Drip Tape Application Rate and Drip System Maintenance

Larry Schwankl
UC Cooperative Extension

schwankl@uckac.edu 559-646-6569

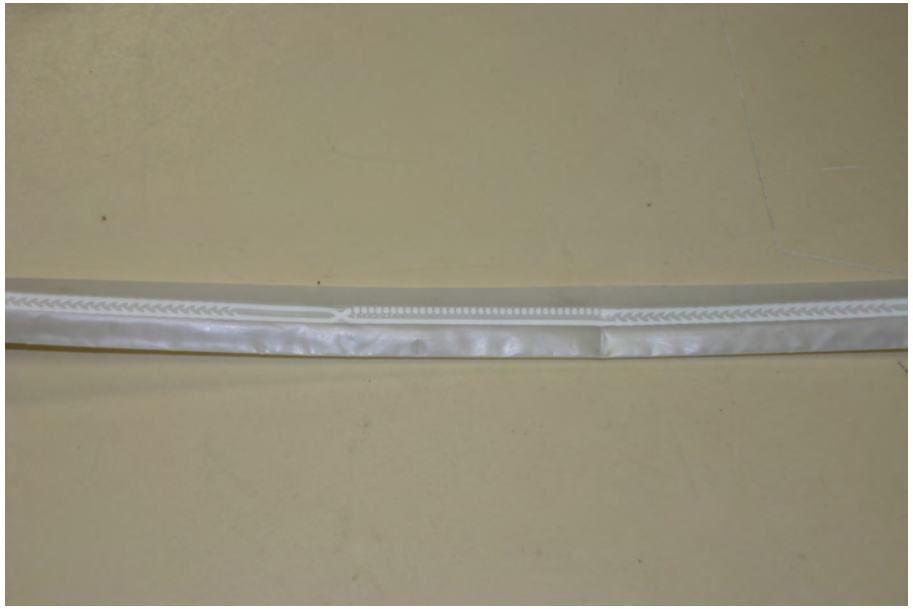
website: http://ucanr.org/schwankl

Irrigation Scheduling with Drip Tape

- Water use (ET) info. usually provided in “inches” (e.g. in/day, in/week).

Irrigation Scheduling with Drip Tape

- Water use (ET) info. usually provided in “inches” (e.g. in/day, in/week).
- Drip tape discharge given as:
  - gpm/100 ft.



Product Summary Chart

Series	Emitter Spacing	Flow Rate	Operating
500 (5/8")	Inch	Gpm/ 100 Ft	Pressure (PSI)
4 mil	8, 12, 16	.170, .220, .340, .450, .670, 1.0	8
5 mil	4, 6, 8, 9, 12, 16	.110, .15, .170, .220, .340, .450, .510, .670, 1.0	8
6 mil	4, 6, 8, 12, 16	.110, .170, .220, .250, .340, .450, .510, 1.00, 1.340	8
8 mil	4, 6, 8, 12, 16, 24	.170, .220, .250, .300, .340, .403, .440	8
10 mil	4, 8, 12, 16, 18	.170, .220, .300, .340, .450, .670	
15 mil	8, 12, 16, 18, 20	.220, .250, .280, .340, .450, .510, .536, .670	8
700 (7/8")			
6 mil	6, 8, 12, 16, 18, 24	.170, .220, .270, .300, .340, .450, .510, .670	
8 mil	6, 8, 12, 16, 18, 24	.220, .250, .340, .403, .450, .510, .670, 1.0	8
10 mil	6, 8, 12, 16, 18, 24	.220, .250, .280, .300, .340, .450, .510, .670	8
15 mil	8, 12, 16, 24	0.220, .250, .280, .340, .422, .450, 0.536, .670, 1.1	8

Application Rate of Drip Tape

Drip tape discharge (in/hr)

Drip Tape Discharge (gpm/100')	Drip Tape Spacing in Field (in.)														
	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
0.10	0.12	0.08	0.06	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01
0.12	0.14	0.09	0.07	0.06	0.05	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
0.14	0.16	0.11	0.08	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02
0.16	0.18	0.12	0.09	0.07	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02
0.18	0.21	0.14	0.10	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.03
0.20	0.23	0.15	0.12	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03
0.22	0.25	0.17	0.13	0.10	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03
0.24	0.28	0.18	0.14	0.11	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03
0.26	0.30	0.20	0.15	0.12	0.10	0.09	0.08	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04
0.28	0.32	0.22	0.16	0.13	0.11	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04
0.30	0.35	0.23	0.17	0.14	0.12	0.10	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.04
0.32	0.37	0.25	0.18	0.15	0.12	0.11	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05
0.34	0.39	0.26	0.20	0.16	0.13	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05
0.36	0.42	0.28	0.21	0.17	0.14	0.12	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.06	0.05
0.38	0.44	0.29	0.22	0.18	0.15	0.13	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05
0.40	0.46	0.31	0.23	0.18	0.15	0.13	0.12	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06
0.42	0.49	0.32	0.24	0.19	0.16	0.14	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06
0.44	0.51	0.34	0.25	0.20	0.17	0.15	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06
0.46	0.53	0.35	0.27	0.21	0.18	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.07

$$\text{Tape Discharge rate (in/hr)} = {}^{\text{gpm}}/_{\text{100 ft.}} \div \text{tape spacing (in.)} \times 11.55$$

Application Rate of Drip Tape

Drip Tape Discharge Rate Tables

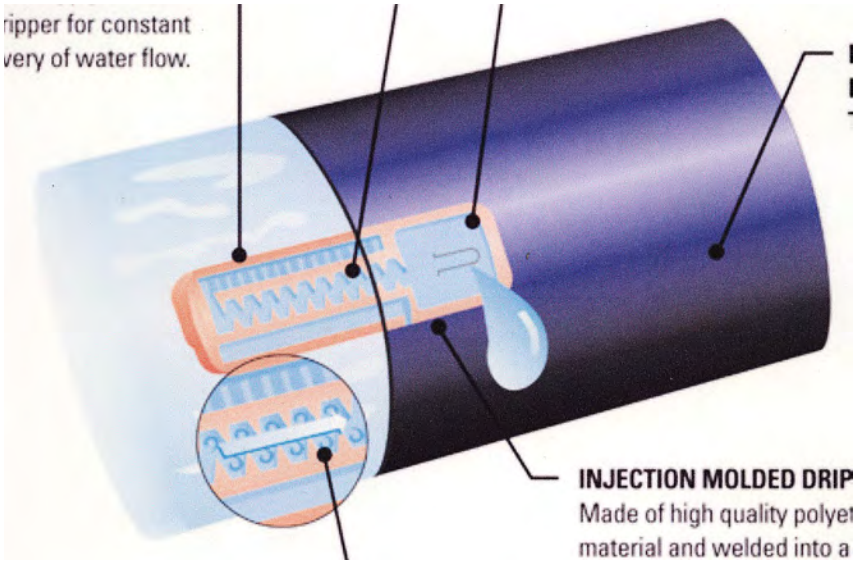
Converting tape discharge in gpm/100 ft. to in/hr

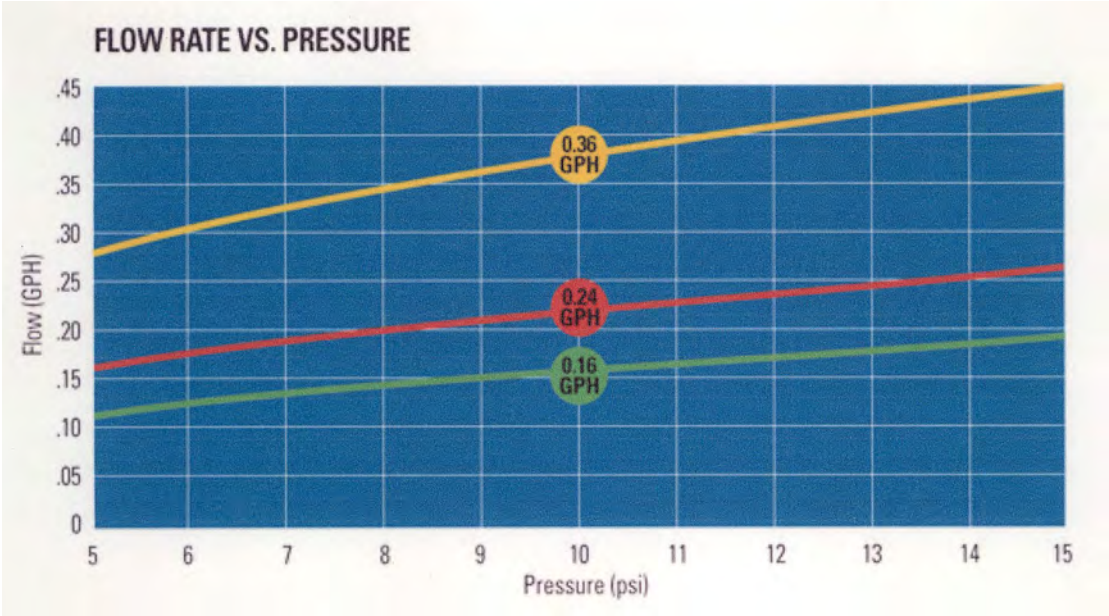
Converting discharge from tape with built-in emitters (gph) to a discharge rate in in/hr

Available at http://ucanr.org/schwankl

Irrigation Scheduling with Drip Tape

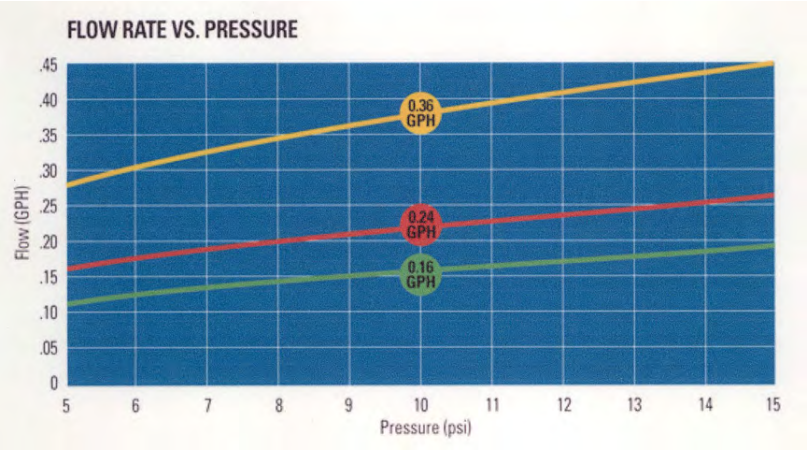
- Water use (ET) info. usually provided in “inches” (e.g. in/day, in/week).
- Drip tape discharge given as:
  - gpm/100 ft.
  - Emitter discharge (gph)





Irrigation Scheduling with Drip Tape

- Water use (ET) info. usually provided in "inches" (e.g. in/day, in/week).
- Drip tape discharge given as:
  - gpm/100ft.
  - Emitter discharge (gph)



$$\text{Tape Discharge rate (in/hr)} = \frac{\text{Emitter discharge (gph)}}{\text{Tape spacing (in)} \times \text{Emitter spacing (in)}} \times 231$$

Irrigation Scheduling with Drip Tape

- Water use (ET) info. usually provided in "inches" (e.g. in/day, in/week).
- Drip tape discharge given as:
  - gpm/100ft.
  - Emitter discharge (gph)

$$\text{Tape Discharge rate (in/hr)} = \frac{\text{Emitter discharge (gph)}}{\text{Tape spacing (in)} \times \text{Emitter spacing (in)}} \times 231$$

Drip tape discharge (in/hr) for drip tape with emitters every 12 inches

Emitter	Drip Tape Spacing in Field (in.)														
Discharge (gph)	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
0.10	0.19	0.13	0.10	0.08	0.06	0.06	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02
0.12	0.23	0.15	0.12	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03
0.14	0.27	0.18	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03
0.16	0.31	0.21	0.15	0.12	0.10	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04
0.18	0.35	0.23	0.17	0.14	0.12	0.10	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.04
0.20	0.39	0.26	0.19	0.15	0.13	0.11	0.10	0.09	0.08	0.07	0.06	0.06	0.06	0.05	0.05
0.22	0.42	0.28	0.21	0.17	0.14	0.12	0.11	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05
0.24	0.46	0.31	0.23	0.18	0.15	0.13	0.12	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06
0.26	0.50	0.33	0.25	0.20	0.17	0.14	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06
0.28	0.54	0.36	0.27	0.22	0.18	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.07
0.30	0.58	0.39	0.29	0.23	0.19	0.17	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07
0.32	0.62	0.41	0.31	0.25	0.21	0.18	0.15	0.14	0.12	0.11	0.10	0.09	0.09	0.08	0.08
0.34	0.65	0.44	0.33	0.26	0.22	0.19	0.16	0.15	0.13	0.12	0.11	0.10	0.09	0.09	0.08
0.36	0.69	0.46	0.35	0.28	0.23	0.20	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.09
0.38	0.73	0.49	0.37	0.29	0.24	0.21	0.18	0.16	0.15	0.13	0.12	0.11	0.10	0.10	0.09
0.40	0.77	0.51	0.39	0.31	0.26	0.22	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.10
0.42	0.81	0.54	0.40	0.32	0.27	0.23	0.20	0.18	0.16	0.15	0.13	0.12	0.12	0.11	0.10
0.44	0.85	0.56	0.42	0.34	0.28	0.24	0.21	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.11
0.46	0.89	0.59	0.44	0.35	0.30	0.25	0.22	0.20	0.18	0.16	0.15	0.14	0.13	0.12	0.11

Tables available at:
http://ucanr.org/schwankl

Microirrigation Systems

What do you want from a well-designed drip system?

Microirrigation Systems

What do you want from a well-designed drip system?

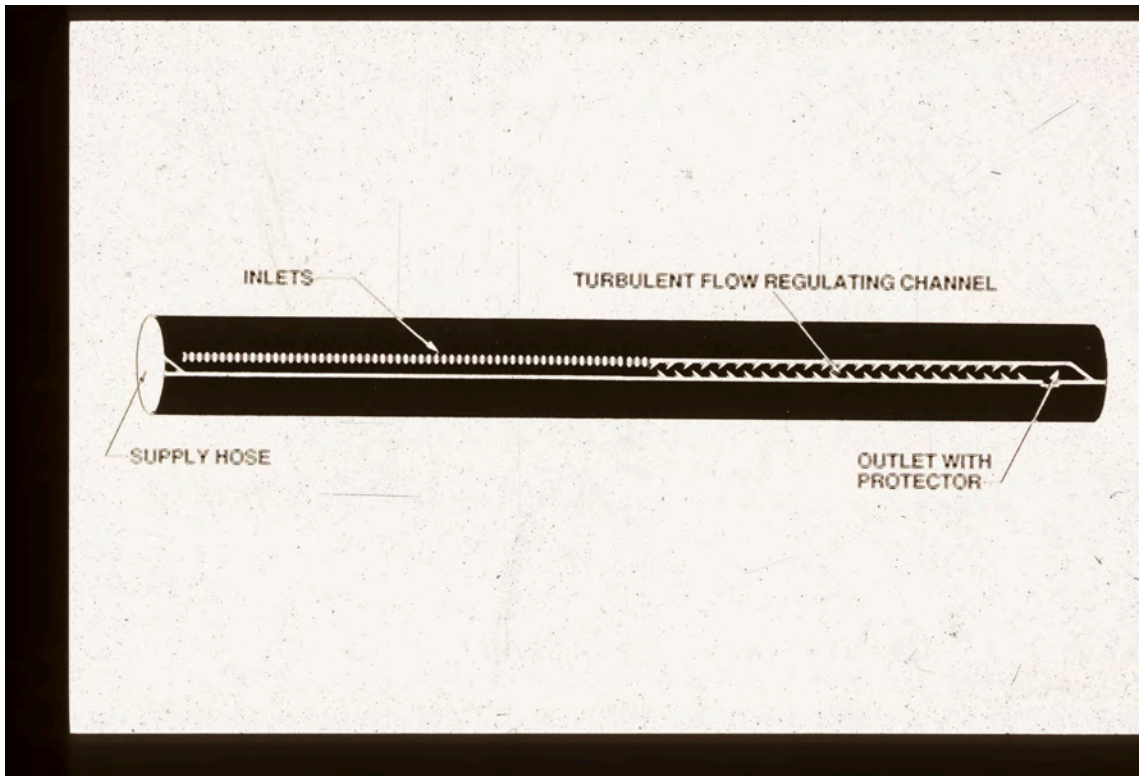
Good **Uniformity:**

All areas of the field receive nearly the same amount of water.

Microirrigation Systems

Why would there be non-uniformity?

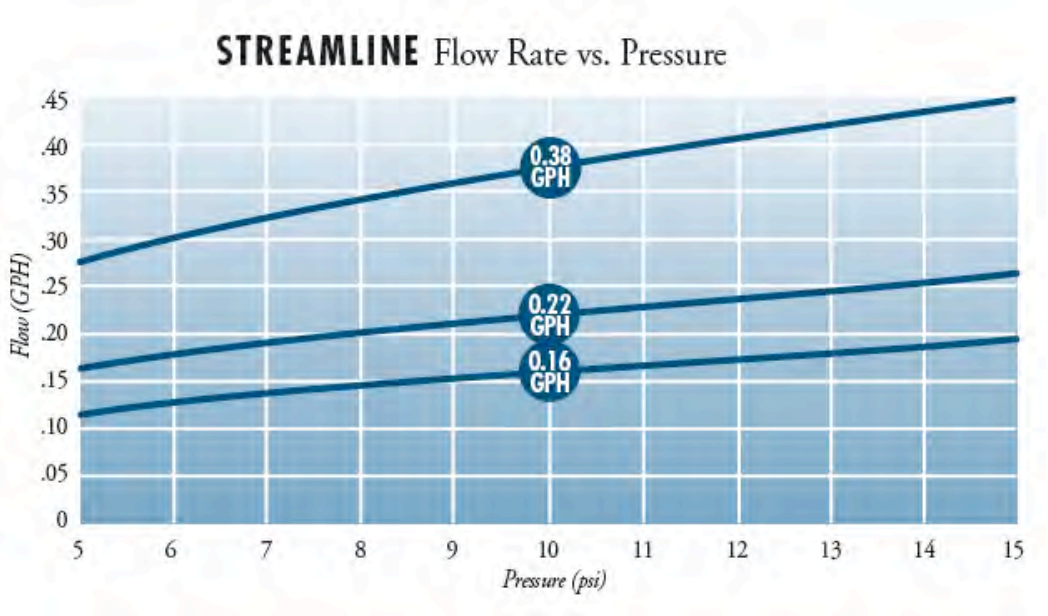
1. **Manufacturing variation - minor with good microirrigation products.**



Microirrigation Systems

Why would there be non-uniformity?

1. Manufacturing variation - minor with good microirrigation products.
2. Pressure differences - due to elevation changes and pressure losses.



Microirrigation Systems

Why would there be non-uniformity?

1. Manufacturing variation - minor with good microirrigation products.
2. Pressure differences - due to elevation changes and pressure losses.

LENGTH OF RUN @ 0% Slope
0.16 GPH Dripper (0.16 @ 10 psi)

Dripper Spacing	GPM per 100 ft.	Emission Uniformity (EU) 94%	92%	90%
8"	0.398	391	472	538
12"	0.267	535	650	743
16"	0.201	670	813	929
18"	0.177	731	888	1001
24"	0.134	902	1093	1243

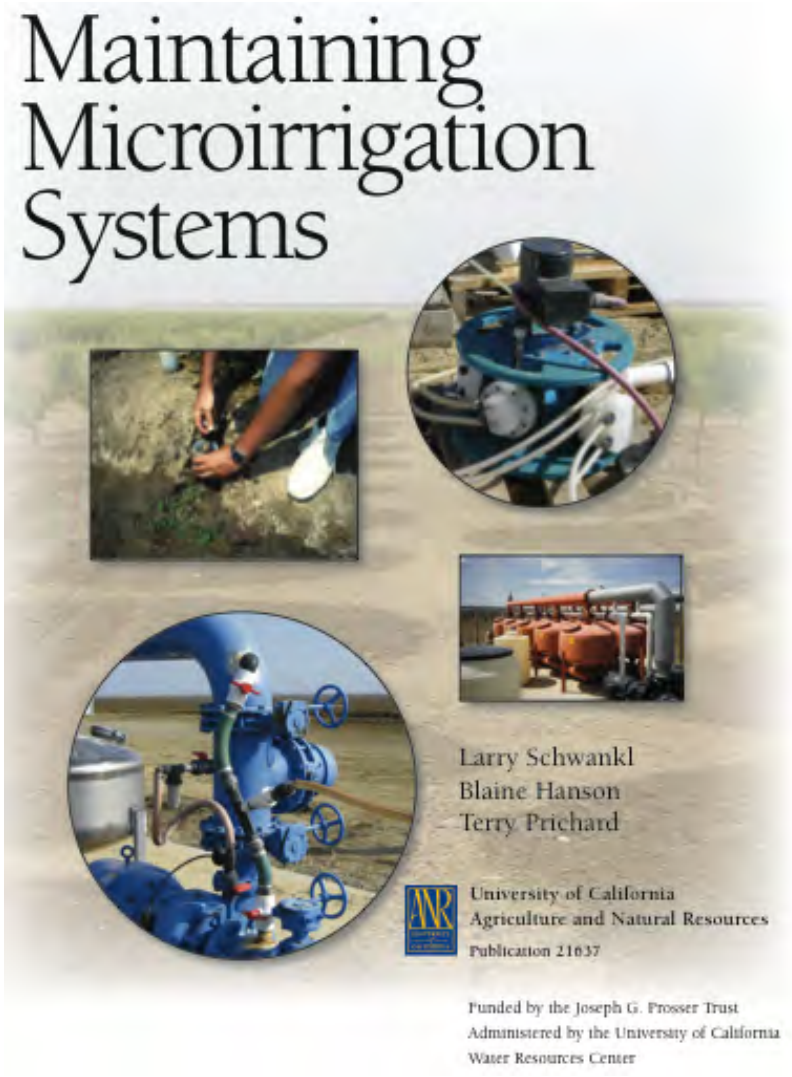
Can minimize pressure differences with good design

Microirrigation Systems

Why would there be non-uniformity?

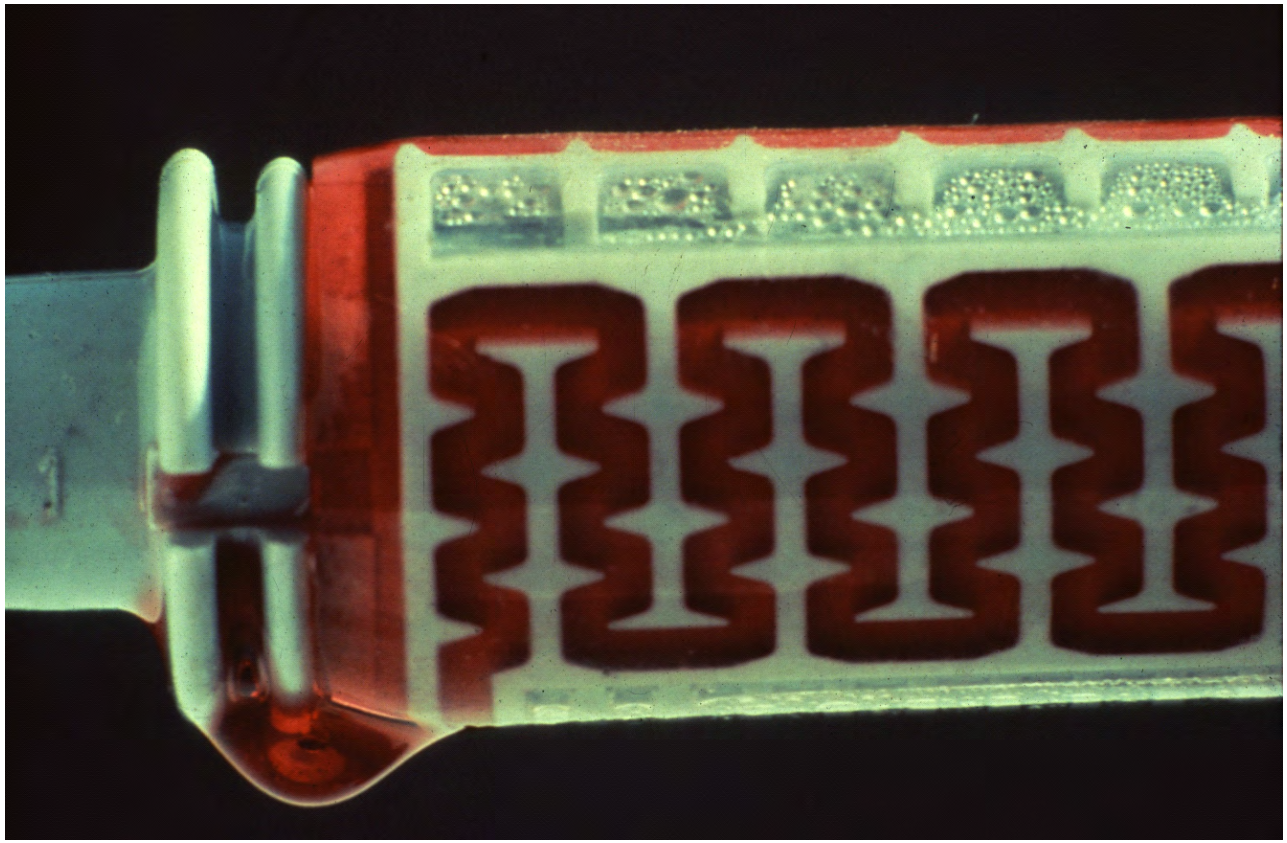
1. Manufacturing variation - minor with good microirrigation products.
2. Pressure differences - due to elevation changes and pressure losses.
3. Clogging problems.

Maintenance of Micro Systems:



Emitters:

Clogging is the greatest “threat” to emitters.



Clogging of Microirrigation Systems

Source: Physical Clogging - Particulates

Clogging of Microirrigation Systems

Source: Physical Clogging - Particulates

Solution: Filtration

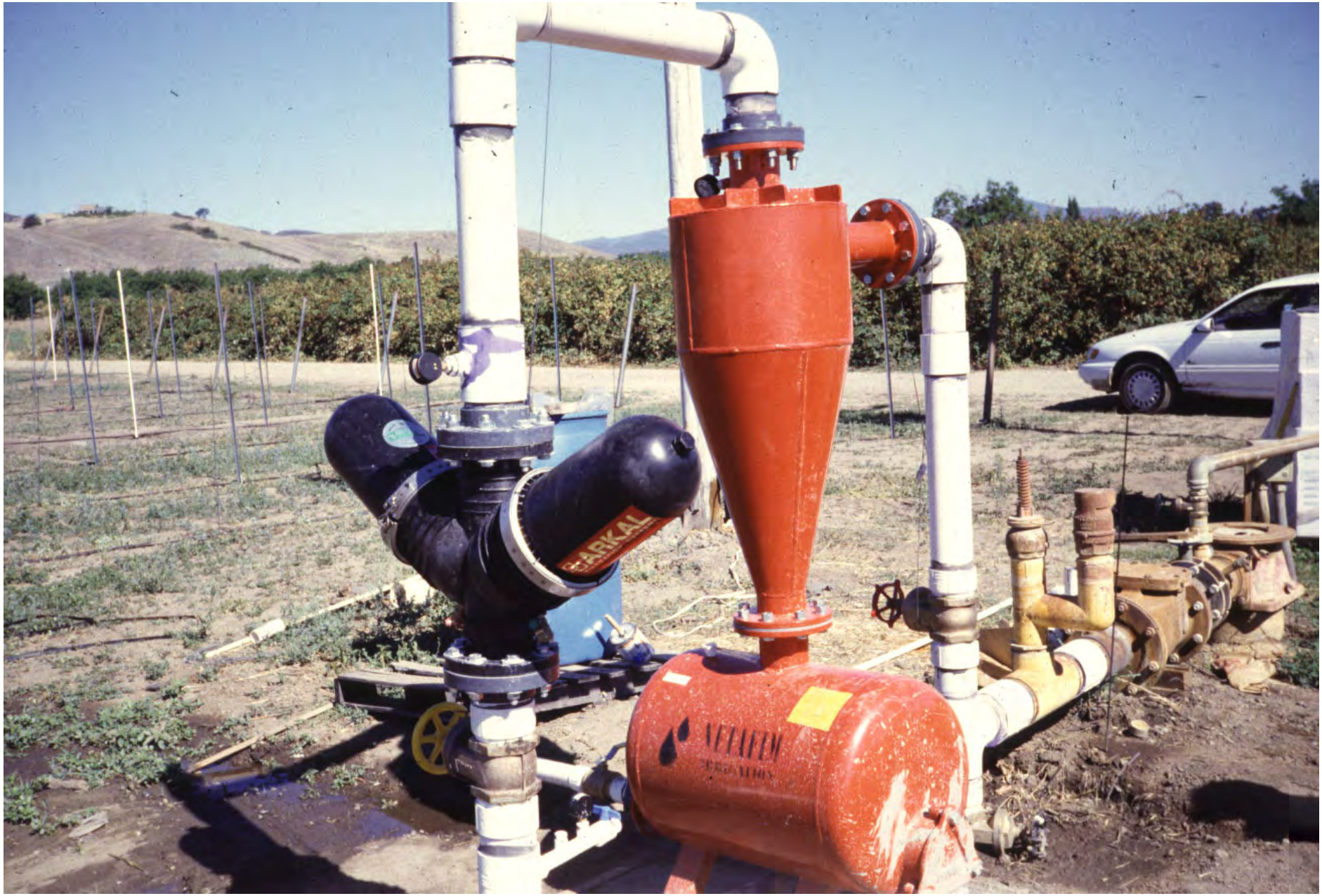
Filters:

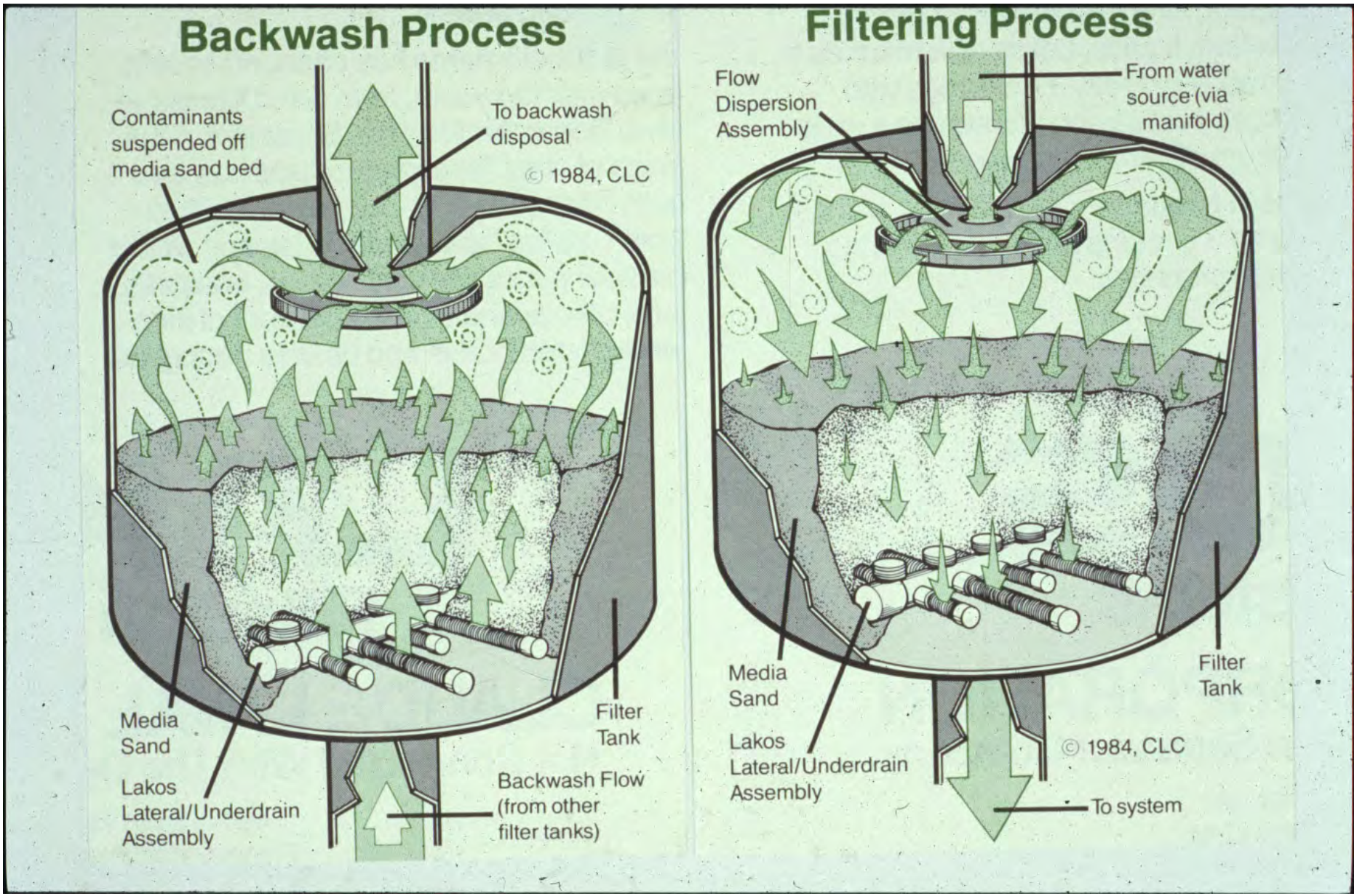
- **Screen, disk, and sand media filters are all available.**

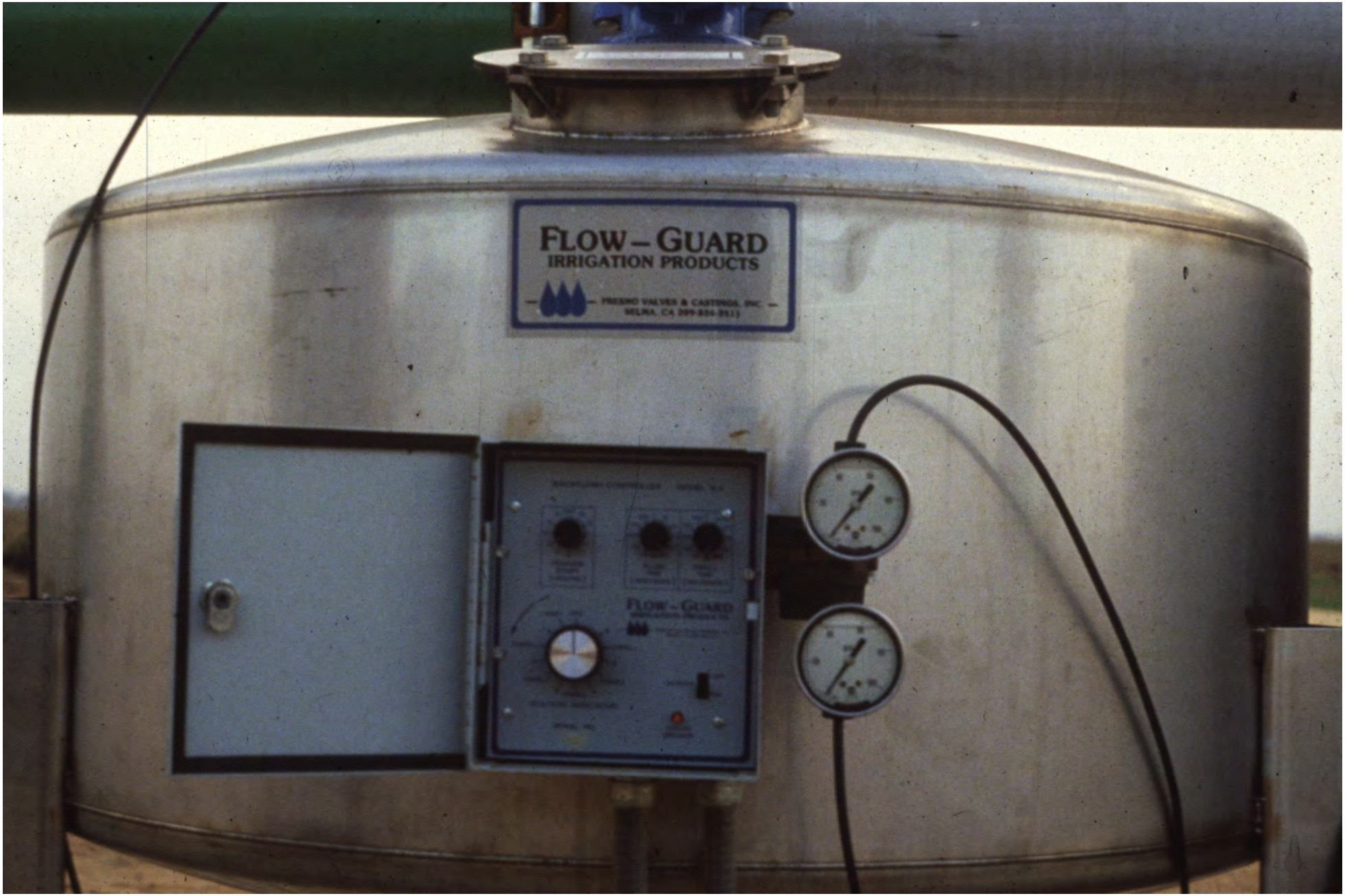
- **They can all filter to the same degree**

BUT

they req. different frequency of cleaning.


ARKAL


Backwash Process
Contaminants suspended off media sand bed
To backwash disposal
© 1984, CLC
Media Sand
Lakos Lateral/Underdrain Assembly
Filter Tank
Backwash Flow (from other filter tanks)
Filtering Process
Flow Dispersion Assembly
From water source (via manifold)
Media Sand
Lakos Lateral/Underdrain Assembly
Filter Tank
© 1984, CLC
To system


FLOW – GUARD
IRRIGATION PRODUCTS
FLOW – GUARD

Clogging of Microirrigation Systems

Source: Chemical Precipitates

- Lime (calcium carbonate) and iron are the most common problems.

Chemical Precipitate Clogging of Microirrigation Systems

Water quality levels of concern:

- **Calcium: pH > 7.5 and 2.0 meq/l (120 ppm) of bicarbonate**

- **Iron: pH > 4.0 and 0.5 ppm iron**

Clogging of Microirrigation Systems

Source: Lime

Solution: pH Control (Acidification)

+

filtration

Dealing with Iron Precipitation:

1. Precipitate iron in a pond / reservoir

Dealing with Iron Precipitation:

1. Precipitate iron in a pond / reservoir

2. Chemicals (e.g. phosphonic acid, phosphonate) may keep iron in solution

Clogging of Microirrigation Systems

Source: Biological Sources

Clogging of Microirrigation Systems

Source: Biological Sources

Solution: Filtration (usually media filters)

+

Biocide

Biolgical Clogging

Acid may deter
but not eliminate

biocide

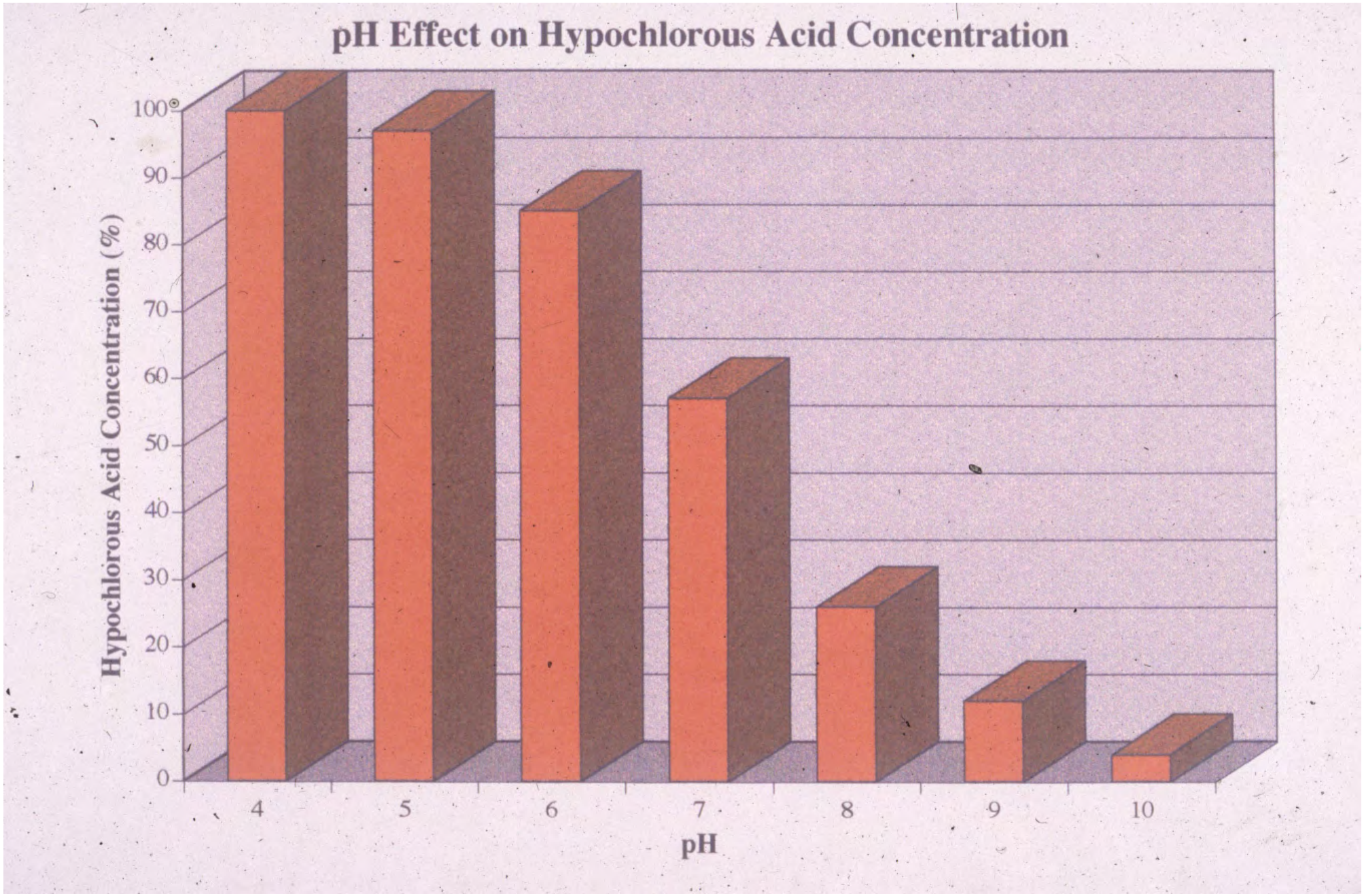
chlorine copper

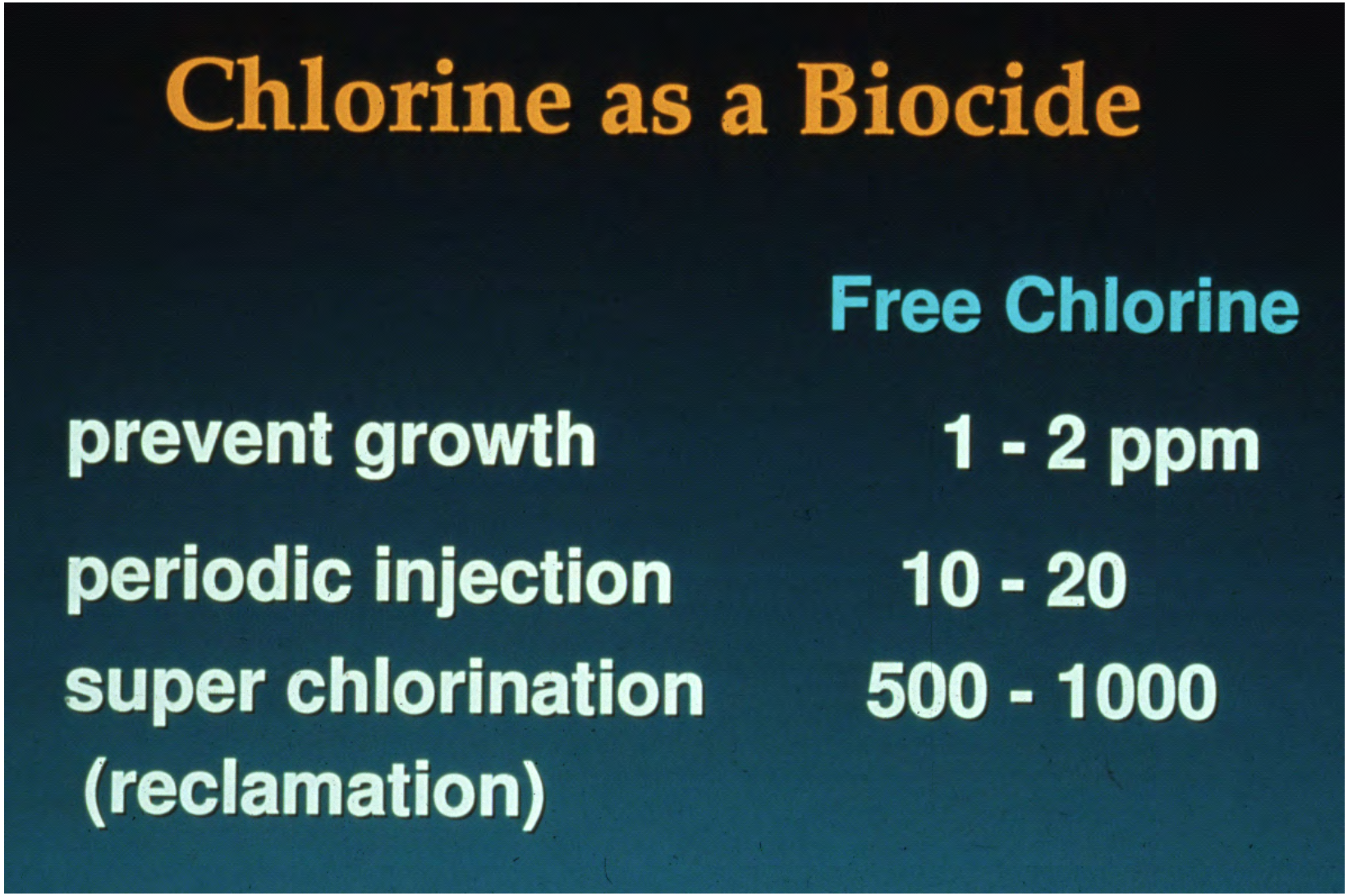
Chlorine

- Sources:
  - Liquid - sodium hypochlorite.
  - Solid - calcium hypochlorite.
  - Gas chlorine.

Chlorine:

- Sources:
  - Liquid - sodium hypochlorite.
  - Solid - calcium hypochlorite.
  - Gas chlorine.
- When add chlorine source to water:
  - Forms hypochlorous acid + hypochlorite.
  - Hypochlorous acid is more powerful biocide.
  - If pH is lower (acidic), more hypochlorous acid is present - better biocide.


pH Effect on Hypochlorous Acid Concentration
Hypochlorous Acid Concentration (%)
100
90
80
70
60
50
40
30
20
10
0
4
5
6
7
8
9
10
pH



Test for chlorine using a pool / spa test kit

Chlorine: Injection Rates

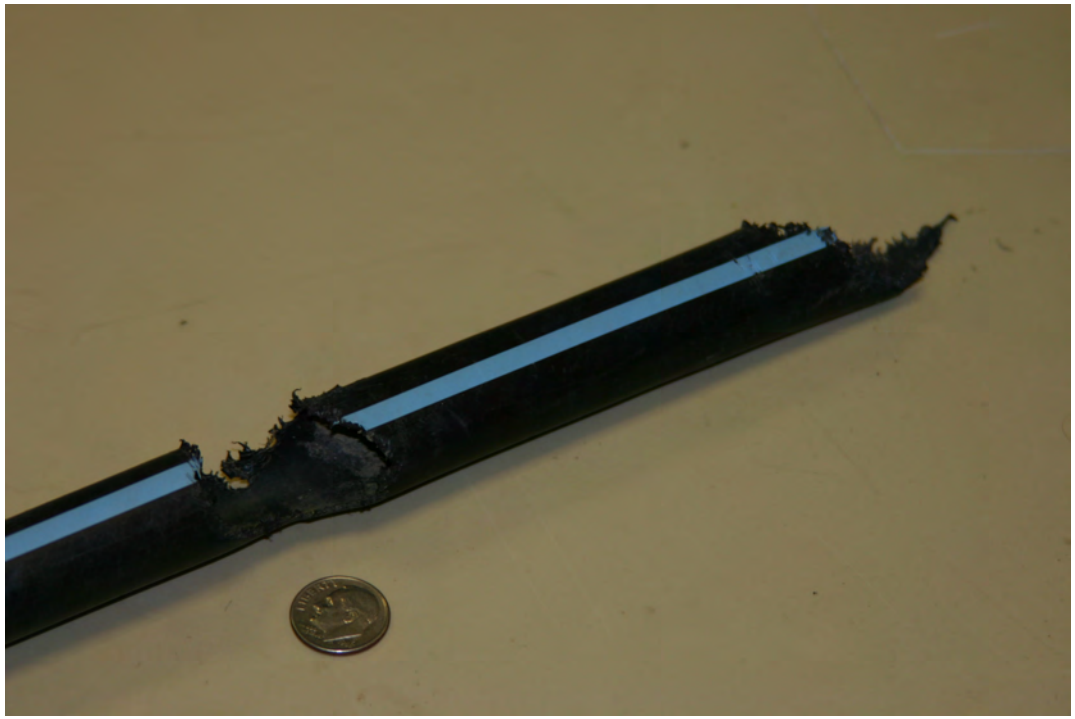
- Sodium hypochlorite (liquid)
  - Example: household bleach w/ 5.25% active chorine.

Chlorine injection rate (gal/hr) = System flow rate (gpm) x Desired Cl Conc. (ppm) x 0.006 ÷ Strength of Cl soln (%)

- Calcium hypochlorite (solid)
  - 65-70% available chlorine.
  - 12.8 lbs. of calcium hypochlorite added to 100 gallons of water forms a 1% solution.
  - Use above formula.

Leaks in Microirrigation Systems

Source: Rodents



Leaks in Microirrigation Systems

Source: Rodents

Solution: Get rid of them.

Flushing of microirrigation systems:

- **Silts and clay particles pass through even the best filters.**

Flushing

- Silts and clay particles pass through even the best filters.

- **Need to flush the system - mainlines, submains, and laterals (in that order).**

Flushing

- Silts and clay particles pass through even the best filters.
- Need to flush the system - mainlines, submains, and laterals (in that order).
  - Flush laterals by hand, use automatic flushing end caps, or manifold the ends together.

Stay on Top of Your Maintenance

Questions?

Larry Schwankl

559-646-6569 e-mail: schwankl@uckac.edu

For this Powerpoint presentation, go to:

http://ucanr.org/schwankl