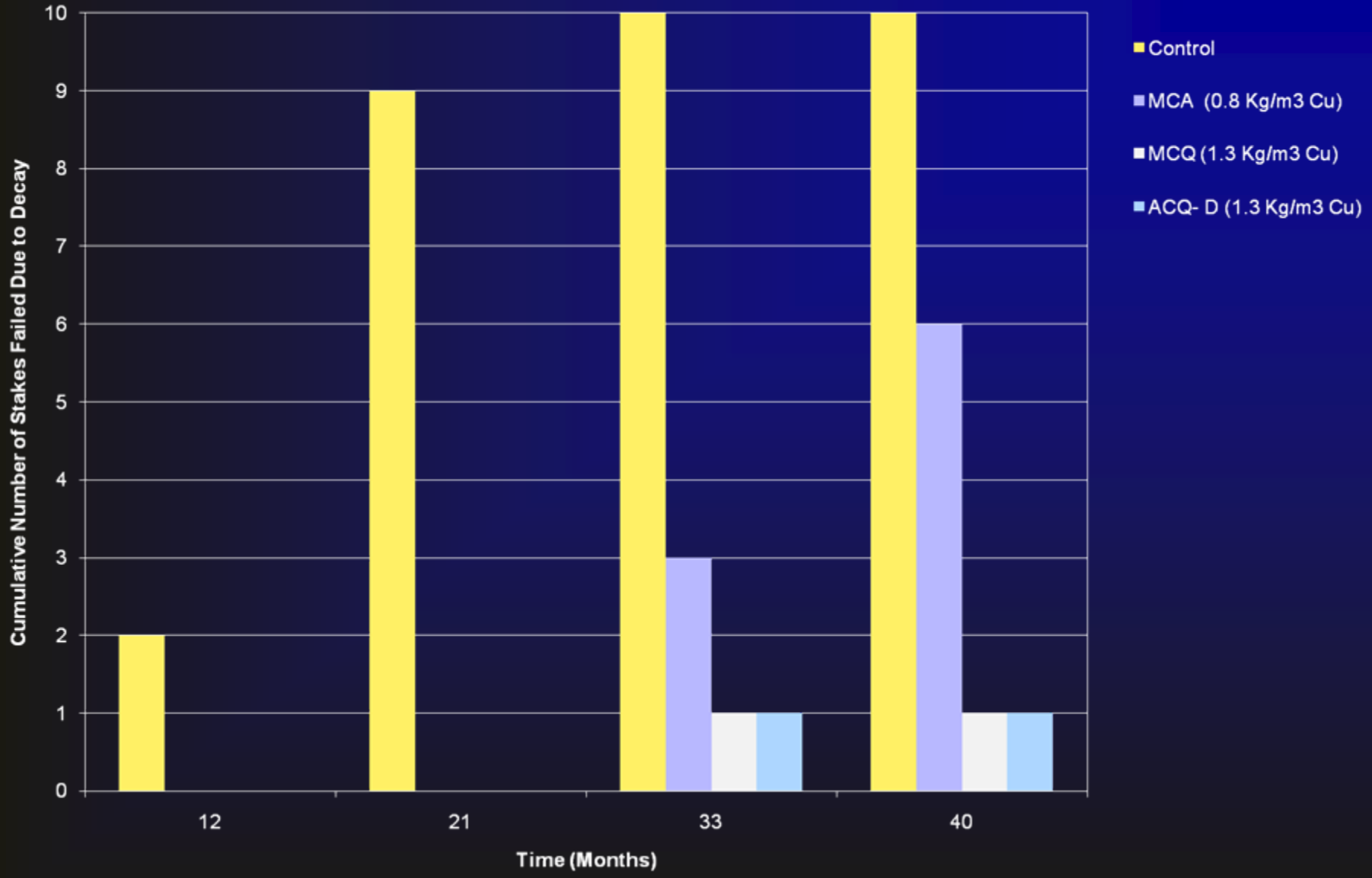
* Retentions shown are from ICC-ES: ESR 1980

Average Decay Rating of Micronized Copper Preservatives after 40 Months of Ground-Contact Field Exposure in Hawaii




Decay Ratings for MCQ-D Exposed in Ground-Contact in Hawaii
Average Decay Rating
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
12
21
33
40
Time (Months)
Control
1.3 Kg/m3 Cu
2.2 Kg/m3 Cu
3.4 Kg/m3 Cu
5.1 Kg/m3 Cu

Cumalitive Decay Failures for Lowest Retention Stakes Exposed to Ground Contact Decay Test 2



Ground-Contact Decay Test 2 Results

- All untreated controls failed by 33 months (most failed by 21 months).
- Clear dose responses were present for all three preservative systems after 40 Months of field exposure.
- After 40 months, MCQ and ACQ-D treated stakes are performing comparably against decay. At or above the recommended UC3 and UC4A retentions, decay ratings were > 9.
- After 40 months, MCA treated stakes at or above the recommended UC3 and UC4A retentions decay ratings were > 9.
- All three preservatives experienced decay failures at their lowest retentions, where MCA-B had less copper than MCQ and ACQ. This is a likely cause for the higher number of failures.

Comparison of Tests

- MCA and ACQ-D performed similarly in an 8-week soil block decay test.

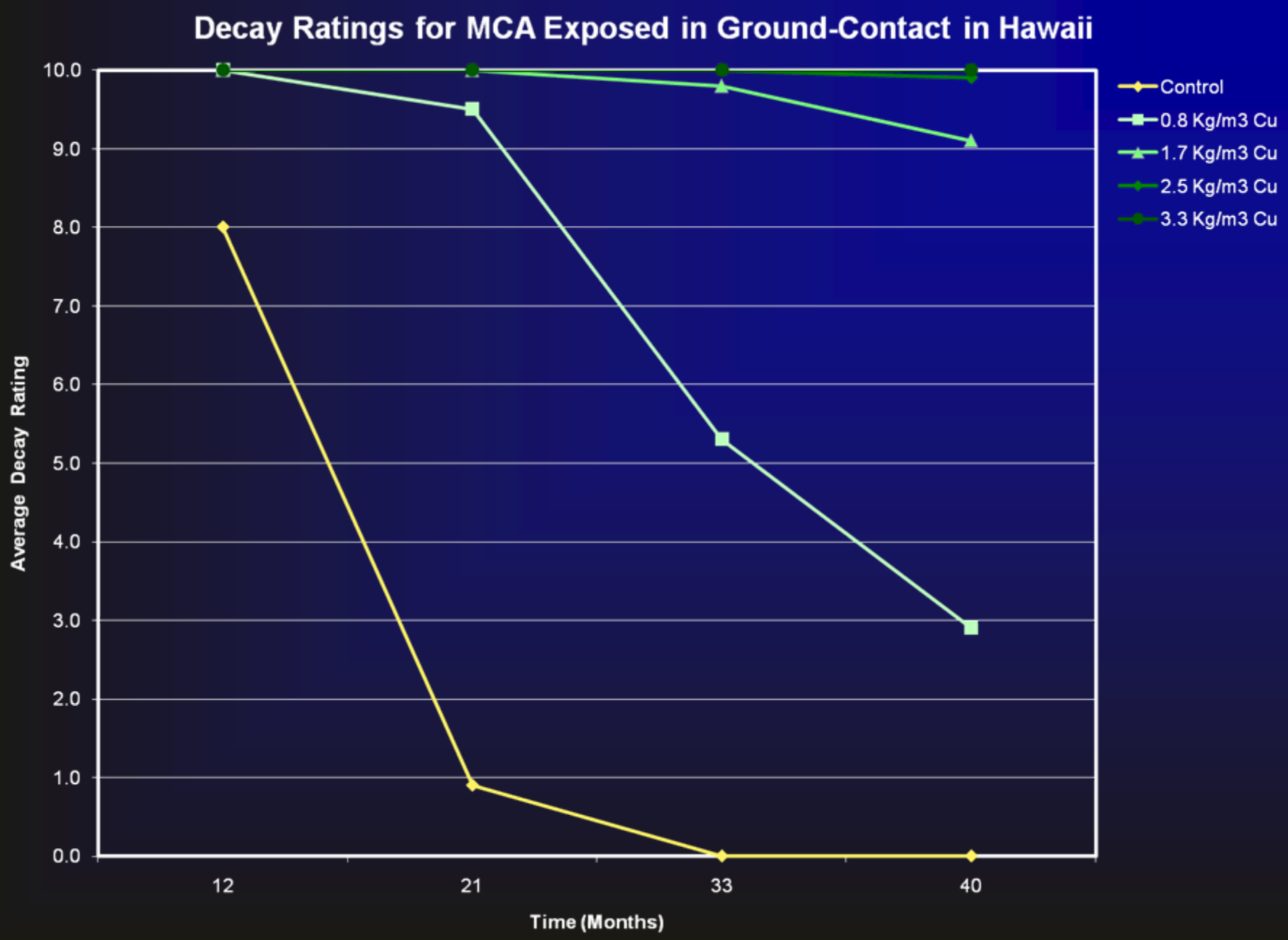
- At or above the recommended UC3 and UC4A retentions, MCA, MCQ, and ACQ-D performed similarly after 40 months of ground-contact field exposure in Hawaii. At these retentions, each preservative system rated > 9 against decay.

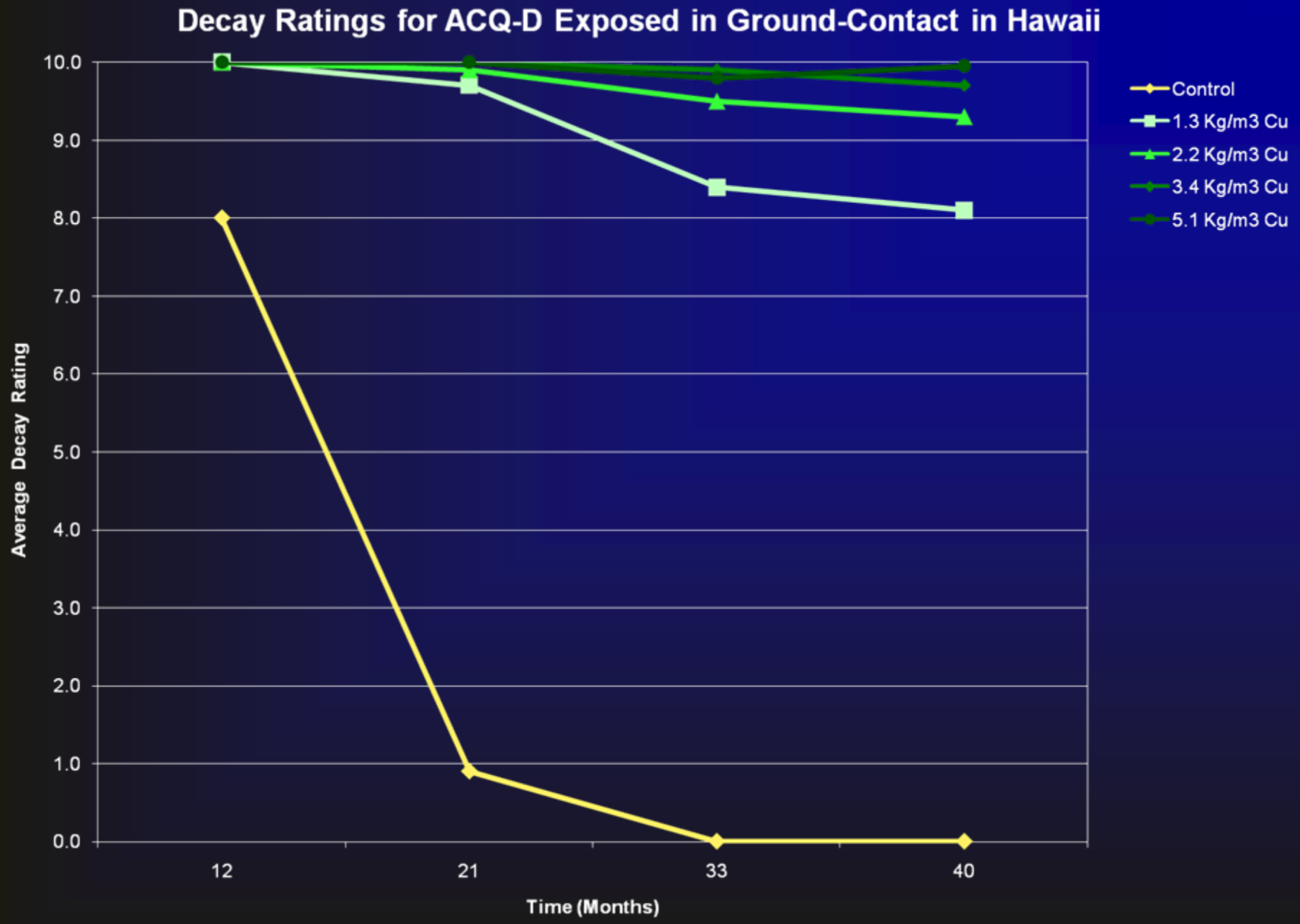
- MCQ appeared to behave similarly in the two ground-contact decay tests. Similar retentions show decay ratings at 45 (Test 1) and 40 (Test 2) months to be within experimental error, with the same number of decay failures. Decay ratings for Test 2 are slightly higher than Test 1, which is likely due to slightly higher retentions.

Conclusions

- In these tests, micronized copper wood preservative systems (MCA and MCQ) performed similarly to ACQ-D at or above the recommended UC3 and UC4A retentions.

Gracias a los organizadores de la reunión por la elección de un lugar soleado y cálido. Gracias por su atención. ¿Preguntas?


Decay Ratings for MCA Exposed in Ground-Contact in Hawaii
Average Decay Rating
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
12
21
33
40
Time (Months)
Control
0.8 Kg/m3 Cu
1.7 Kg/m3 Cu
2.5 Kg/m3 Cu
3.3 Kg/m3 Cu


Decay Ratings for ACQ-D Exposed in Ground-Contact in Hawaii
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Average Decay Rating
12
21
33
40
Time (Months)
Control
1.3 Kg/m3 Cu
2.2 Kg/m3 Cu
3.4 Kg/m3 Cu
5.1 Kg/m3 Cu