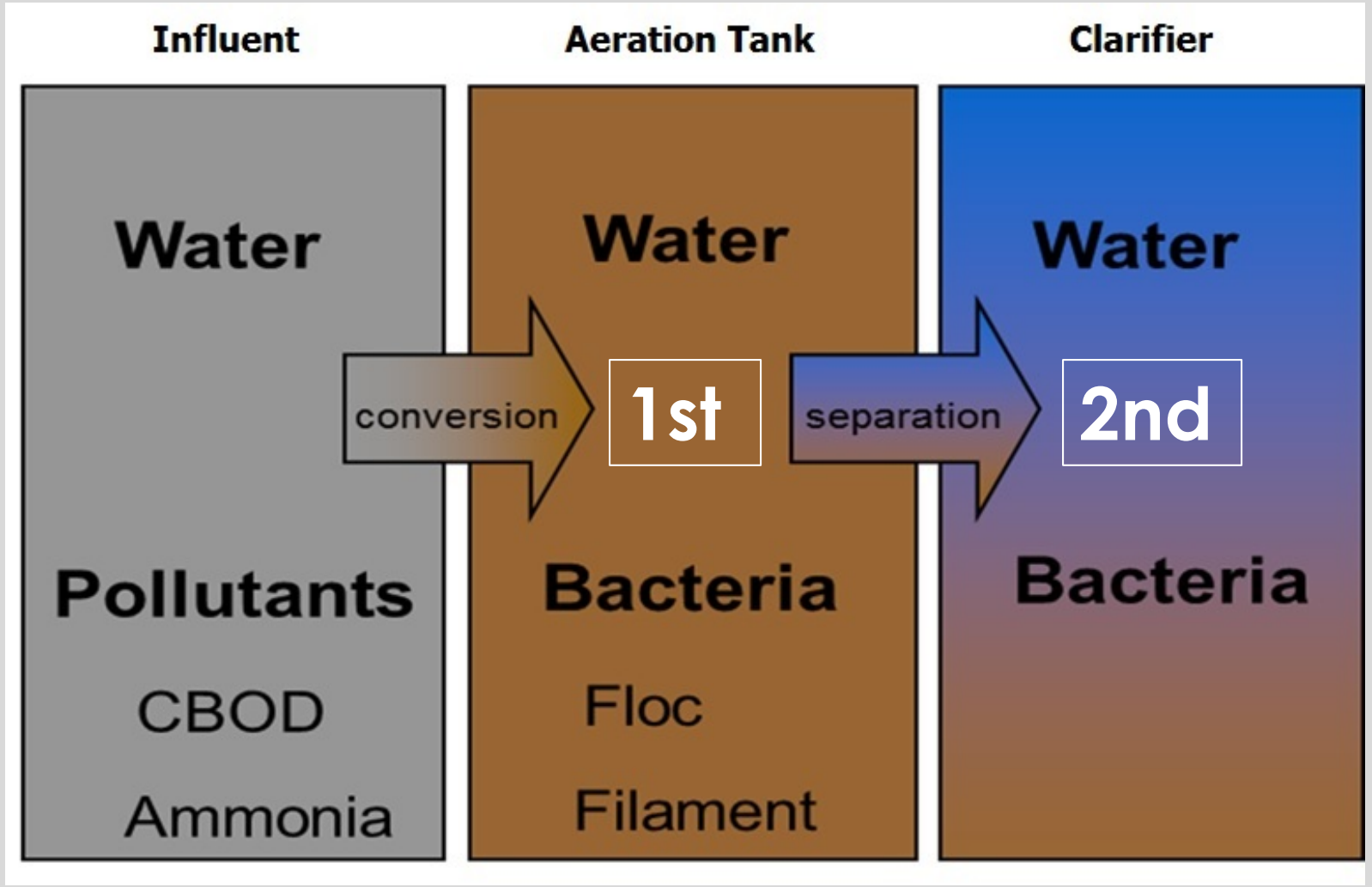
ACTIVATED SLUDGE PROCESS CONTROL

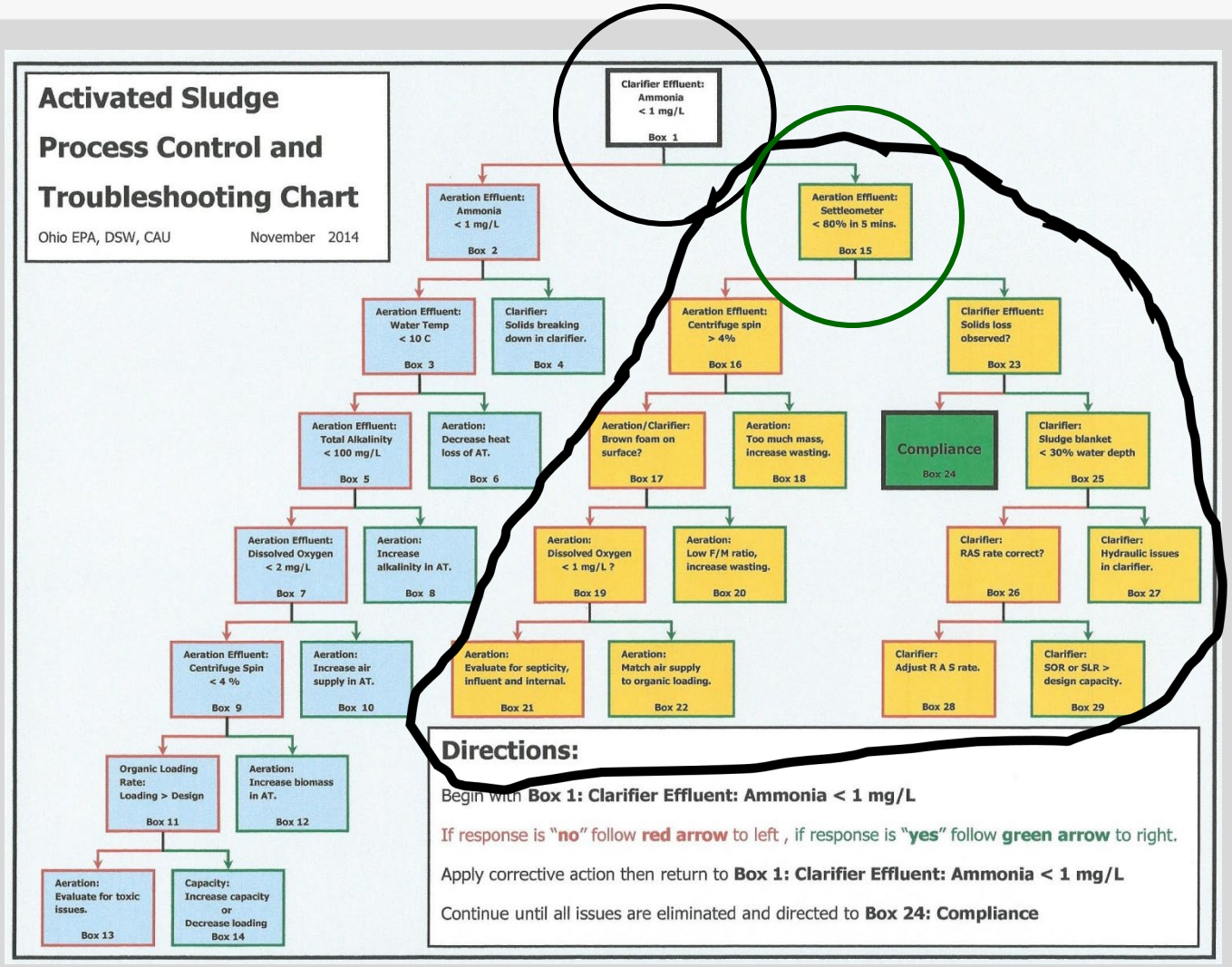
TROUBLESHOOTING CHART

Part Two: Separation

BASIC CONCEPTS

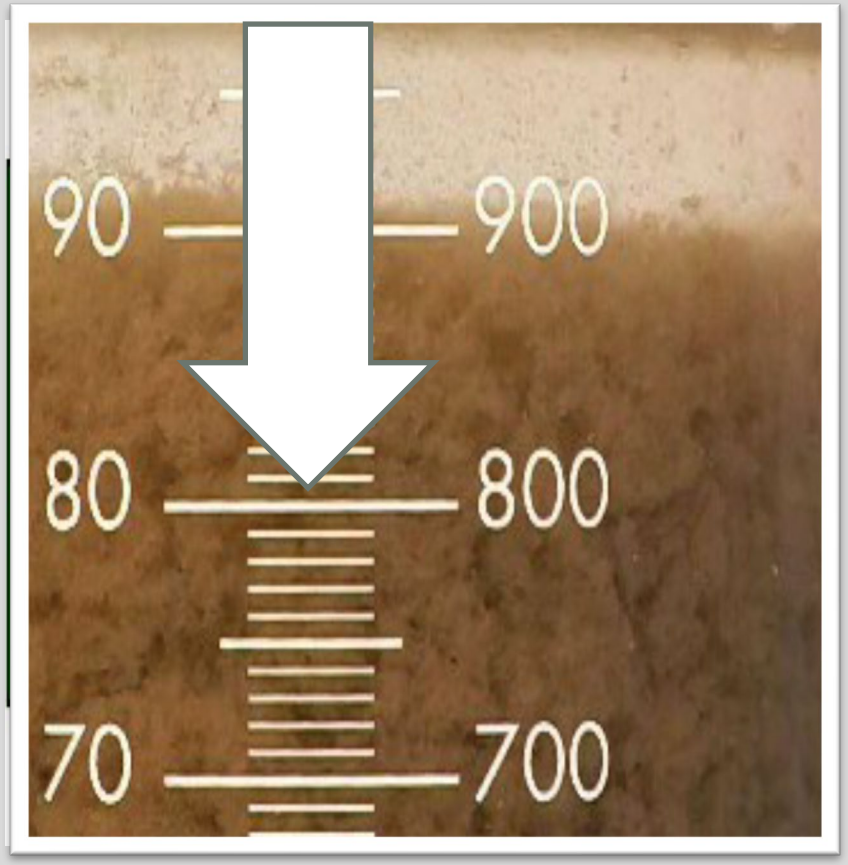


A. S. PROCESS CONTROL



BOX # 15

AERATION EFFLUENT: SETTLEOMETER < 80% IN 5 MINUTES



- Conversion Complete
- Separation Analysis
  - "Perfect Clarifier"
  - < 80 % in 5 minutes
- Inhibited Settling
  - High concentration mass (too crowded)
  - Low density mass (too buoyant)

BOX # 16 **AERATION EFFLUENT: CENTRIFUGE SPIN > 4%**

- Centrifuge Spin
  - Aeration Effluent
  - > 4% inhibits settling
  - Measure and know
- 2 Minute Diluted Settleometer
  - 100% vs 50%

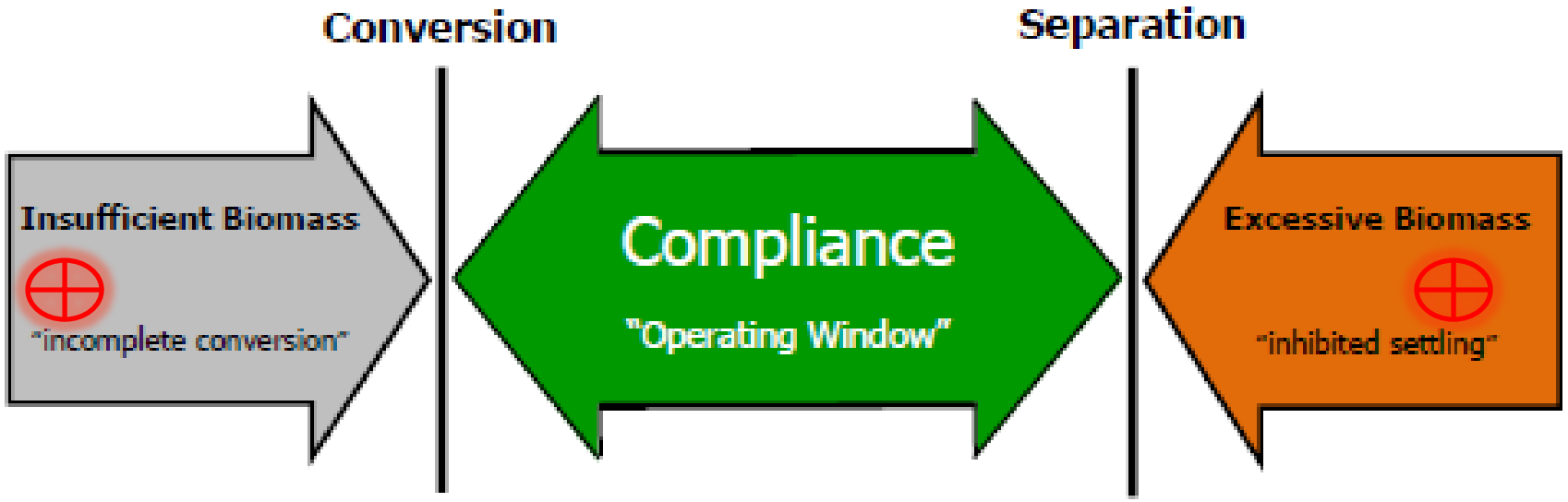
BOX # 16 **AERATION EFFLUENT: CENTRIFUGE SPIN > 4%**

- Centrifuge Spin
  - Aeration Effluent
  - > 4% inhibits settling
  - Measure and know
- 2 Minute Diluted Settleometer
  - 100% vs 50%


2 Minute Diluted
Settleometer Test
Concentration


2 Minute Diluted
Settleometer Test
Density

BOX # 18 **AERATION:**
TOO MUCH BIOMASS, INCREASE WASTING



Establishing a wasting rate is simply a process of maintaining sufficient biomass to achieve complete conversion in the aeration tank (ammonia < 1 mg/L), while not maintaining an excessive amount of biomass to inhibit the settling rate in the clarifier (< 80% in 5 minutes).

BOX # 17 **AERATION / CLARIFIER: BROWN FOAM ON SURFACE**

- Filaments
  - >80% in 5 mins.
  - AT spin < 4%
  - 2 min. diluted Settleometer analysis
  - Coning/Jagged
  - Supernatant Clarity
  - Low AT effluent NH3
  - **Brown Foam**
- Low F/M Environment

BOX # 17 **AERATION / CLARIFIER: BROWN FOAM ON SURFACE**

- Filaments
  - >80% in 5 mins.
  - AT spin < 4%
  - 2 min. diluted Settleometer analysis
  - Coning/Jagged
  - Supernatant Clarity
  - Low AT effluent NH3
  - **Brown Foam**
- Low F/M Environment

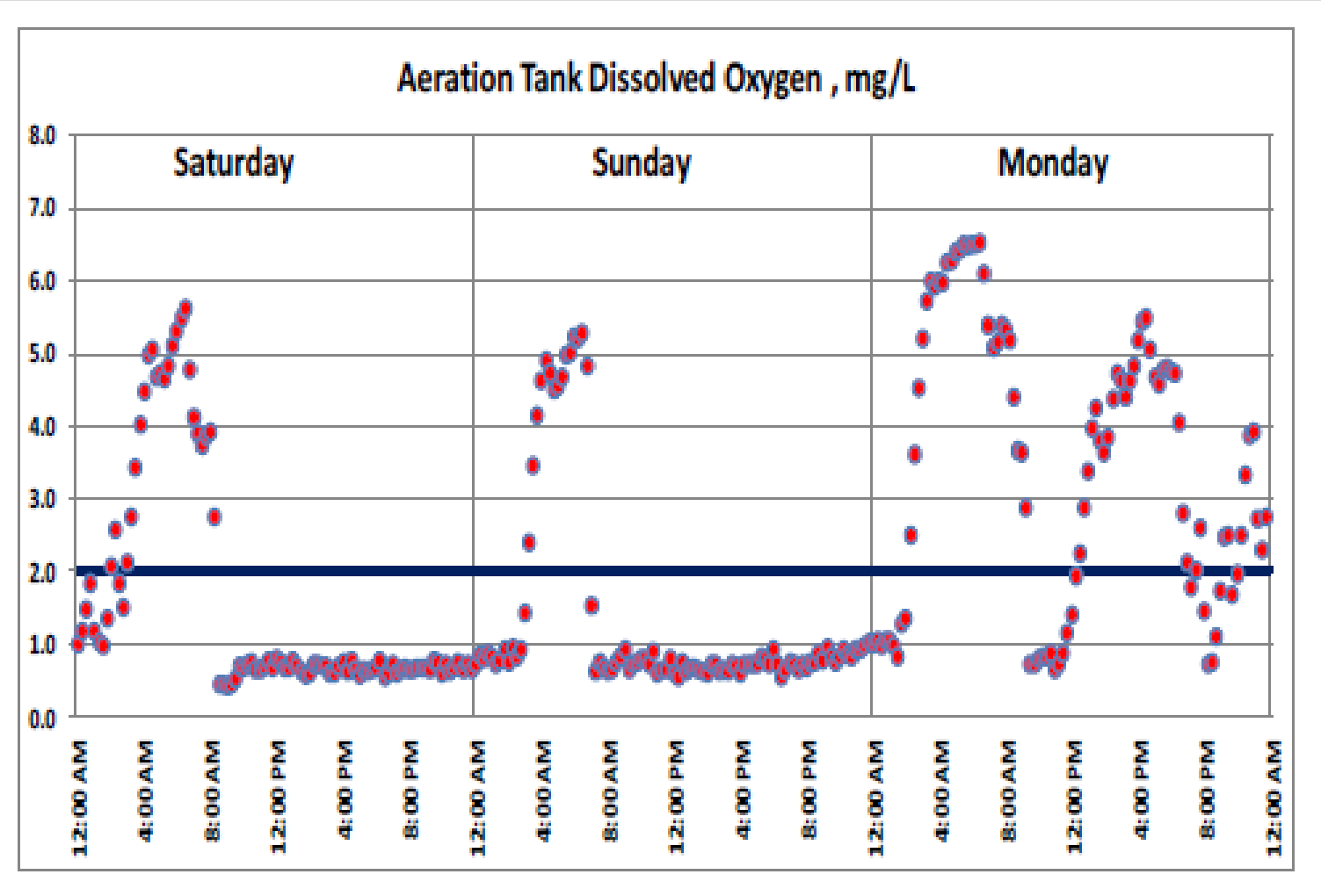
BOX # 20 **AERATION: LOW F/M RATIO, INCREASE WASTING**

- Low F/M Filaments
- Waste
  - Stop the madness
  - Clean up the mess

BOX # 19 **AERATION: DISSOLVED OXYGEN < 1 MG/L**

- Filaments
  - >80% in 5 mins.
  - AT spin < 4%
  - 2 min. diluted Settleometer analysis
- Low DO
  - Long, low levels
    - 1 mg/L DO
  - Short, deep levels
    - < 1 mg/L DO
  - Measure and know

BOX # 22 **AERATION: MATCH AIR SUPPLY TO ORGANIC LOADING**



BOX # 21 **AERATION: EVALUATE FOR SEPTICITY, INFLUENT AND INTERNAL**

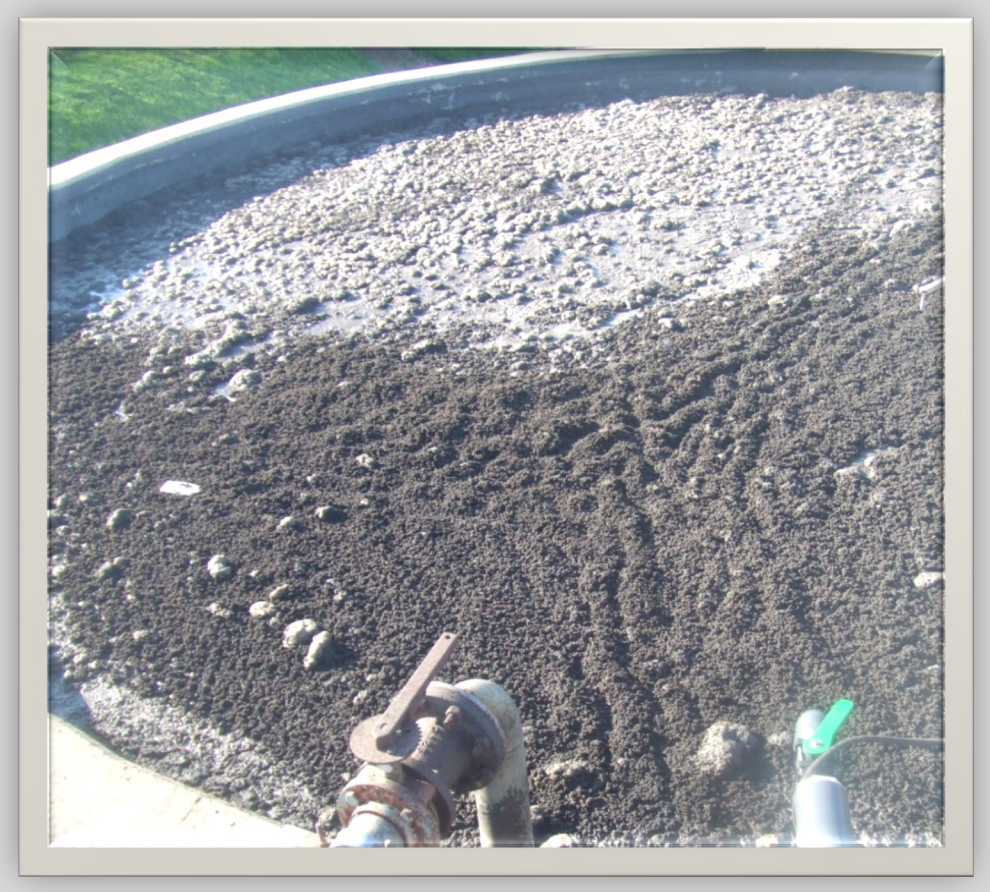
- Filaments
  - >80% in 5 mins.
  - AT spin < 4%
- Septic Sources
  - Influent
    - Odor
    - Corrosion
    - Color
  - Internal
    - "aerobic" digester
    - Solids breaking down in clarifier

BOX # 21

AERATION: EVALUATE FOR SEPTICITY, INFLUENT AND INTERNAL

- Filaments
  - >80% in 5 mins.
  - AT spin < 4%
- Septic Sources
  - Influent
    - Odor
    - Corrosion
    - Color
  - Internal
    - “aerobic” digester
    - Solids breaking down in clarifier

BOX # 21 **AERATION: EVALUATE FOR SEPTICITY, INFLUENT AND INTERNAL**

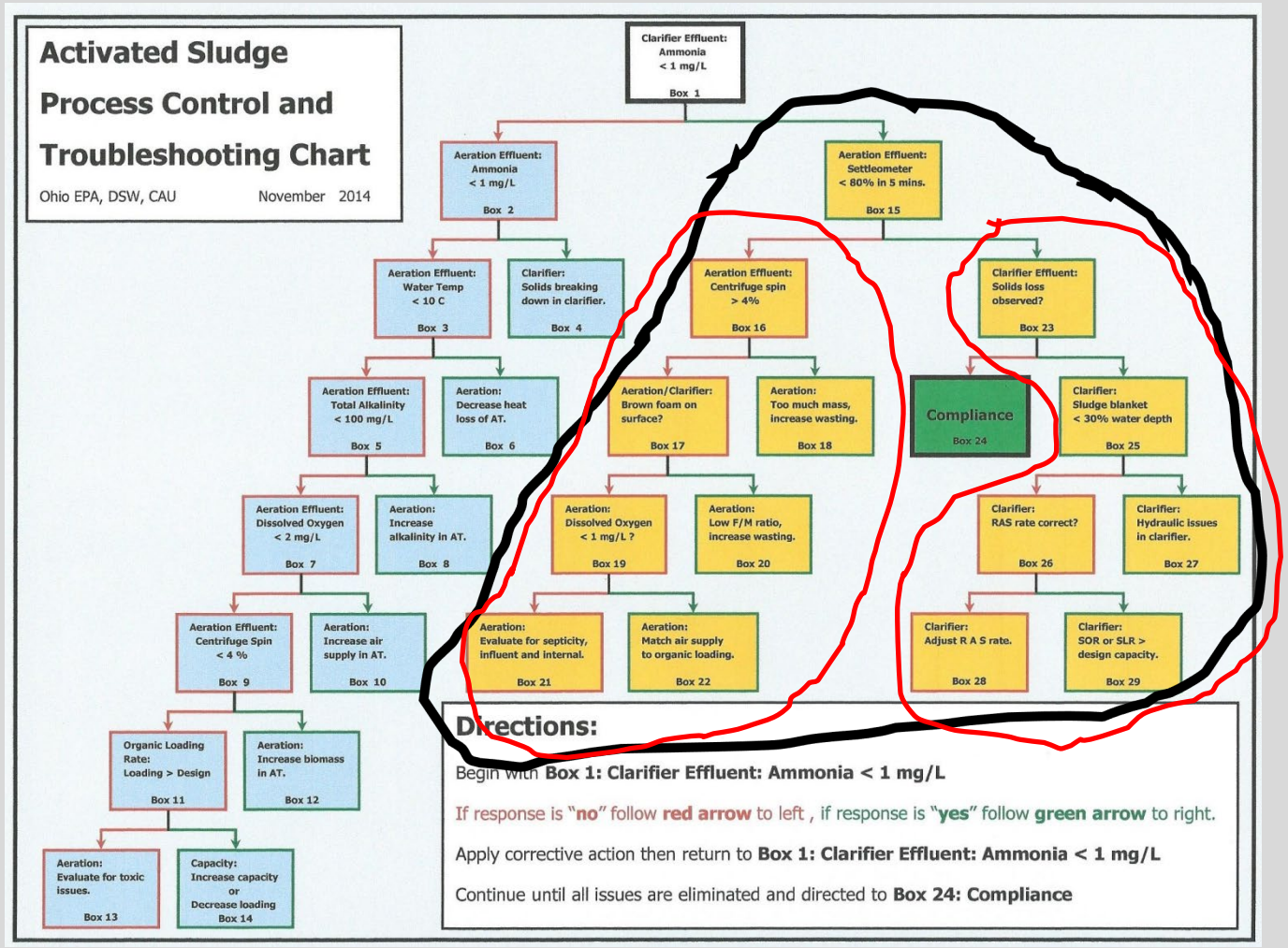


- Filaments
  - >80% in 5 mins.
  - AT spin < 4%

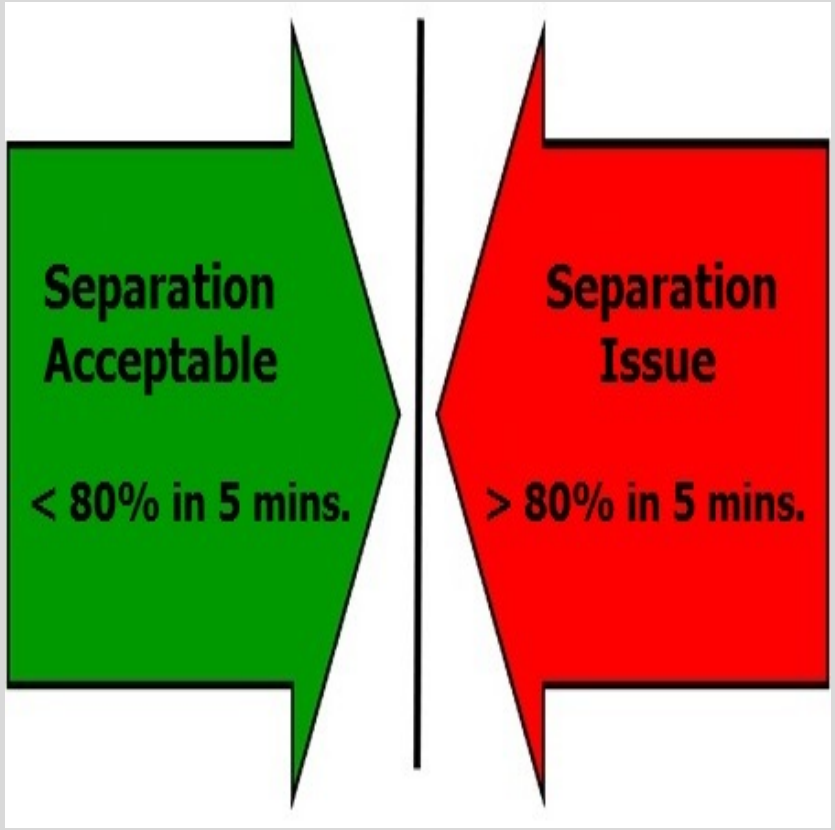
Septic Sources

- Influent
  - Odor
  - Corrosion
  - Color
- Internal
  - "aerobic" digester
  - Solids breaking down in clarifier

A. S. PROCESS CONTROL

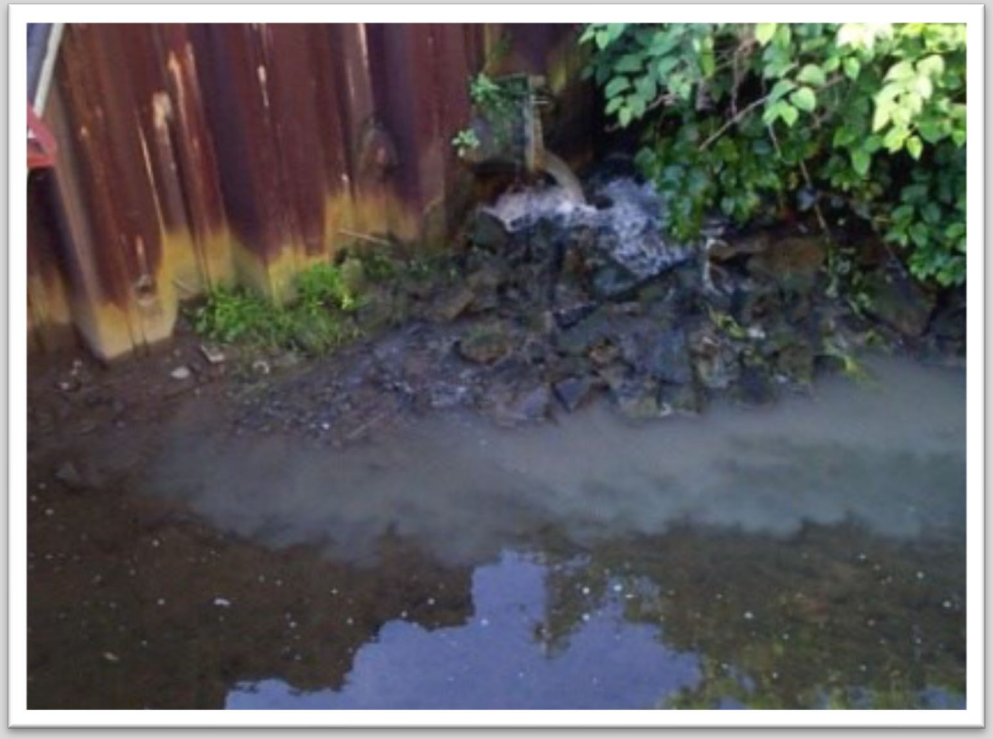


BOX # 15 **AERATION EFFLUENT:**
SETTLEOMETER < 80% IN 5 MINUTES



- Conversion Complete
- Separation Analysis
  - "Perfect Clarifier"
  - < 80 % in 5 minutes
- Inhibited Settling
  - High concentration mass (too crowded)
  - Low density mass (too buoyant)

BOX # 23 **CLARIFIER EFFLUENT: SOLIDS LOSS OBSERVED**



- Observed Loss
  - Clarifier Weir
  - Effluent
- Unobserved Loss
  - Life Expectancy
    - Birth
    - Aged
    - Deceased
  - 2-3 months?

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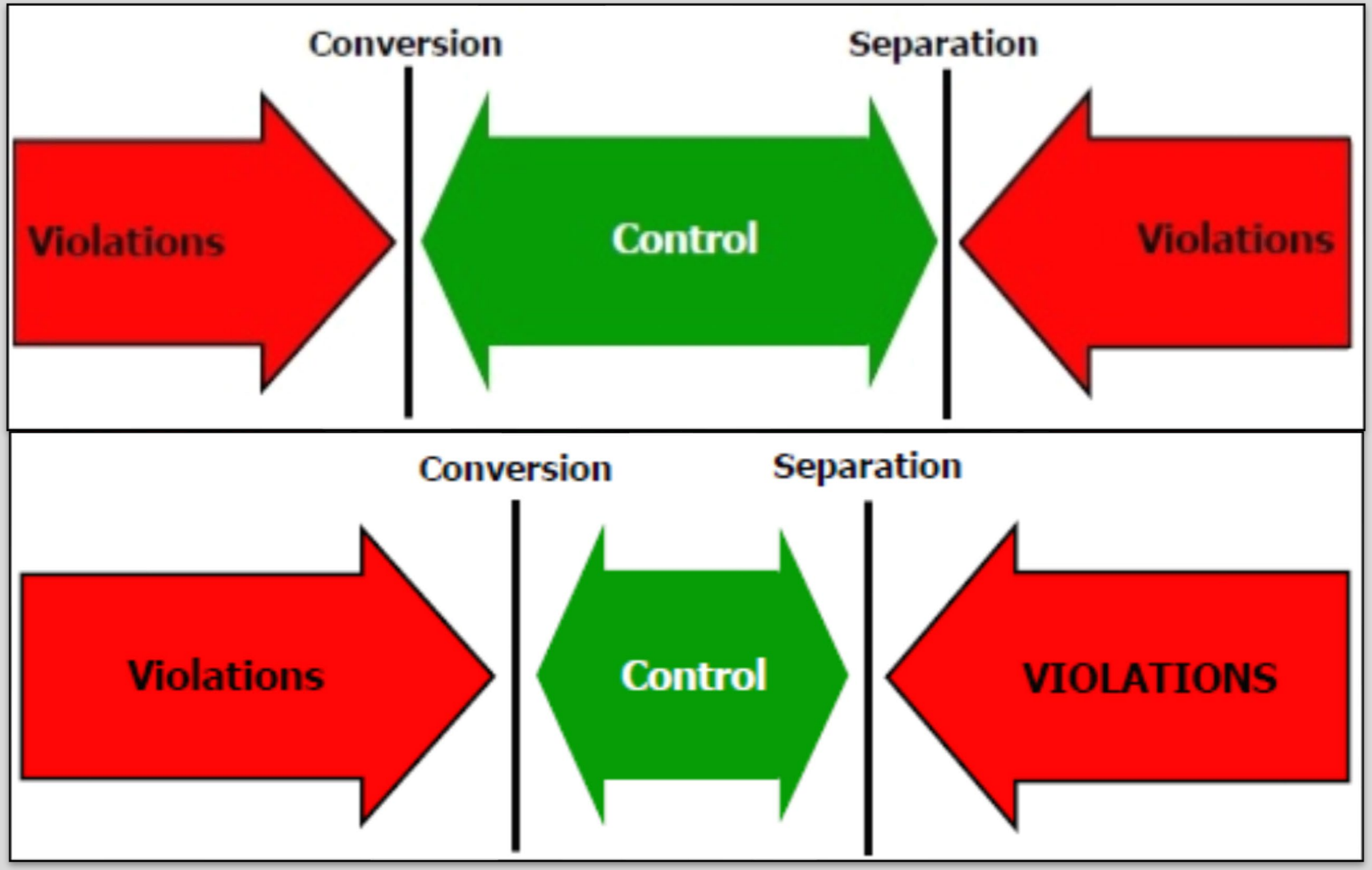
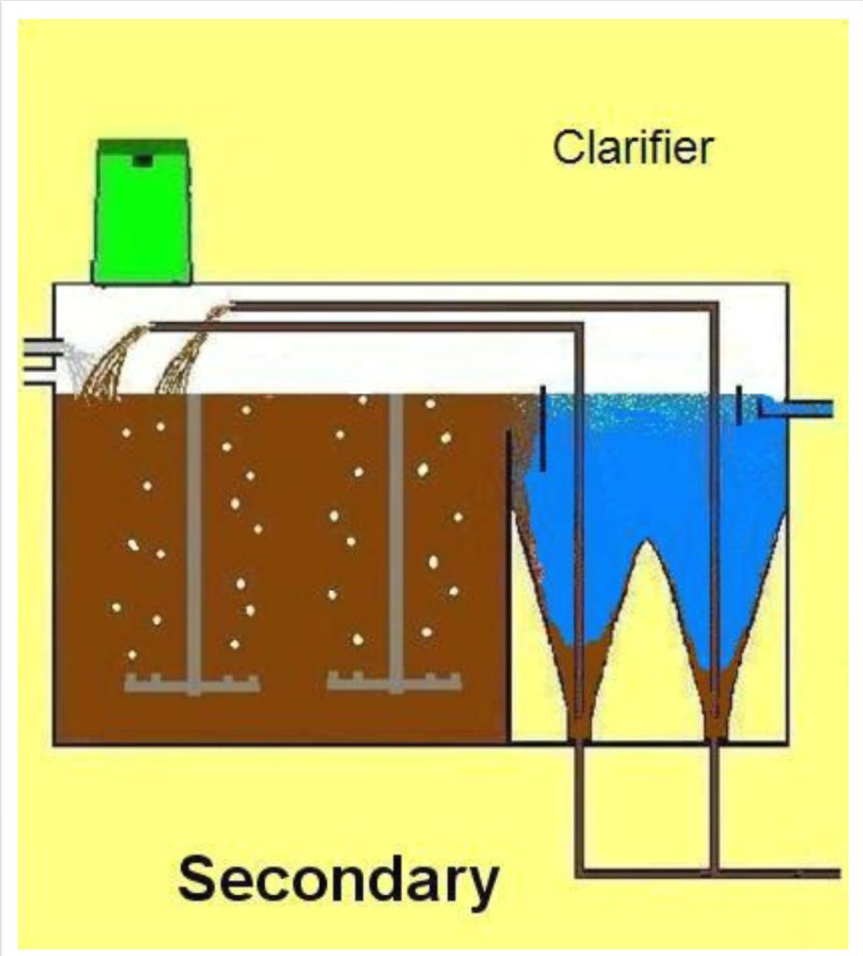
  - Effluent
- Unobserved Loss
  - Life Expectancy
    - Birth
    - Aged
    - Deceased
  - 2-3 months?

BOX # 24

COMPLIANCE

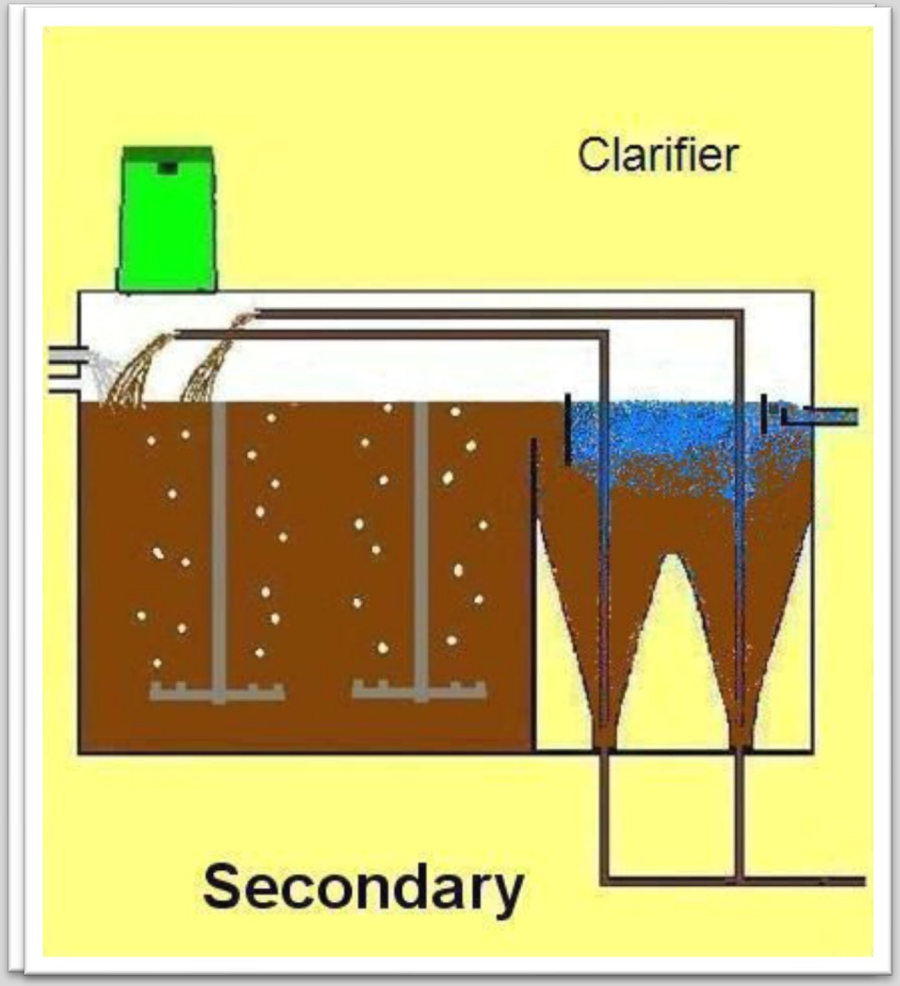


BOX # 25 **CLARIFIER:**
SLUDGE BLANKET < 30% WATER DEPTH



- Blanket Depth
- High blanket,
  less capacity
- Range: 20% to 30%
- Reduce blanket
  - RAS rate correct?
  - Too much biomass?

BOX # 25 **CLARIFIER:**
SLUDGE BLANKET < 30% WATER DEPTH



- Blanket Depth
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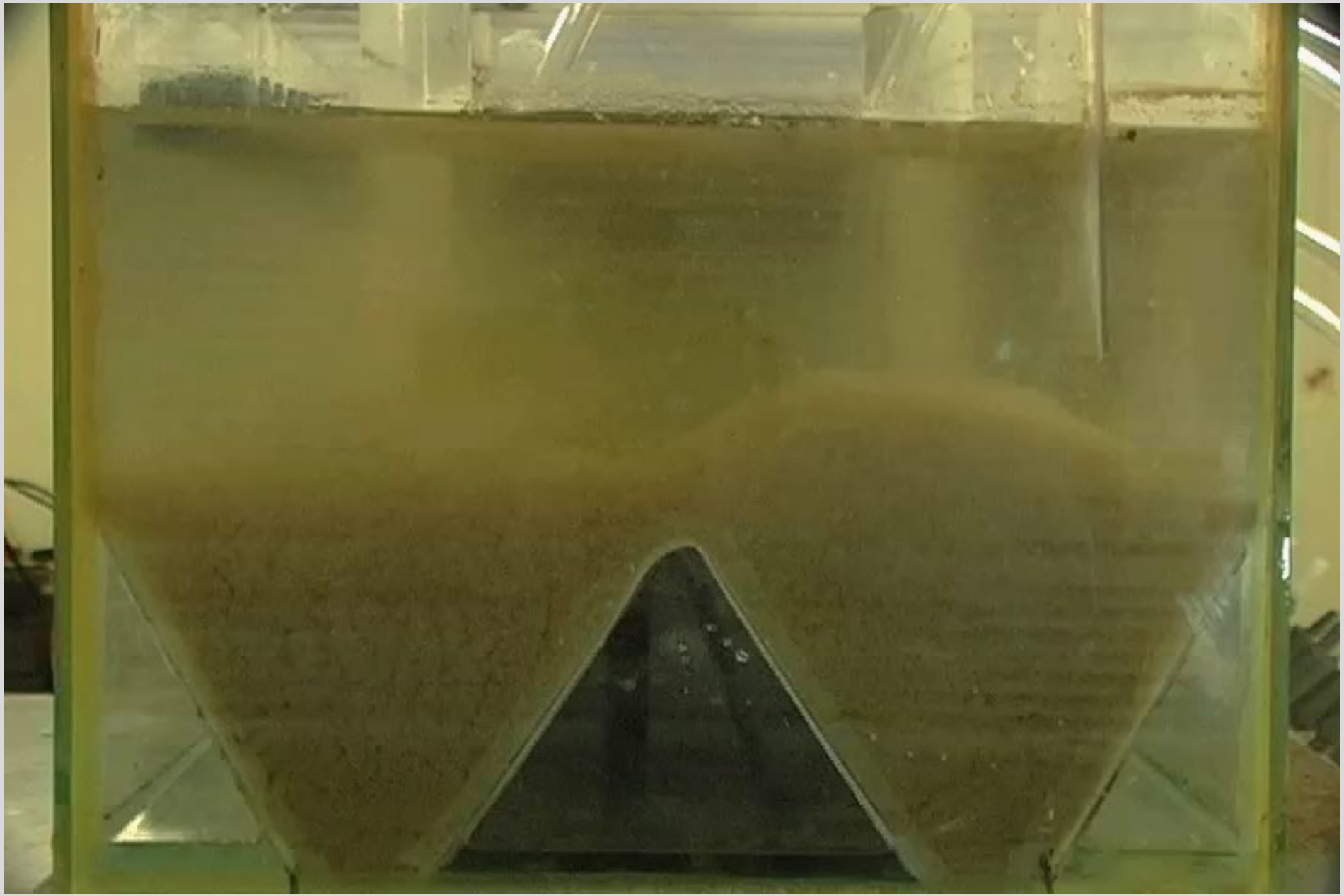
- Range: 20% to 30%
- Reduce blanket
  - RAS rate correct?
  - Too much biomass?



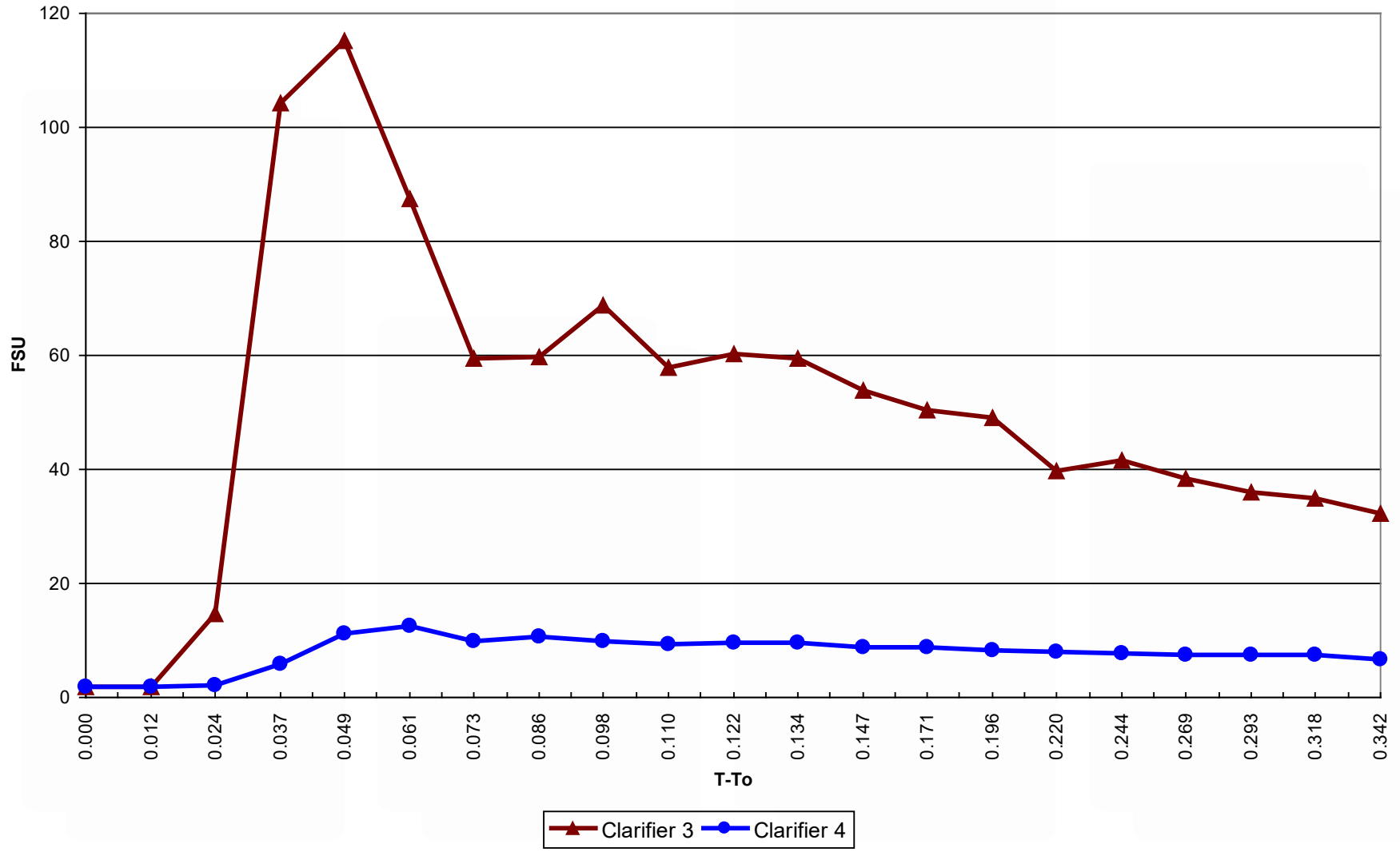
BOX # 25

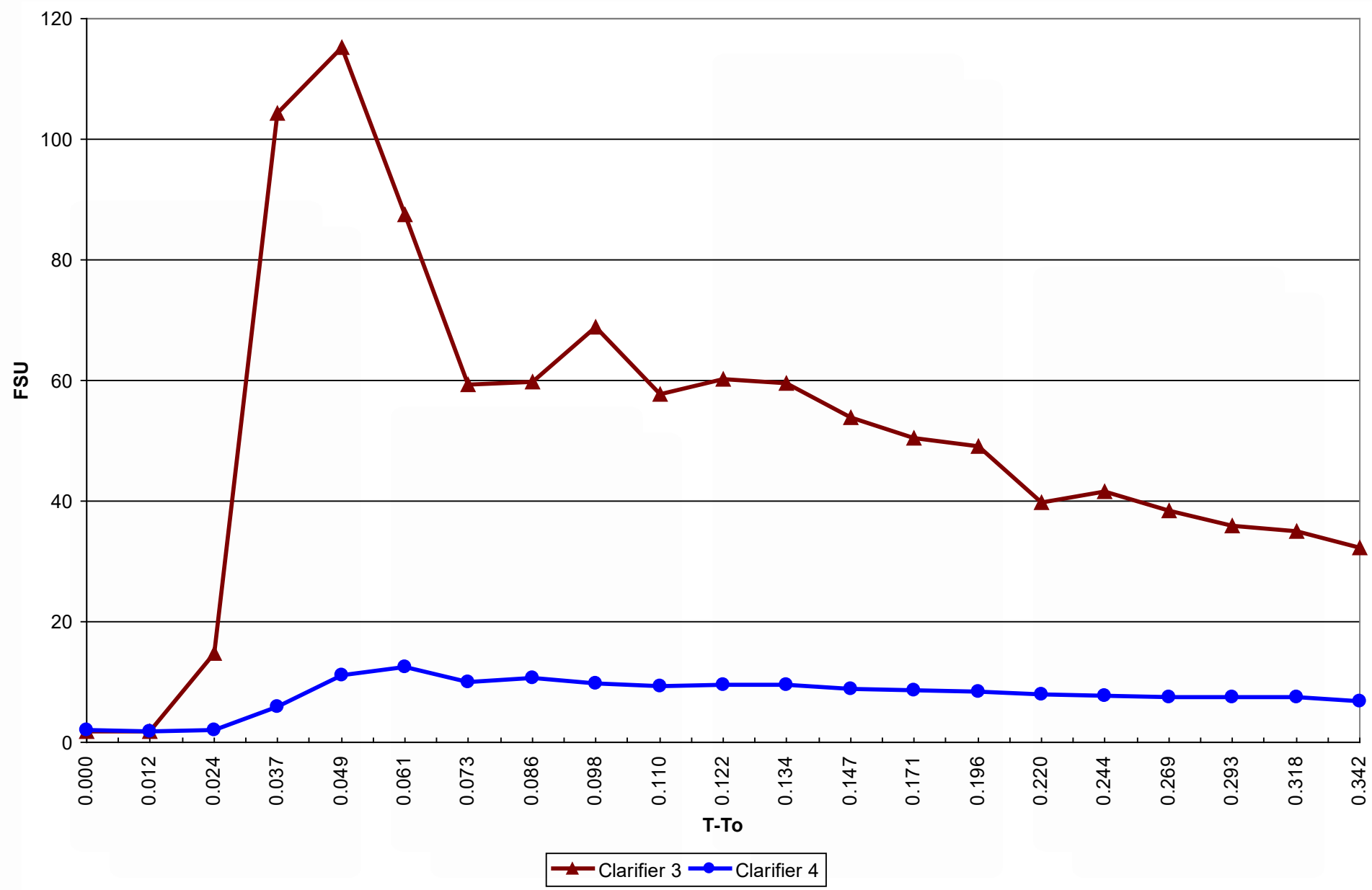
CLARIFIER:
SLUDGE BLANKET < 30% WATER DEPTH

- Blanket Depth
- High blanket,
  less capacity
- Range: 20% to 30%
- Reduce blanket
  - RAS rate correct?
  - Too much biomass?

BOX # 27 **CLARIFIER: HYDRAULIC ISSUE IN CLARIFIER**

- Flow Splitting
- Density Currents
- Effluent Weir
  - Location
  - Elevation


120
100
80
60
40
20
0
FSU
0.000
0.012
0.024
0.037
0.049
0.061
0.073
0.086
0.098
0.110
0.122
0.134
0.147
0.171
0.196
0.220
0.244
0.269
0.293
0.318
0.342
T-To
Clarifier 3
Clarifier 4


120
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FSU
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0.024
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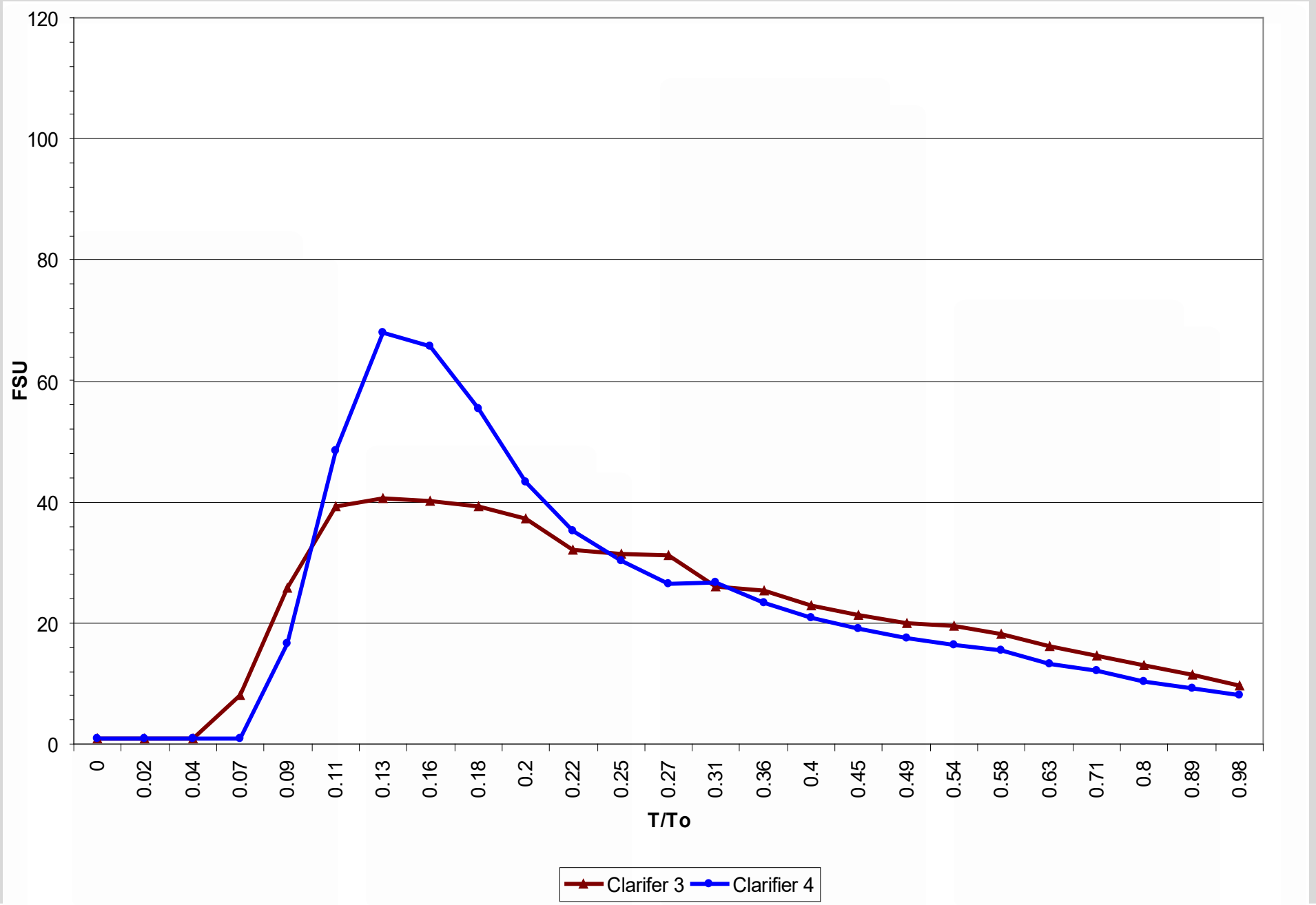
0.086
0.098
0.110
0.122
0.134
0.147
0.171
0.196
0.220
0.244
0.269
0.293
0.318
0.342
T-To
Clarifier 3
Clarifier 4


120
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0.18
0.2
0.22
0.25
0.27
0.31
0.36
0.4
0.45
0.49
0.54
0.58
0.63
0.71
0.8
0.89
0.98
T/To
Clarifer 3
Clarifier 4

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- Flow Splitting
- Density Currents
- Effluent Weir
  - Location
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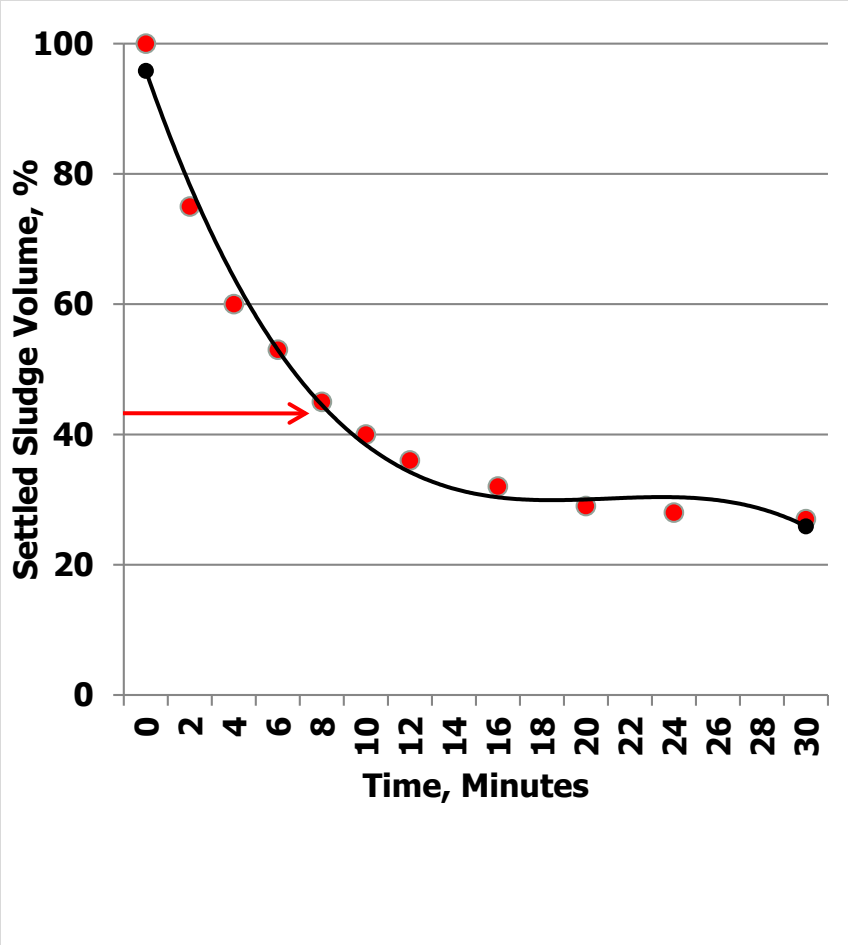
BOX # 27 **CLARIFIER: HYDRAULIC ISSUE IN CLARIFIER**

- Flow Splitting
- Density Currents
- Effluent Weir
  - Location
  - Elevation

BOX # 26 **CLARIFIER: RAS RATE CORRECT**



- RAS rate
  - Slow settling/slow rate
  - Fast settling/fast rate
- Chart settling rate
- Locate "knee"
- Spin Aeration & RAS
- Calculate
  - Increase/decrease
  - Adjust

CALCULATING CORRECT RAS RATE

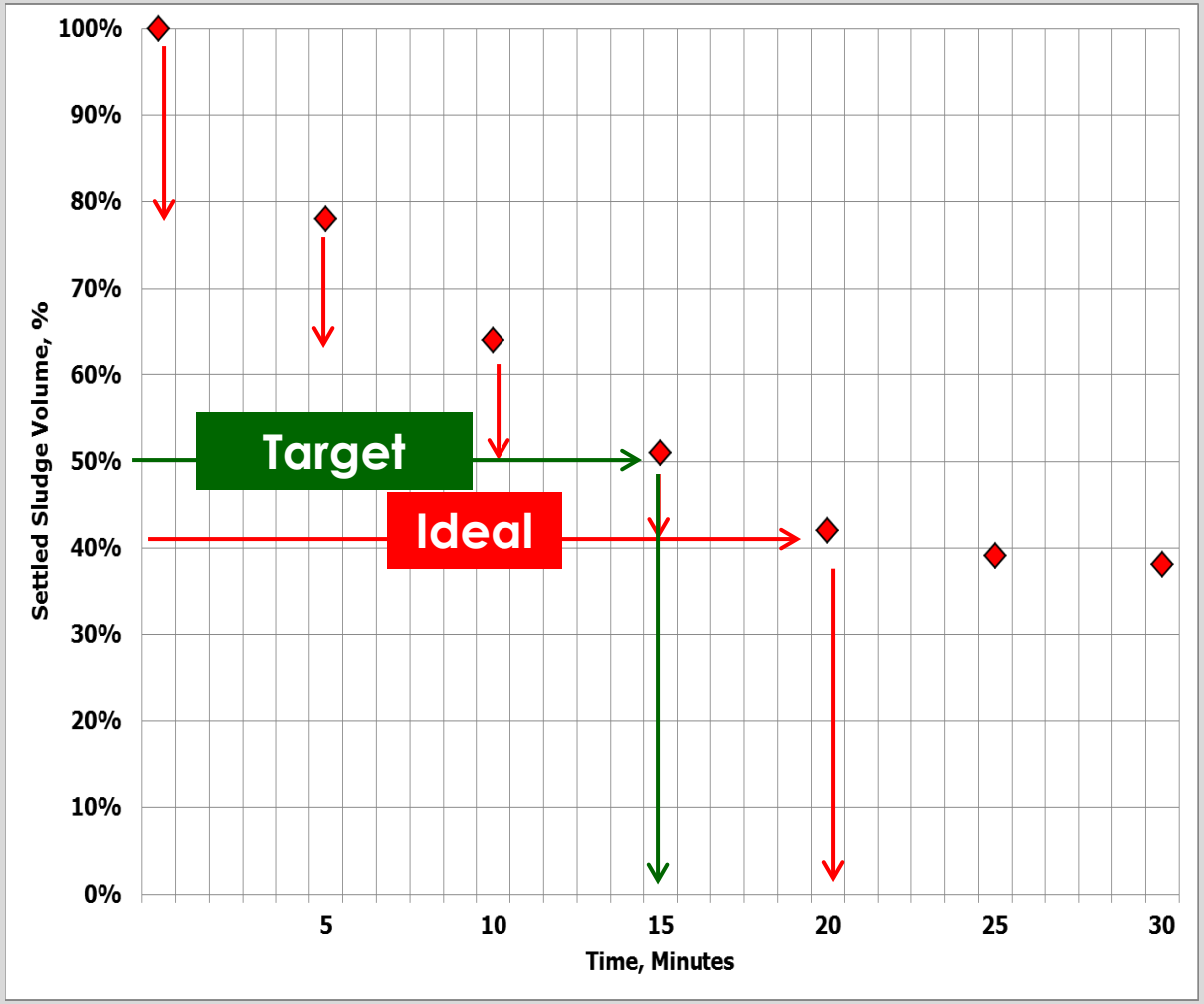
Spins:

AT = 3.2 %

Actual RAS = 8.8 %

Settleometer Results

Time,mins.	SS, %
0	100
5	78
10	64
15	51
20	42
25	39
30	38



CALCULATING CORRECT RAS RATE

Spins:

AT = 3.2 %

Actual RAS = 8.8 %

Target RAS = 6.3 %

Settleometer Results

Time,mins.	SS, %
0	100
5	78
10	64
15	**51**
20	42
25	39
30	38

Calculating Correct RAS Rate

1. Volume of Settleometer at start of analysis: 100

2. Aeration Tank Spin 3.2

3. Settled RAS volume (from Chart) 51

Target RAS Spin: 6.3%

$$\frac{100 \times 3.2}{51} =$$

What adjustment is required to the RAS?

BOX # 29 **CLARIFIER: SOR OR SLR > DESIGN CAPACITY**

- SOR
  - Surface overflow rate
- SLR
  - Solids loading rate

BOX # 29 **CLARIFIER: SOR OR SLR > DESIGN CAPACITY**

"Ten States Standards" Clarifiers
=1000 gpd/ft^2

- SOR
  - Surface overflow rate

Clarifier: 90 ft diameter
= 6361 ft^2

Flow Rate 4.6 mgd

$$\frac{4.6 \text{ mgd}}{6361 \text{ ft}^2} = 723 \text{ gpd/ft}^2$$

BOX # 29 **CLARIFIER: SOR OR SLR > DESIGN CAPACITY**

Ten States Standards Clarifiers
=35 lbs./d/ft^2

- SLR
  - Solids loading rate

Clarifier	6361 ft^2
MLSS	3,250 mg/L
Inf. Flow	4.6 MGD
RAS Flow	2.3 MGD

$$\frac{3{,}250 \times 6.9 \times 8.34}{6361\ ft^2} =$$

29.4 lbs./d/ft^2

BOX # 28 **CLARIFIER: ADJUST RAS RATE**

- Evaluate Rate
- RAS_{spin} 2 x to 3 x AT_{spin}
- RAS_{spin} 4 x AT_{spin}
  - Possible
  - Problems can occur
- Confirm with Core

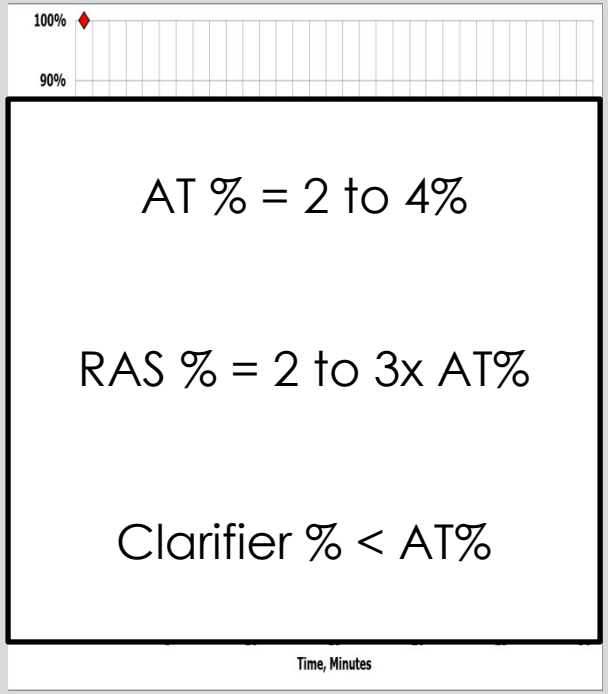
EVALUATE CORRECT RAS RATE

Spins:

AT = 3.2 %

Actual RAS = 8.8 %

Target RAS = 6.3 %



Evaluate Correct RAS Rate

Compare ratio of AT, RAS and Clarifier Spins

Typical Spin Ratios

RAS% 2 to 3 x greater than AT%

RAS > 2x could be RAS too slow

Clarifier % greater than AT % ?

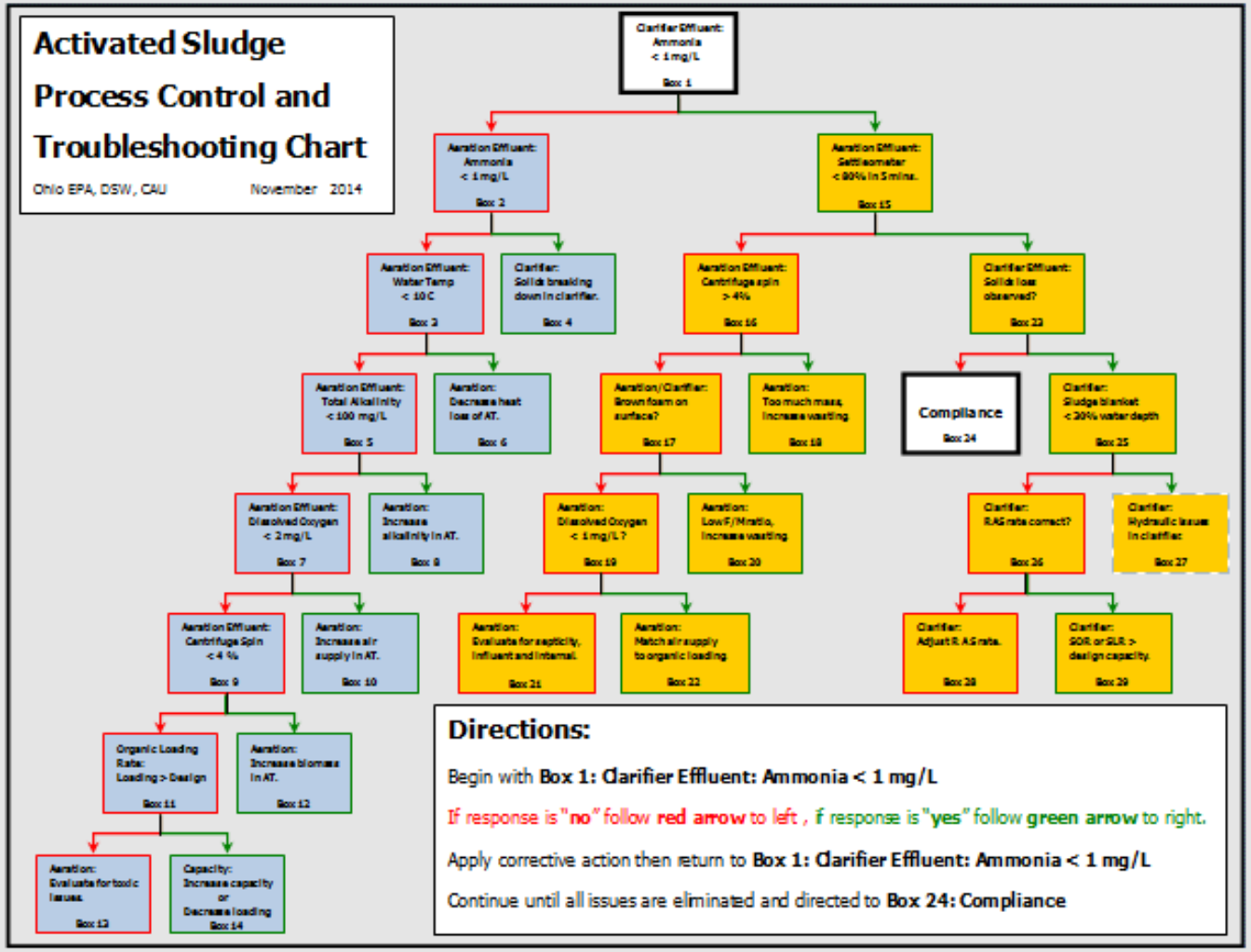
indicates solids stored in clarifier

RAS too slow

Too much mass in system

Develop a trend for "standard" operations, evaluate periodically, calculate if necessary

ACTIVATED SLUDGE PROCESS CONTROL



http://epa.ohio.gov

Divisions and Offices

Environmental and Financial Assistance

Wastewater Treatment Plants:

Get Free Technical Assistance to Improve Compliance

Technical Resources

Activated Sludge Process Control and Troubleshooting Chart

Or email me at: jon.vandommelen@epa.ohio.gov

DISINFECTION

A QUICK GUIDE TO TROUBLESHOOTING DISINFECTION PROBLEMS

DISINFECTION

- Three Types
  - Chlorine
    - Tablet Chlorinator / Dechlorinator
    - Chemical process
  - Peracetic Acid (PAA)
    - Newer technology
    - Chemical process
  - Ultraviolet Light
    - Light wavelength disrupts bacterial DNA
    - Physical process

DISINFECTION: CHLORINE

- Balance
  - Chlorine / Dechlor
  - Bacterial limit / Chlorine residual limit
  - Enough chlorine to get the kill
  - Enough dechlorination to meet chlorine residual

CHLORINE DISINFECTION

CHLORINE DISINFECTION

Tablet Chlorinator

DISINFECTION: CHLORINE

Chlorine Tablets

Dechlorination Tablets

DISINFECTION: CHLORINE

DISINFECTION: CHLORINE

- Check Free Chlorine Concentration
  - After the Chlorinator in the Chlorine Contact Tank
    - Grab Sample (CLEAN tools and containers!)
    - Must have ~ 0.2 mg/L free Chlorine Residual

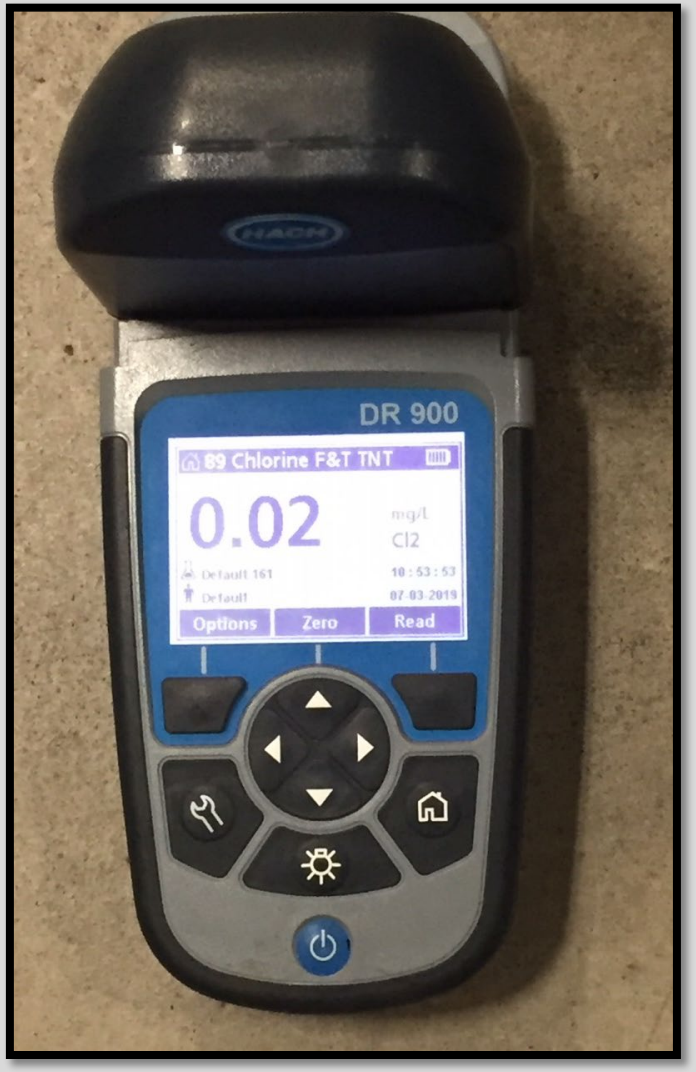
DISINFECTION: CHLORINE

DISINFECTION: CHLORINE

DISINFECTION: CHLORINE

- Check Total Chlorine Concentration
  - After Dechlorination (effluent)
    - Grab Sample (CLEAN tools and containers!)
    - Must be within Permitted Limit
    - If measured value < 0.05 mg/L, presumed Compliant

DISINFECTION: CHLORINE



CHLORINE DISINFECTION

- Conversion First
  - Incomplete conversion will impact disinfection
  - Chlorine is more effective in “clean water”

- No tablets, no hypochlorite, no disinfection, no kill
  - Tablets must be in the water, not bridged

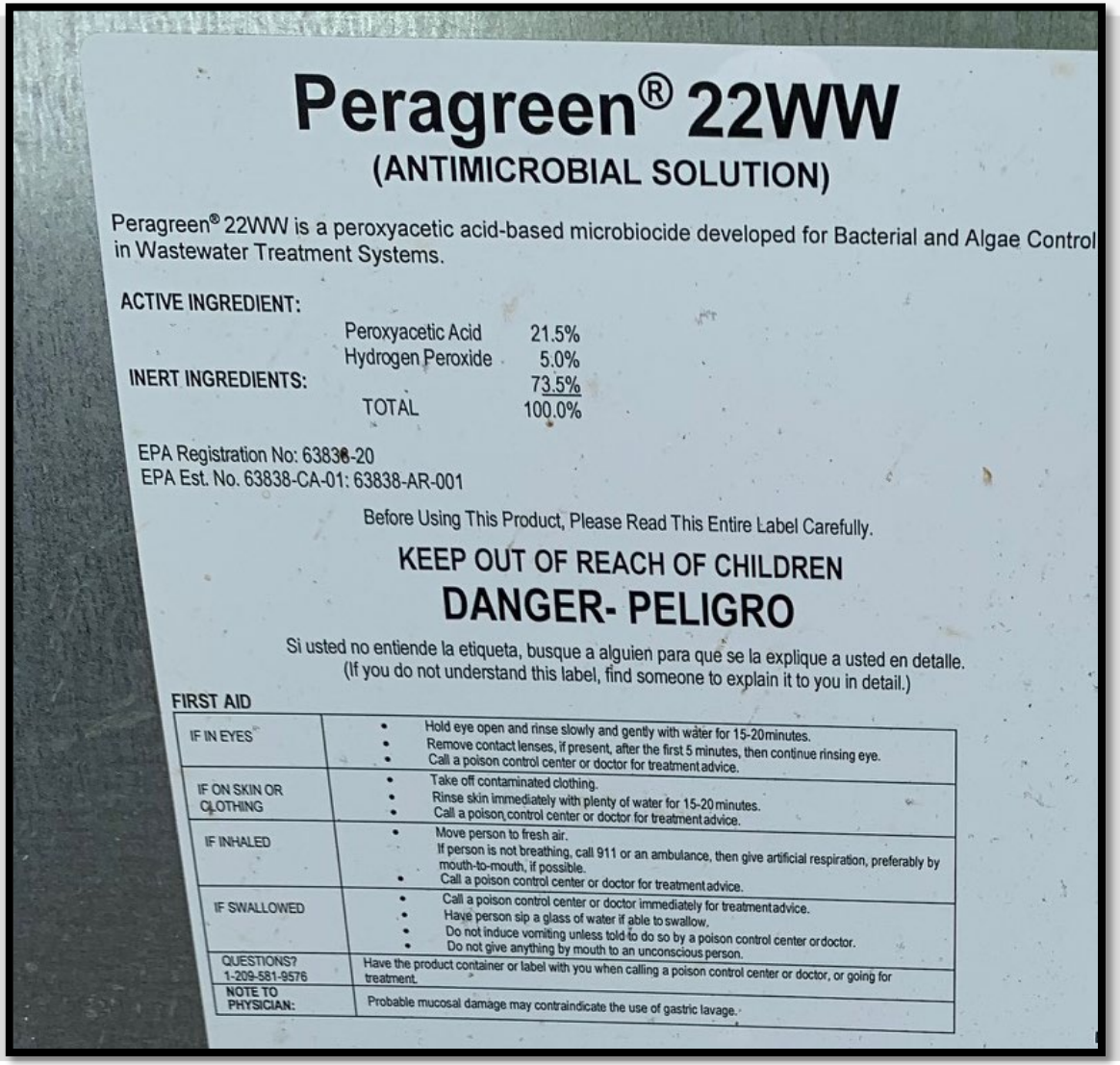
CHLORINE DISINFECTION

PERACETIC ACID (PAA)

- PAA is gaining a following
  - Similar contact time as chlorine
  - Can test concentration with Chlorine Test Kit
    - Multiply meter result by 1.07 to get PAA concentration
  - Seems to be effective disinfectant
  - Apparently no residual in receiving stream
  - Economical?

PERACETIC ACID (PAA)

PERACETIC ACID (PAA)



Peragreen® 22WW

(ANTIMICROBIAL SOLUTION)

Peragreen® 22WW is a peroxyacetic acid-based microbiocide developed for Bacterial and Algae Control in Wastewater Treatment Systems.

ACTIVE INGREDIENT:

	Peroxyacetic Acid	21.5%
	Hydrogen Peroxide	5.0%
INERT INGREDIENTS:		73.5%
	TOTAL	100.0%

EPA Registration No: 63838-20
EPA Est. No. 63838-CA-01: 63838-AR-001

Before Using This Product, Please Read This Entire Label Carefully.

KEEP OUT OF REACH OF CHILDREN

DANGER- PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID

IF IN EYES	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
IF ON SKIN OR CLOTHING	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.
IF INHALED	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. • Call a poison control center or doctor for treatment advice.
IF SWALLOWED	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to an unconscious person.
QUESTIONS? 1-209-581-9576	Have the product container or label with you when calling a poison control center or doctor, or going for treatment.
NOTE TO PHYSICIAN:	Probable mucosal damage may contraindicate the use of gastric lavage.

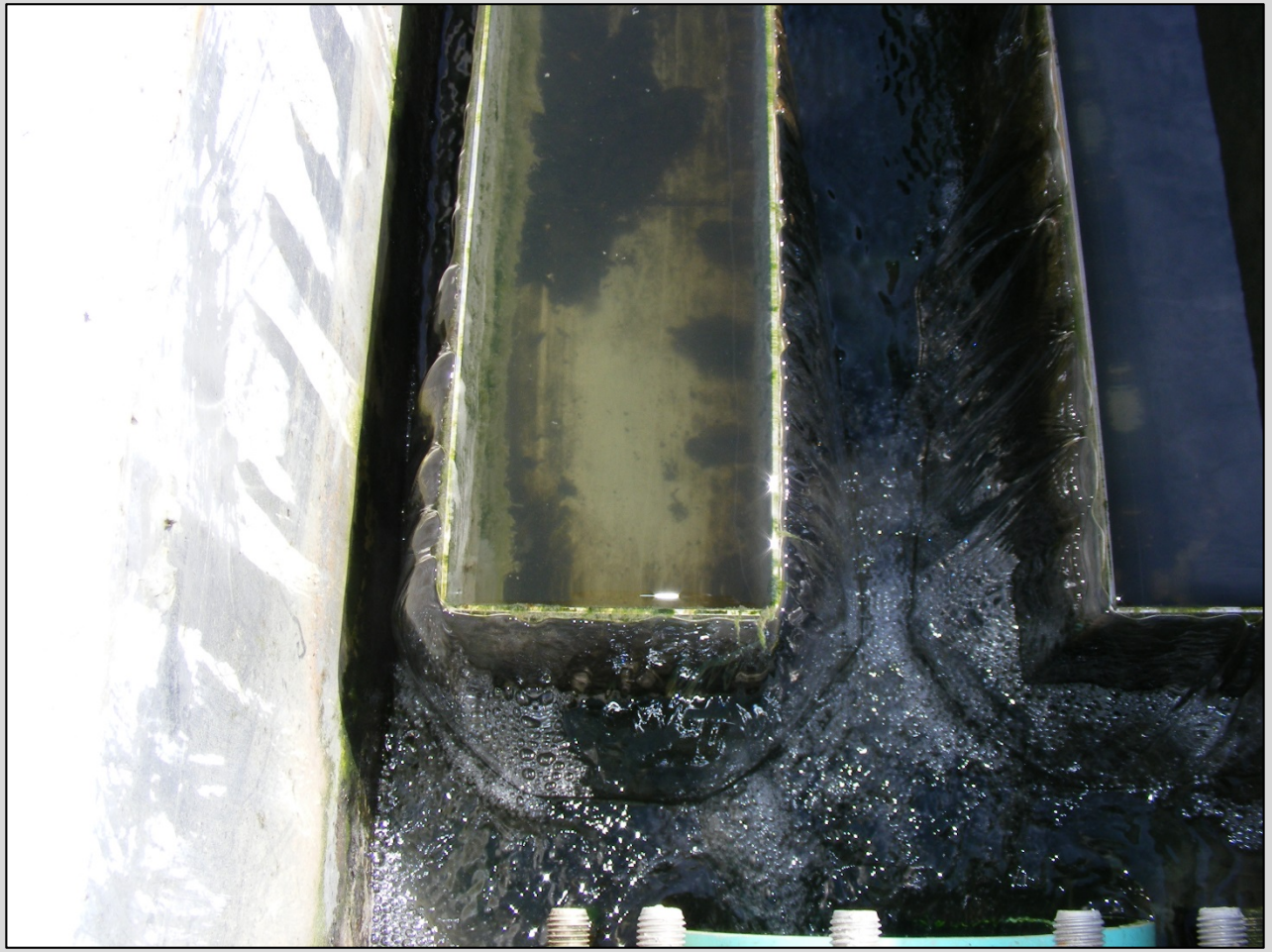
PERACETIC ACID (PAA)

ULTRAVIOLET DISINFECTION

- Ultraviolet is very effective…
  - If the light can penetrate the water
- Problems
  - Proper hydraulic design
  - Low suspended solids
  - Bulbs must be clean
  - Unit must be powered

ULTRAVIOLET DISINFECTION

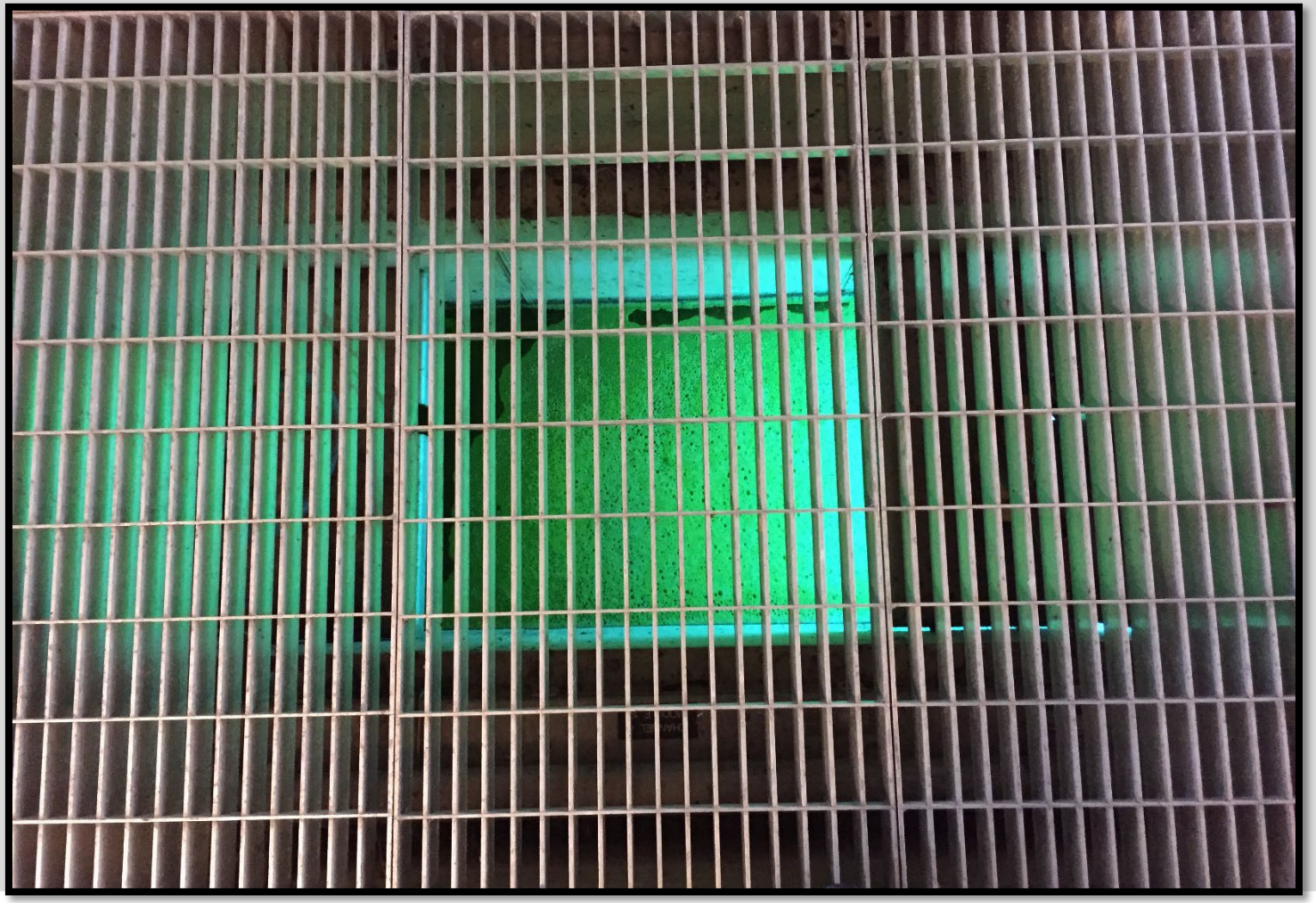
ULTRAVIOLET DISINFECTION



ULTRAVIOLET DISINFECTION

ULTRAVIOLET DISINFECTION

ULTRAVIOLET DISINFECTION



Ultraviolet Disinfection

- If light doesn't penetrate the water?

- Substances that impact UV Transmission:
  - Iron
  - Nitrate
  - Dissolved organic matter
  - A variety of chemicals (rare in large quantities)

ULTRAVIOLET DISINFECTION

- How good is your effluent?
- How do you know?

ULTRAVIOLET DISINFECTION

ULTRAVIOLET DISINFECTION

Zero with DI Water

Read with the Sample

DISINFECTION

Measure…

…Don’t guess

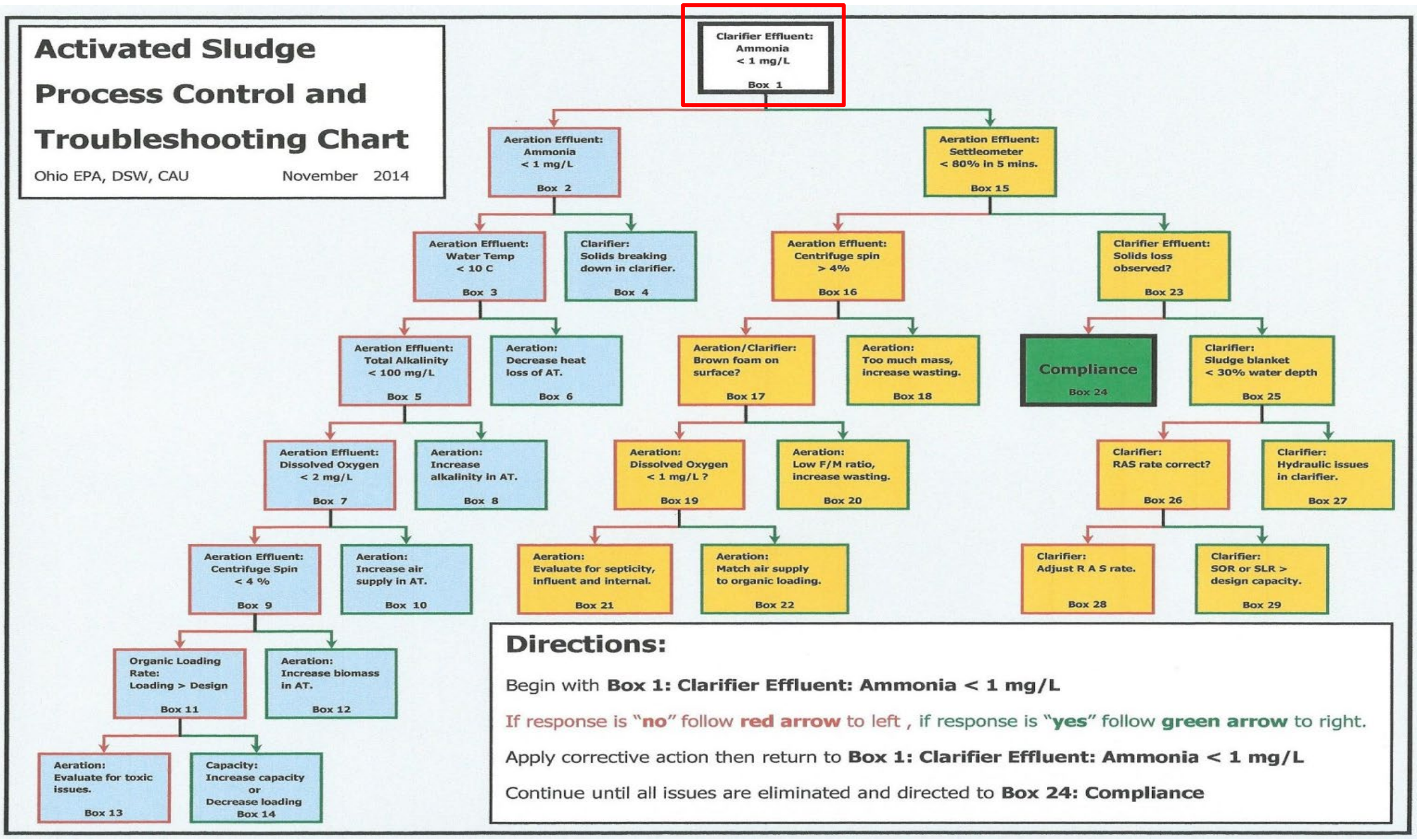
DISINFECTION

Questions?

jon.vandommelen@epa.ohio.gov
(614) 580-5069

What if . . . ?

Troubleshooting oxic issues


Activated Sludge Process Control and Troubleshooting Chart
Ohio EPA, DSW, CAU November 2014
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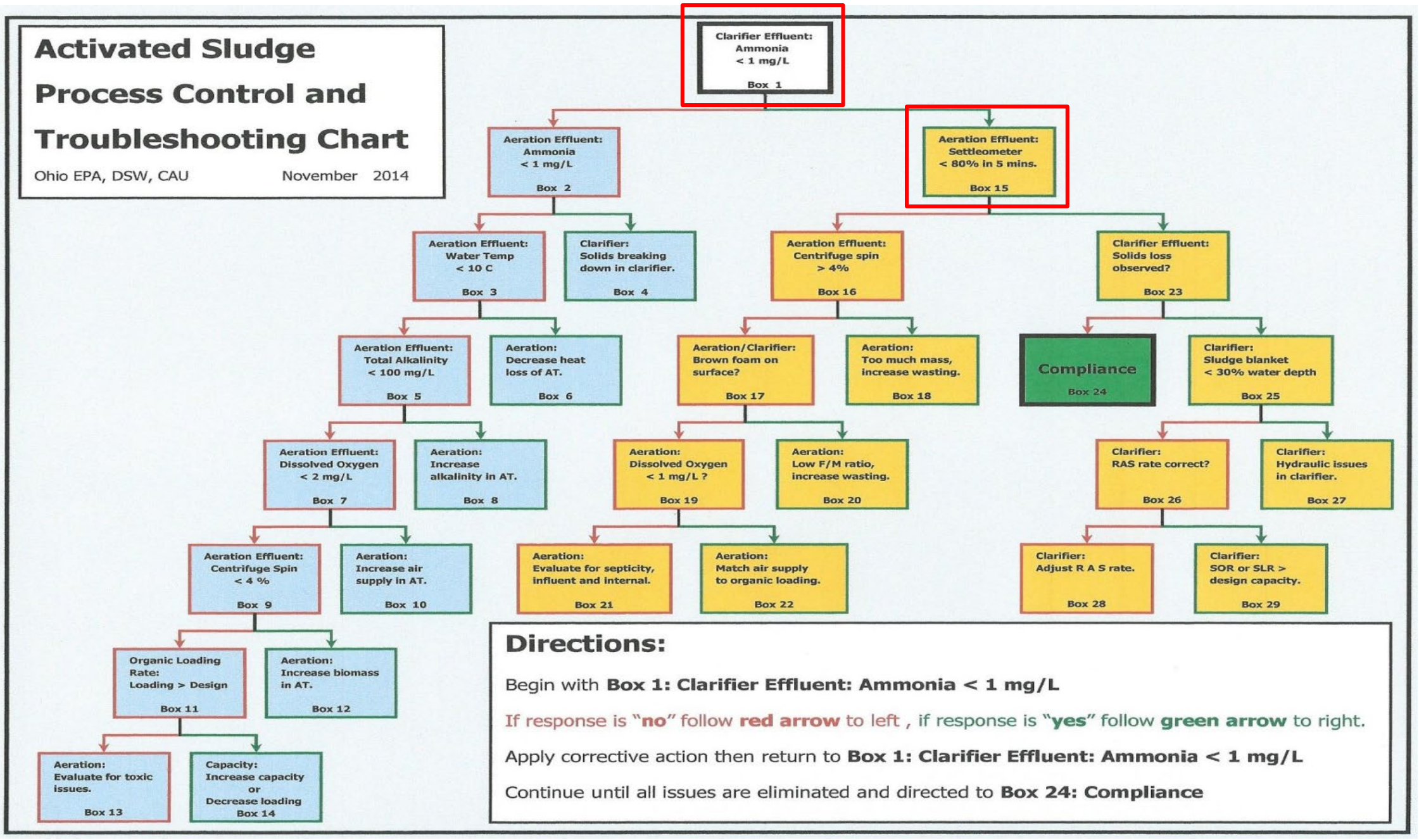
Aeration Effluent: Ammonia < 1 mg/L Box 2
Aeration Effluent: Settleometer < 80% in 5 mins. Box 15
Aeration Effluent: Water Temp < 10 C Box 3
Clarifier: Solids breaking down in clarifier. Box 4
Aeration Effluent: Centrifuge spin > 4% Box 16
Clarifier Effluent: Solids loss observed? Box 23
Aeration Effluent: Total Alkalinity < 100 mg/L Box 5
Aeration: Decrease heat loss of AT. Box 6
Aeration/Clarifier: Brown foam on surface? Box 17
Aeration: Too much mass, increase wasting. Box 18
Compliance Box 24
Clarifier: Sludge blanket < 30% water depth Box 25
Aeration Effluent: Dissolved Oxygen < 2 mg/L Box 7
Aeration: Increase alkalinity in AT. Box 8
Aeration: Dissolved Oxygen < 1 mg/L ? Box 19
Aeration: Low F/M ratio, increase wasting. Box 20
Clarifier: RAS rate correct? Box 26
Clarifier: Hydraulic issues in clarifier. Box 27
Aeration Effluent: Centrifuge Spin < 4 % Box 9
Aeration: Increase air supply in AT. Box 10
Aeration: Evaluate for septicity, influent and internal. Box 21
Aeration: Match air supply to organic loading. Box 22
Clarifier: Adjust R A S rate. Box 28
Clarifier: SOR or SLR > design capacity. Box 29
Organic Loading Rate: Loading > Design Box 11
Aeration: Increase biomass in AT. Box 12
Aeration: Evaluate for toxic issues. Box 13
Capacity: Increase capacity or Decrease loading Box 14
Directions:
Begin with Box 1: Clarifier Effluent: Ammonia < 1 mg/L
If response is "no" follow red arrow to left , if response is "yes" follow green arrow to right.
Apply corrective action then return to Box 1: Clarifier Effluent: Ammonia < 1 mg/L
Continue until all issues are eliminated and directed to Box 24: Compliance

What if . . . ?

Clarifier, NH_3	0.2 mg/L	AT, dissolved oxygen	_____ mg/L
AT, effluent NH_3	_____ mg/L	AT, concentration	_____ %
AT, water temperature	_____ °C	AT, OLR > design	_____ y/n
AT, total alkalinity	_____ mg/L	AT, toxicity evaluation	_____ y/n

Settleometer, < 80%	_____ %	AT, dissolved oxygen	_____ mg/L
AT, concentration	_____ %	AT, corrosion/septicity	_____ y/n
AT, excess brown foam	_____ y/n		

Clarifier, solids loss observed	_____ y/n	Clarifier, SOR/SLR over design	_____ y/n
Clarifier, blanket depth	_____ %	Clarifier, RAS rate correct	_____ y/n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Aeration Effluent: Total Alkalinity < 100 mg/L Box 5
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Aeration: Increase biomass in AT. Box 12
Aeration: Evaluate for toxic issues. Box 13
Capacity: Increase capacity or Decrease loading Box 14
Directions:
Begin with Box 1: Clarifier Effluent: Ammonia < 1 mg/L
If response is "no" follow red arrow to left , if response is "yes" follow green arrow to right.
Apply corrective action then return to Box 1: Clarifier Effluent: Ammonia < 1 mg/L
Continue until all issues are eliminated and directed to Box 24: Compliance

What if . . . ?

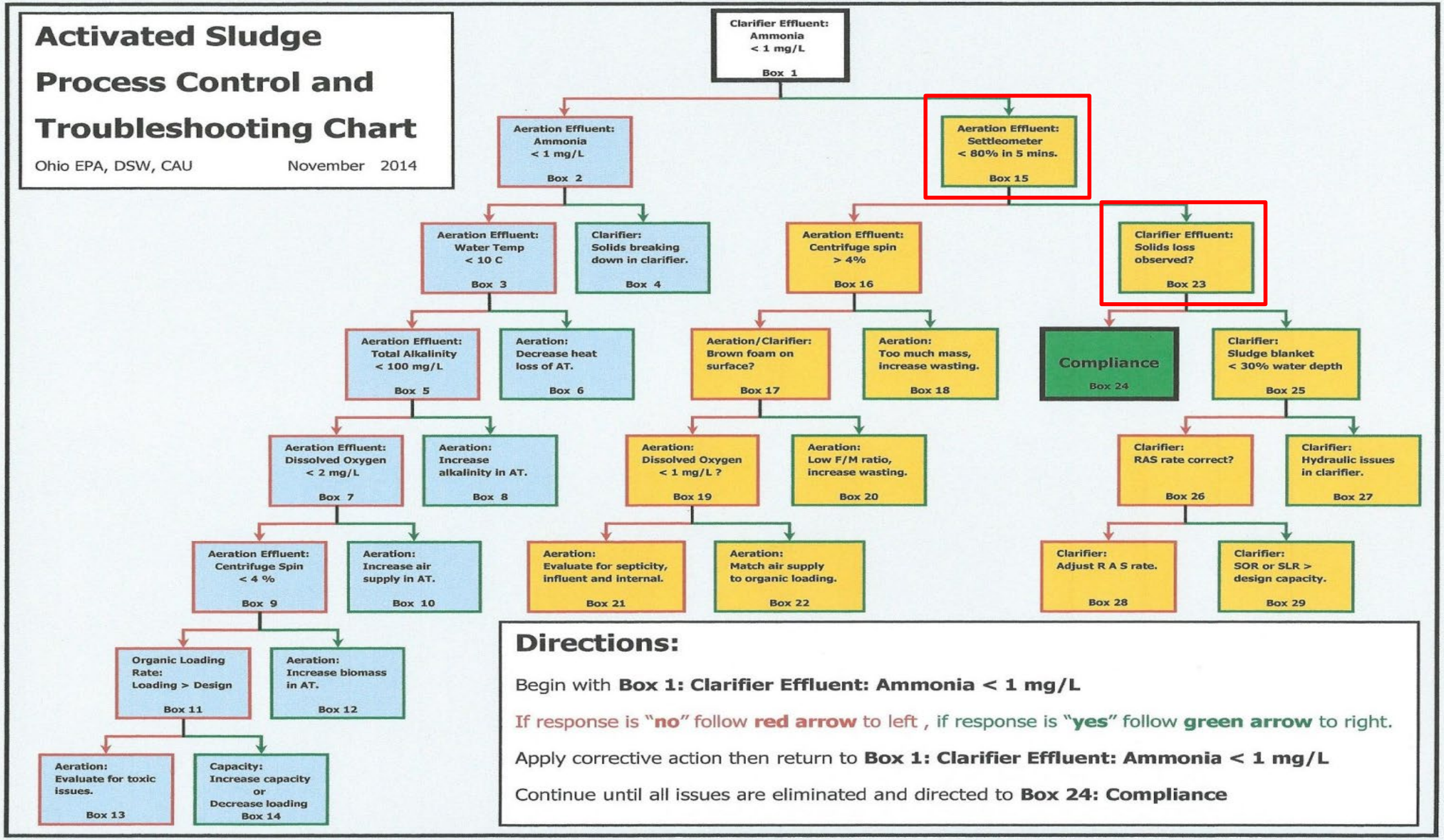
Clarifier, NH_3	0.2	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	_____	mg/L	AT, concentration	_____	%
AT, water temperature	_____	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	_____	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	65	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	_____	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	_____	y/n			

Clarifier, solids loss observed	_____	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014




ADENA
CORPORATION
NUCOR
SIMS BROS

What if . . . ?

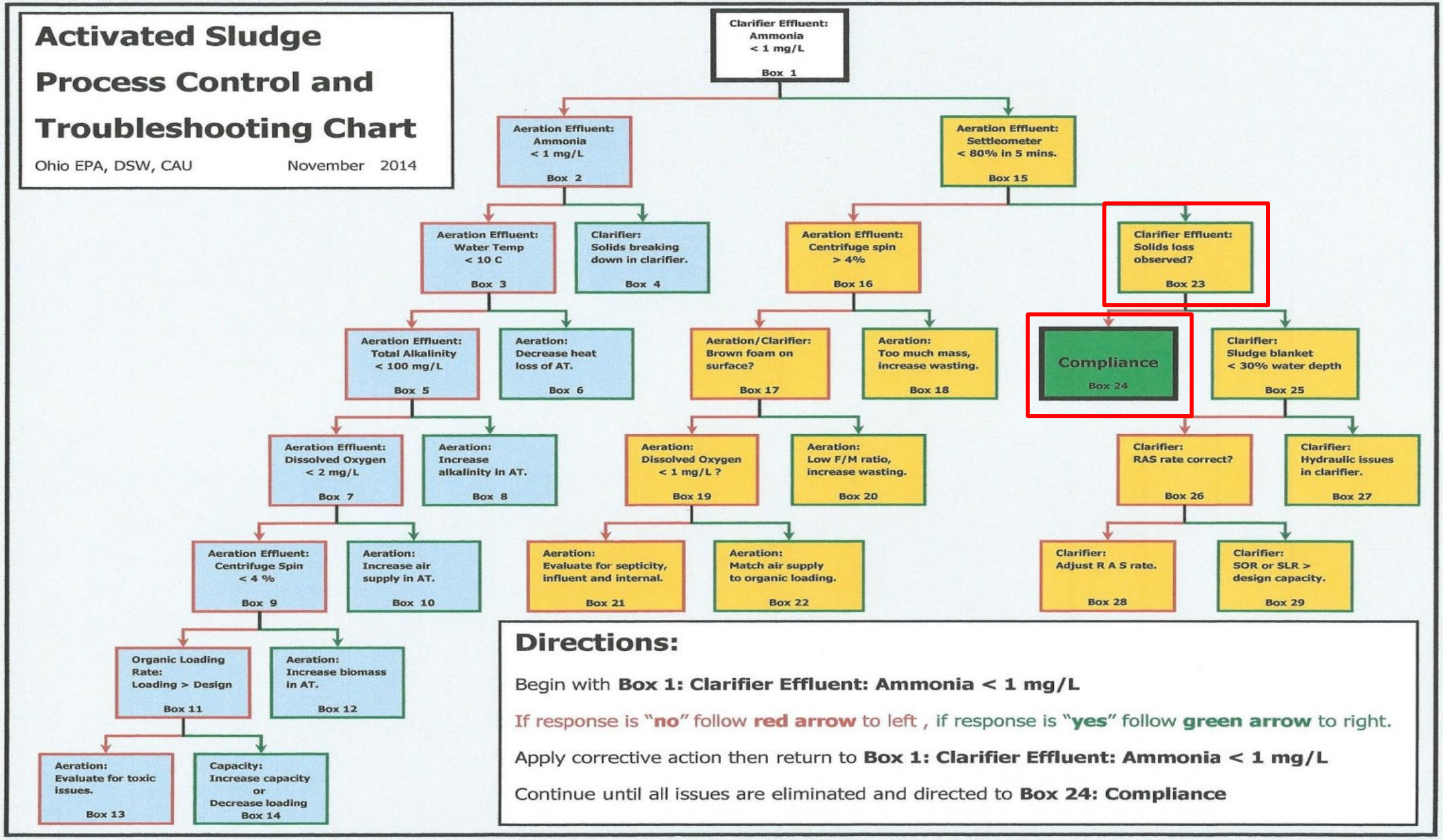
Clarifier, NH_3	0.2	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	_____	mg/L	AT, concentration	_____	%
AT, water temperature	_____	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	_____	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	65	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	_____	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	_____	y/n			

Clarifier, solids loss observed	No	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

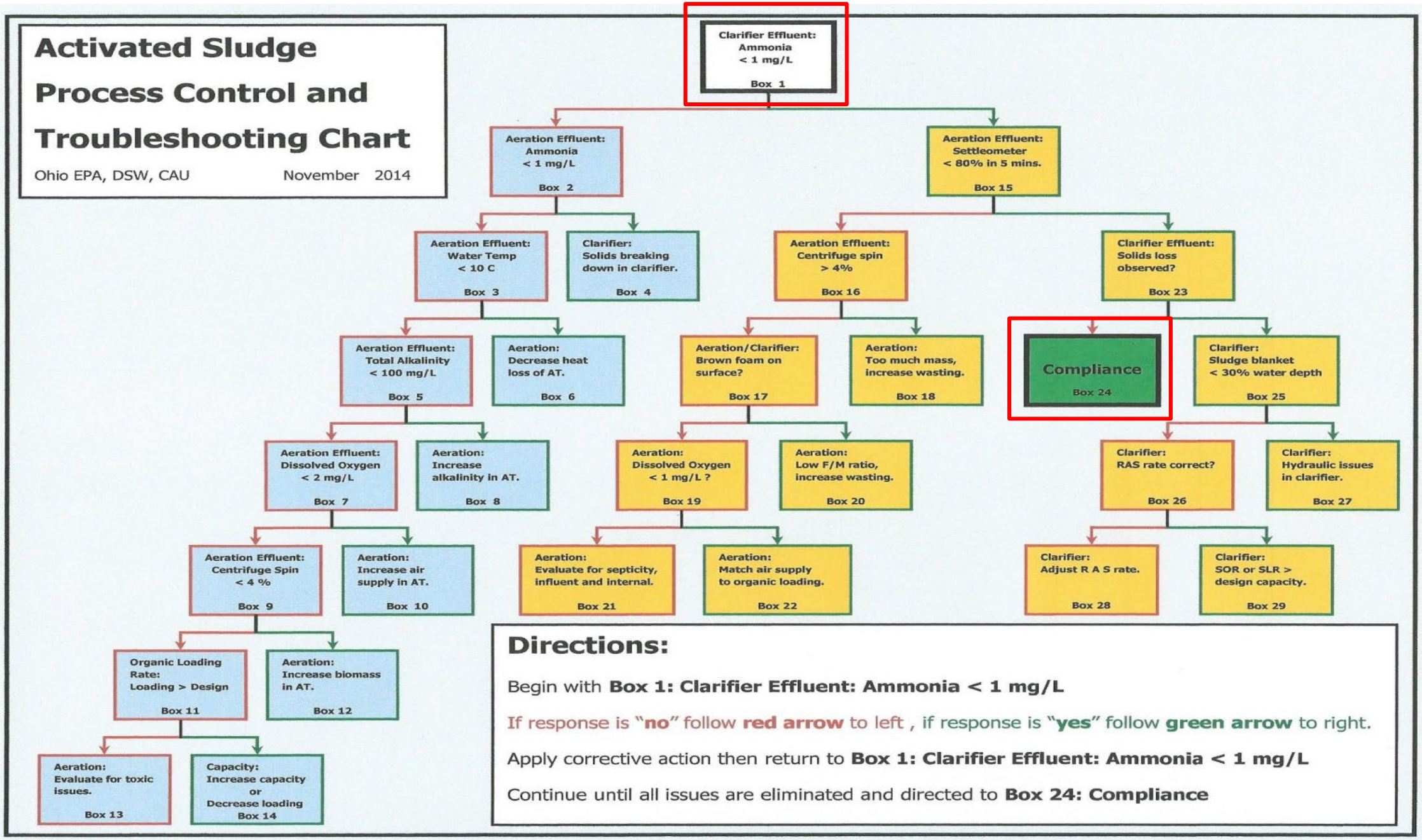
If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

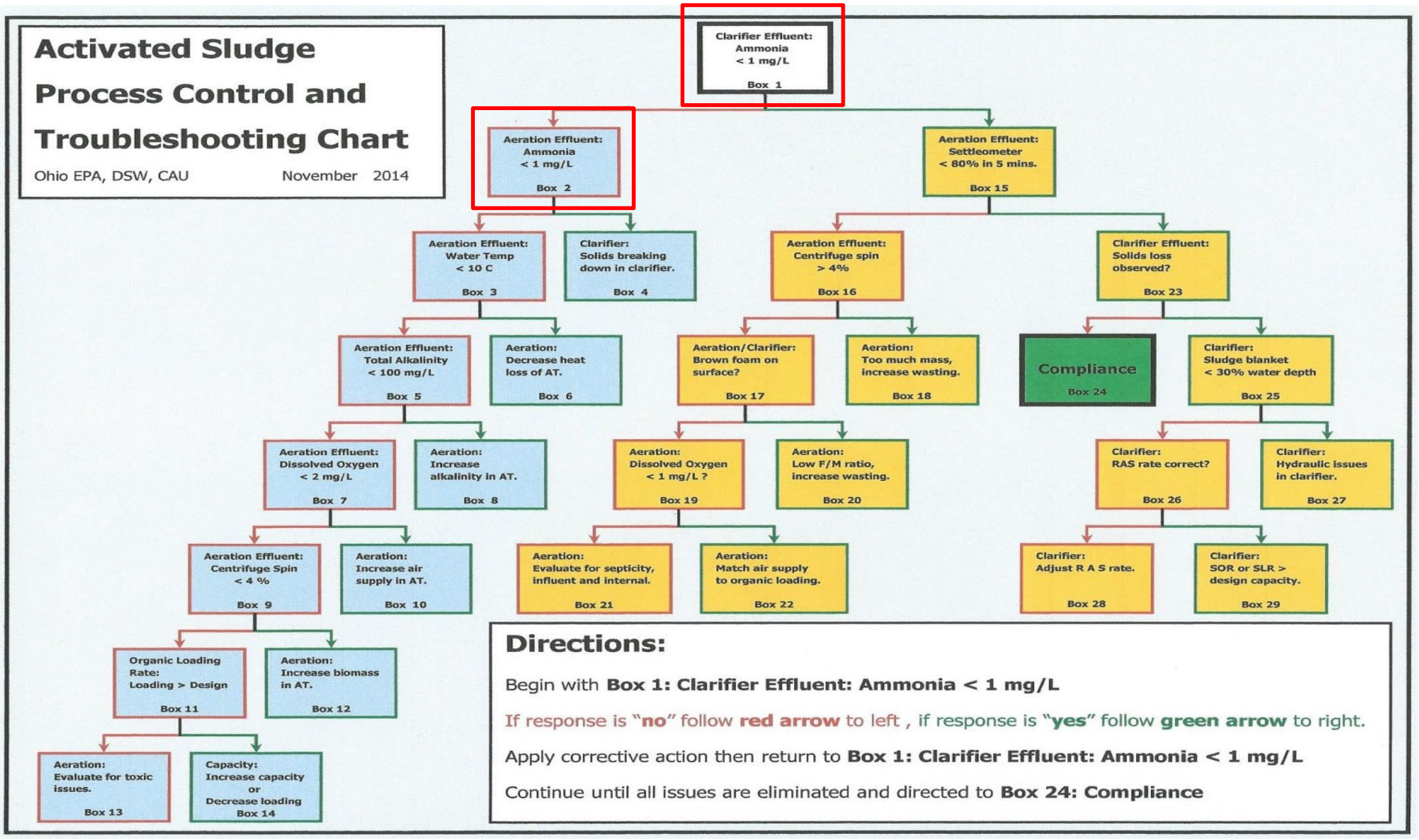
Continue until all issues are eliminated and directed to **Box 24: Compliance**

What if . . . ?

Clarifier, NH_3	11.2 mg/L	AT, dissolved oxygen	_____ mg/L
AT, effluent NH_3	_____ mg/L	AT, concentration	_____ %
AT, water temperature	_____ °C	AT, OLR > design	_____ y/n
AT, total alkalinity	_____ mg/L	AT, toxicity evaluation	_____ y/n

Settleometer, < 80%	_____ %	AT, dissolved oxygen	_____ mg/L
AT, concentration	_____ %	AT, corrosion/septicity	_____ y/n
AT, excess brown foam	_____ y/n		

Clarifier, solids loss observed	_____ y/n	Clarifier, SOR/SLR over design	_____ y/n
Clarifier, blanket depth	_____ %	Clarifier, RAS rate correct	_____ y/n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Aeration Effluent: Centrifuge spin > 4% Box 16
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Aeration Effluent: Total Alkalinity < 100 mg/L Box 5
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Compliance Box 24
Clarifier: Sludge blanket < 30% water depth Box 25
Aeration Effluent: Dissolved Oxygen < 2 mg/L Box 7
Aeration: Increase alkalinity in AT. Box 8
Aeration: Dissolved Oxygen < 1 mg/L ? Box 19
Aeration: Low F/M ratio, increase wasting. Box 20
Clarifier: RAS rate correct? Box 26
Clarifier: Hydraulic issues in clarifier. Box 27
Aeration Effluent: Centrifuge Spin < 4 % Box 9
Aeration: Increase air supply in AT. Box 10
Aeration: Evaluate for septicity, influent and internal. Box 21
Aeration: Match air supply to organic loading. Box 22
Clarifier: Adjust R A S rate. Box 28
Clarifier: SOR or SLR > design capacity. Box 29
Organic Loading Rate: Loading > Design Box 11
Aeration: Increase biomass in AT. Box 12
Aeration: Evaluate for toxic issues. Box 13
Capacity: Increase capacity or Decrease loading Box 14
Directions:
Begin with Box 1: Clarifier Effluent: Ammonia < 1 mg/L
If response is "no" follow red arrow to left , if response is "yes" follow green arrow to right.
Apply corrective action then return to Box 1: Clarifier Effluent: Ammonia < 1 mg/L
Continue until all issues are eliminated and directed to Box 24: Compliance

What if . . . ?

Is the problem in the clarifier or the aeration tank?

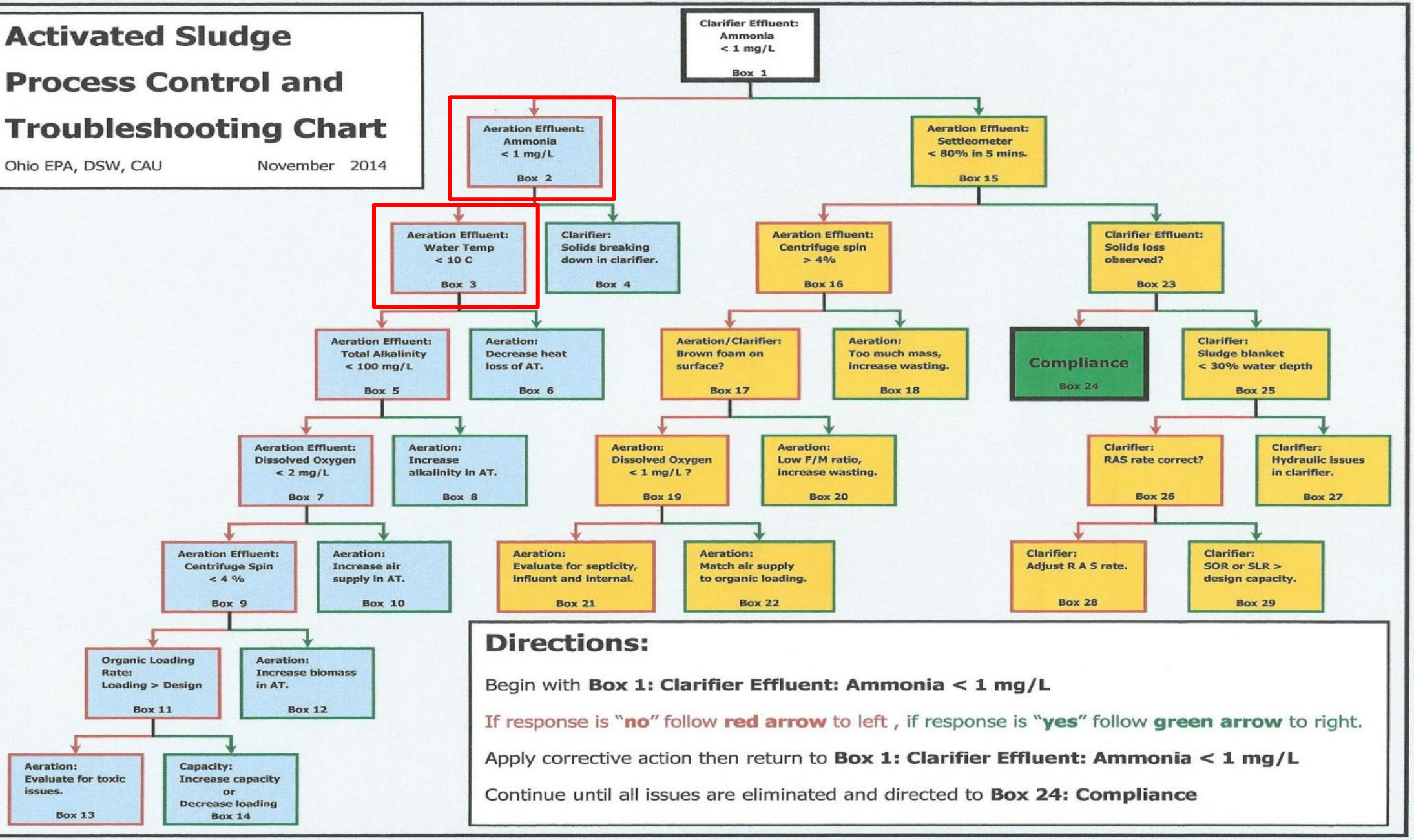
Clarifier, NH_3	11.2	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	13.8	mg/L	AT, concentration	_____	%
AT, water temperature	_____	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	_____	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	_____	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	_____	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	_____	y/n			

Clarifier, solids loss observed	_____	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**


YSI
550A
3.30
21.9

What if . . . ?

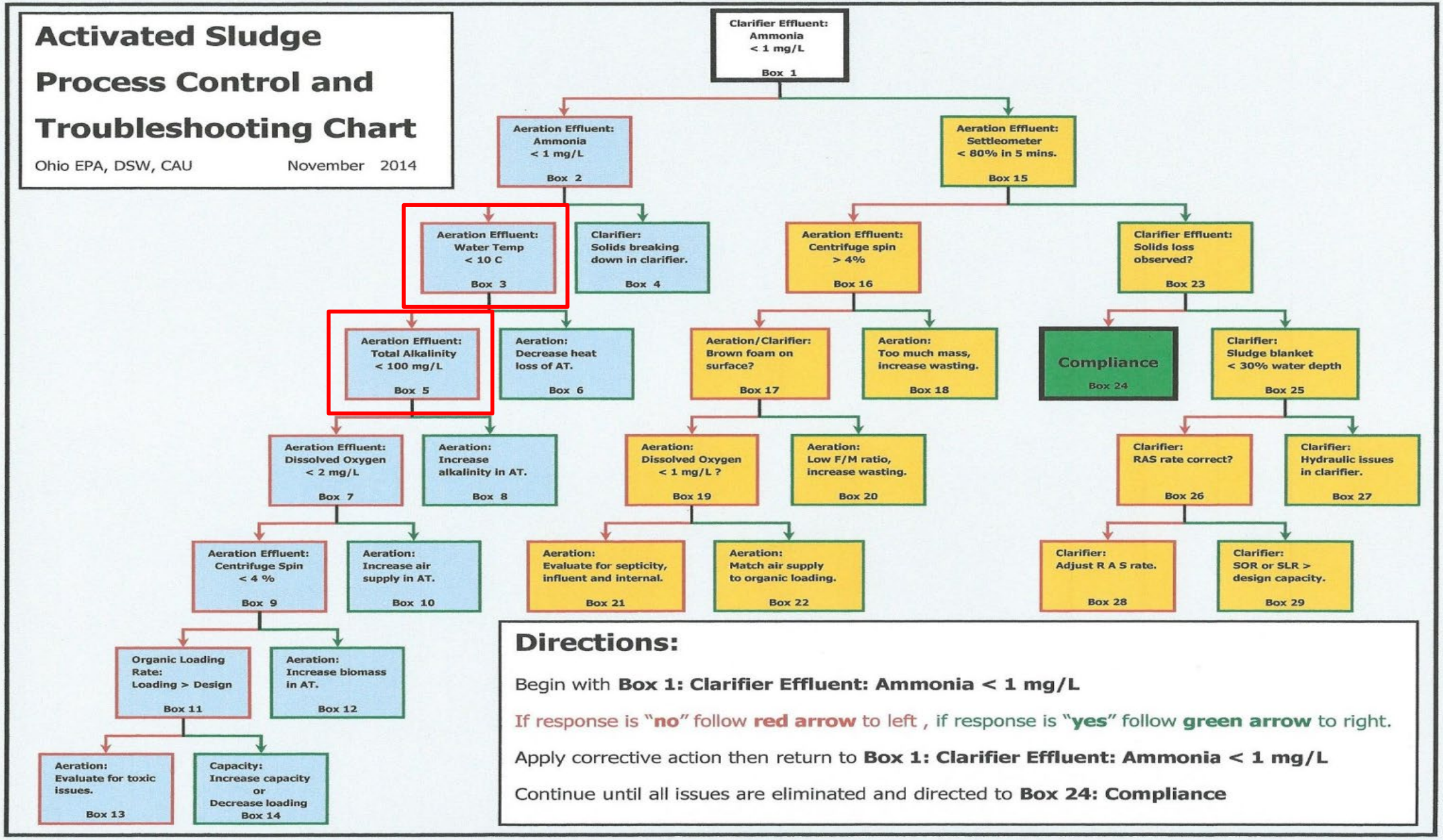
Clarifier, NH_3	11.2	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	13.8	mg/L	AT, concentration	_____	%
AT, water temperature	21.9	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	_____	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	_____	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	_____	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	_____	y/n			

Clarifier, solids loss observed	_____	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014




RAVEN
50
40
30
25
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15
10
5


HACH
TEST KIT
ALKALINITY
5-400 mg/l Mocel AL-AP MG-L
Cat. No. 24443-01

What if . . . ?

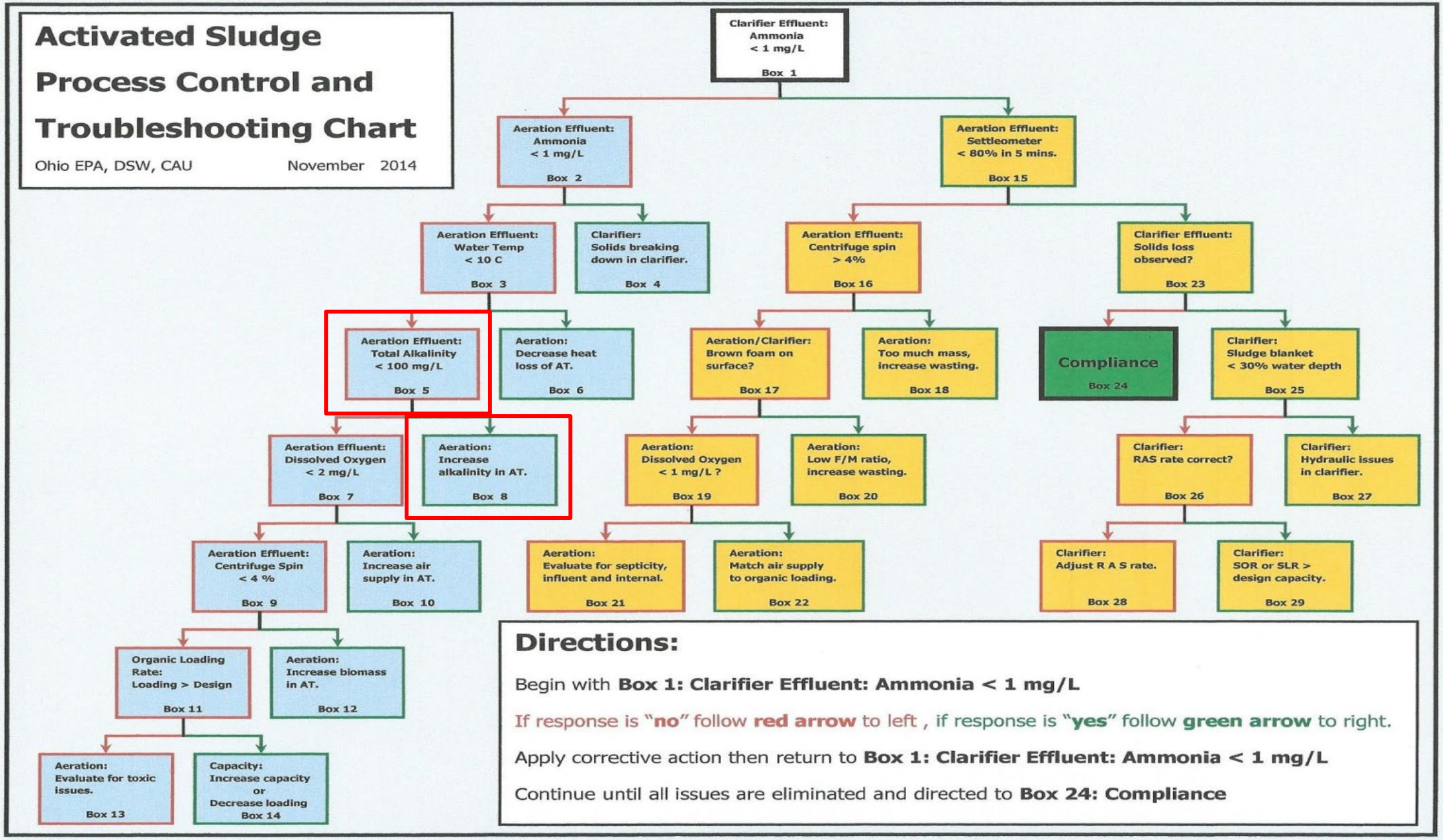
Clarifier, NH_3	11.2	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	13.8	mg/L	AT, concentration	_____	%
AT, water temperature	21.9	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	60	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	_____	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	_____	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	_____	y/n			

Clarifier, solids loss observed	_____	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



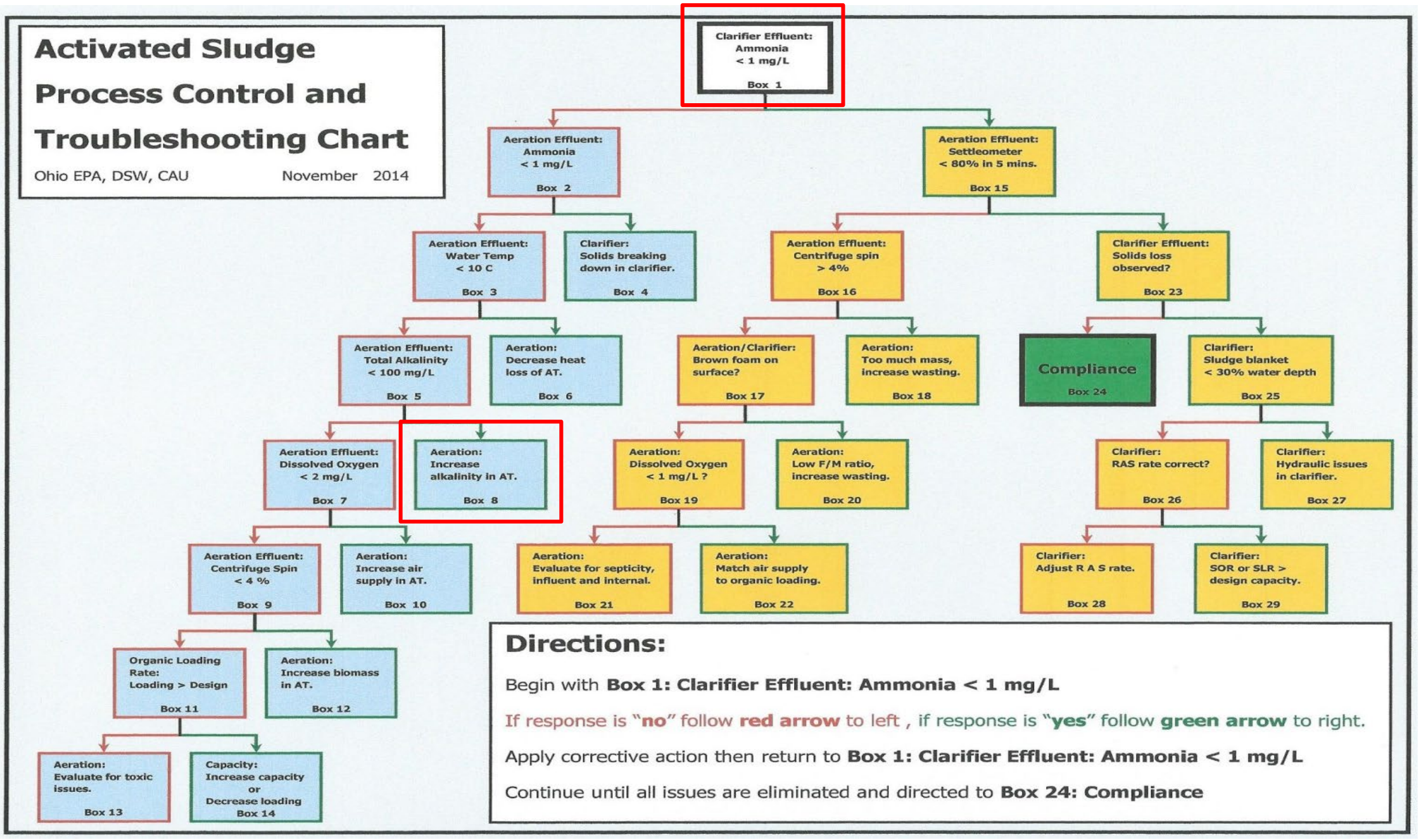
Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**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Aeration: Dissolved Oxygen < 1 mg/L ? Box 19
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Clarifier: SOR or SLR > design capacity. Box 29
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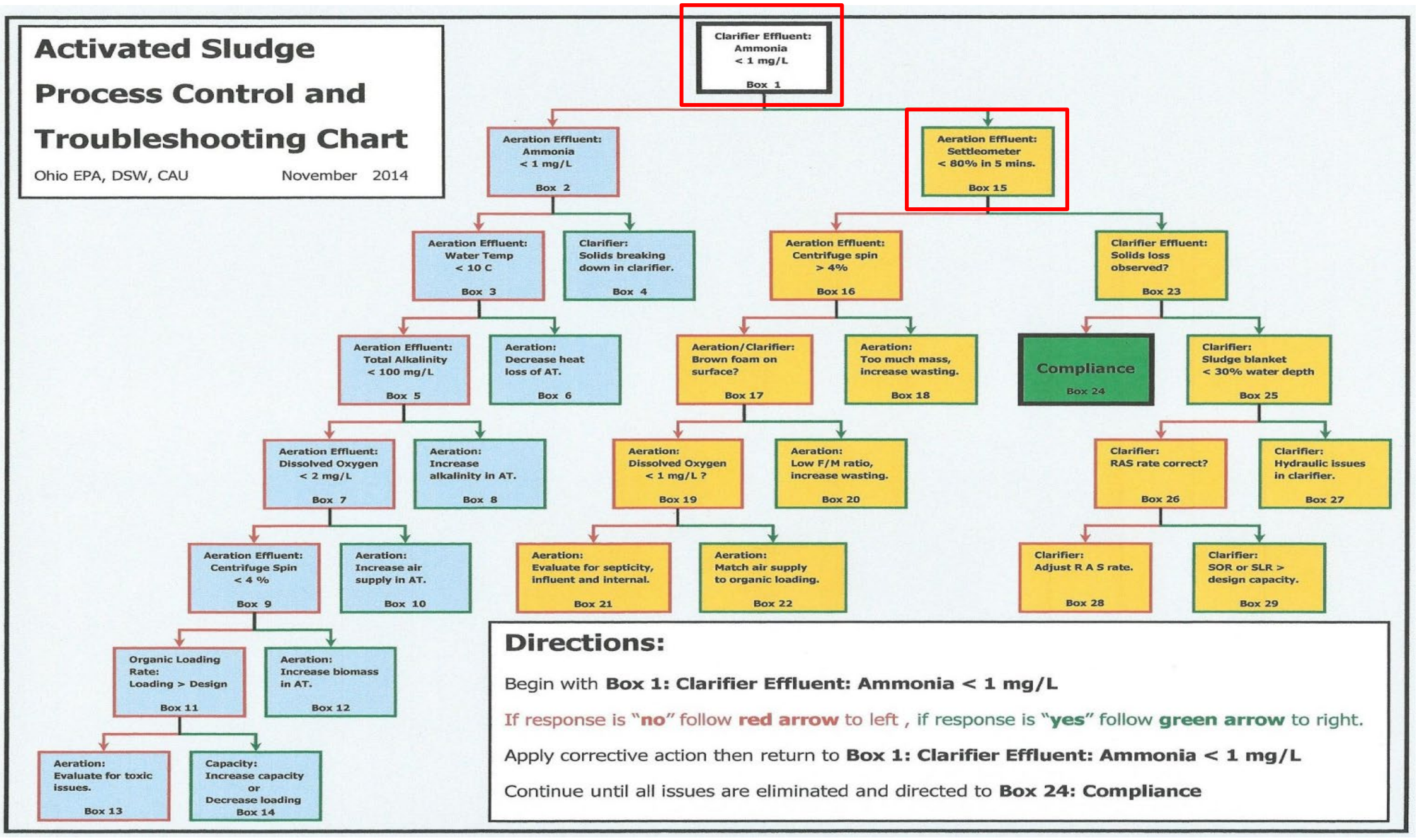
Aeration: Increase biomass in AT. Box 12
Aeration: Evaluate for toxic issues. Box 13
Capacity: Increase capacity or Decrease loading Box 14
Directions:
Begin with Box 1: Clarifier Effluent: Ammonia < 1 mg/L
If response is "no" follow red arrow to left , if response is "yes" follow green arrow to right.
Apply corrective action then return to Box 1: Clarifier Effluent: Ammonia < 1 mg/L
Continue until all issues are eliminated and directed to Box 24: Compliance

What if . . . ?

Clarifier, NH_3	0.3 mg/L	AT, dissolved oxygen	_____ mg/L
AT, effluent NH_3	_____ mg/L	AT, concentration	_____ %
AT, water temperature	_____ °C	AT, OLR > design	_____ y/n
AT, total alkalinity	_____ mg/L	AT, toxicity evaluation	_____ y/n

Settleometer, < 80%	_____ %	AT, dissolved oxygen	_____ mg/L
AT, concentration	_____ %	AT, corrosion/septicity	_____ y/n
AT, excess brown foam	_____ y/n		

Clarifier, solids loss observed	_____ y/n	Clarifier, SOR/SLR over design	_____ y/n
Clarifier, blanket depth	_____ %	Clarifier, RAS rate correct	_____ y/n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Aeration Effluent: Total Alkalinity < 100 mg/L Box 5
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Aeration: Too much mass, increase wasting. Box 18
Compliance Box 24
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Clarifier: Hydraulic issues in clarifier. Box 27
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Aeration: Increase biomass in AT. Box 12
Aeration: Evaluate for toxic issues. Box 13
Capacity: Increase capacity or Decrease loading Box 14
Directions:
Begin with Box 1: Clarifier Effluent: Ammonia < 1 mg/L
If response is "no" follow red arrow to left , if response is "yes" follow green arrow to right.
Apply corrective action then return to Box 1: Clarifier Effluent: Ammonia < 1 mg/L
Continue until all issues are eliminated and directed to Box 24: Compliance

What if . . . ?

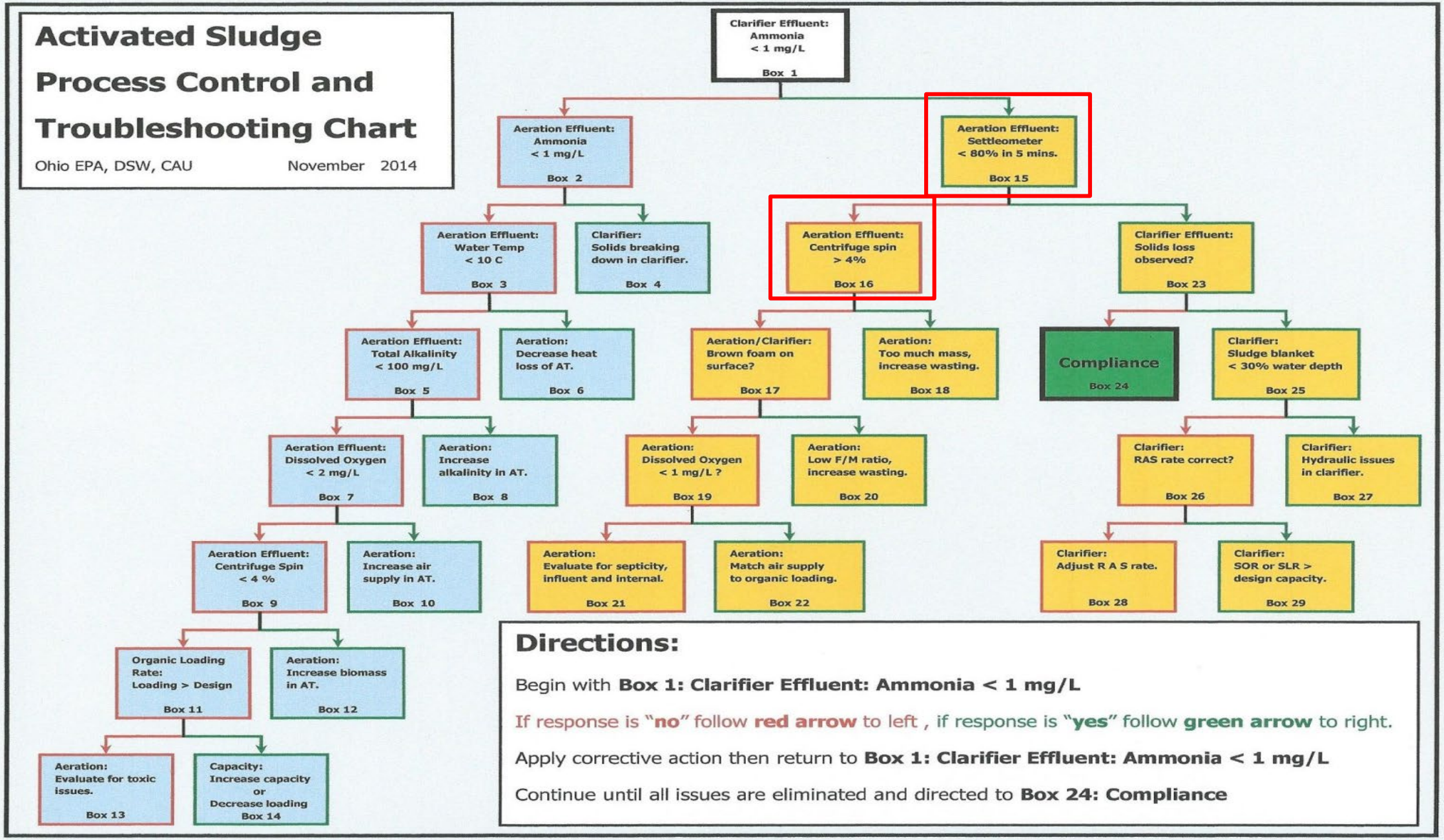
Clarifier, NH_3	0.3	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	_____	mg/L	AT, concentration	_____	%
AT, water temperature	_____	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	_____	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	85	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	_____	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	_____	y/n			

Clarifier, solids loss observed	_____	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**

What if . . . ?

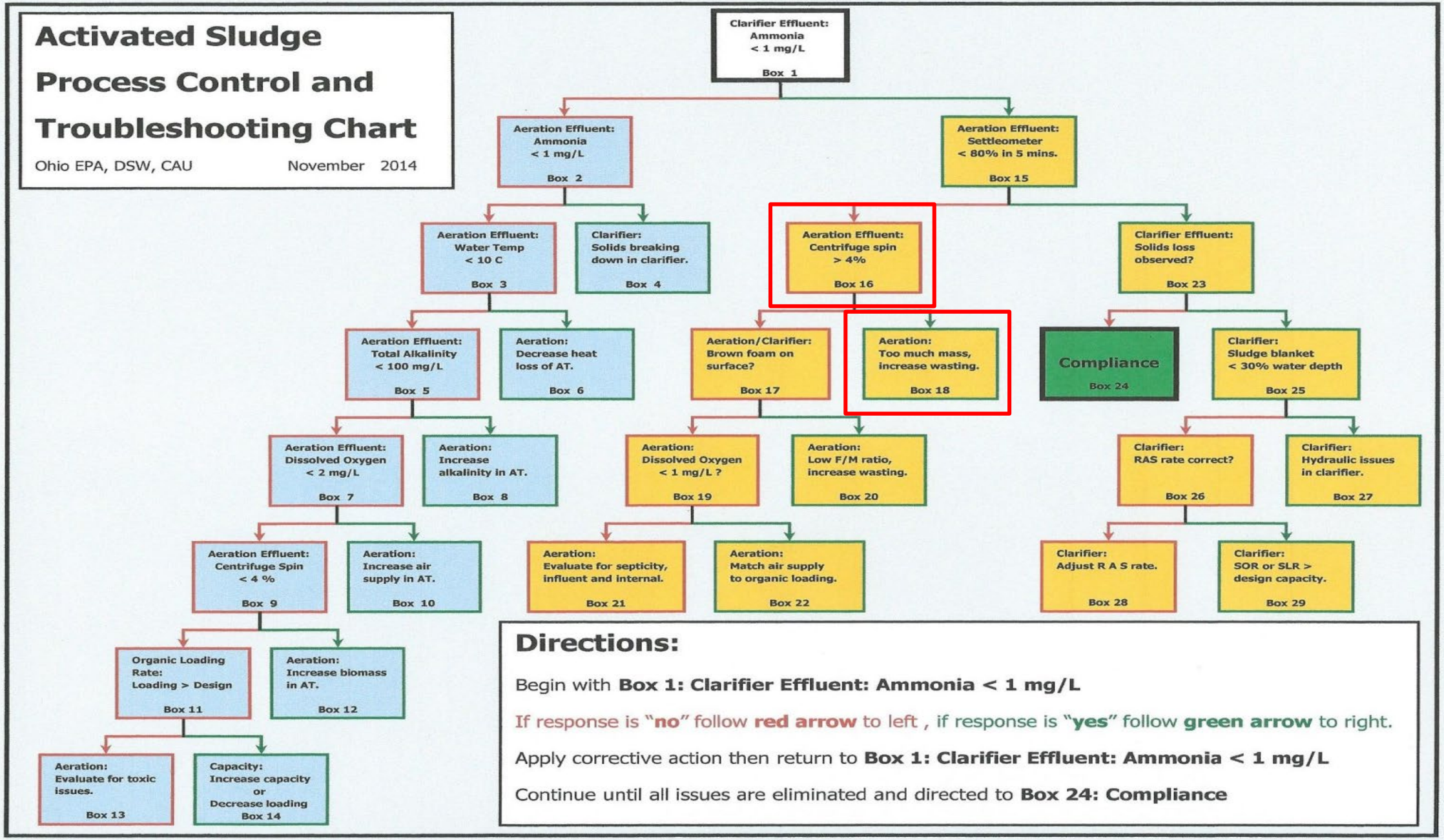
Clarifier, NH_3	0.3	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	_____	mg/L	AT, concentration	_____	%
AT, water temperature	_____	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	_____	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	85	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	6.4	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	_____	y/n			

Clarifier, solids loss observed	_____	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**

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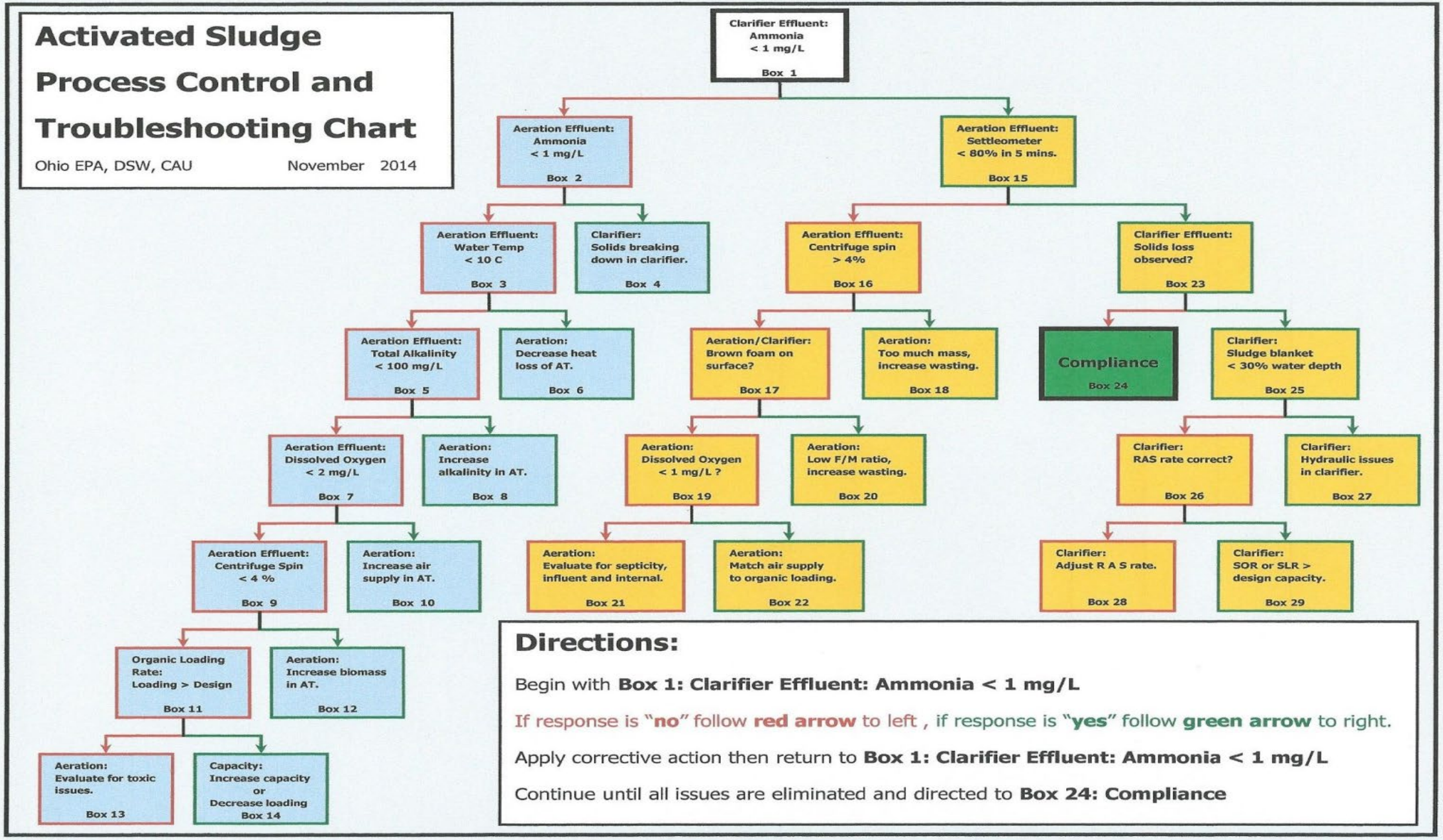


Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**

What if . . . ?

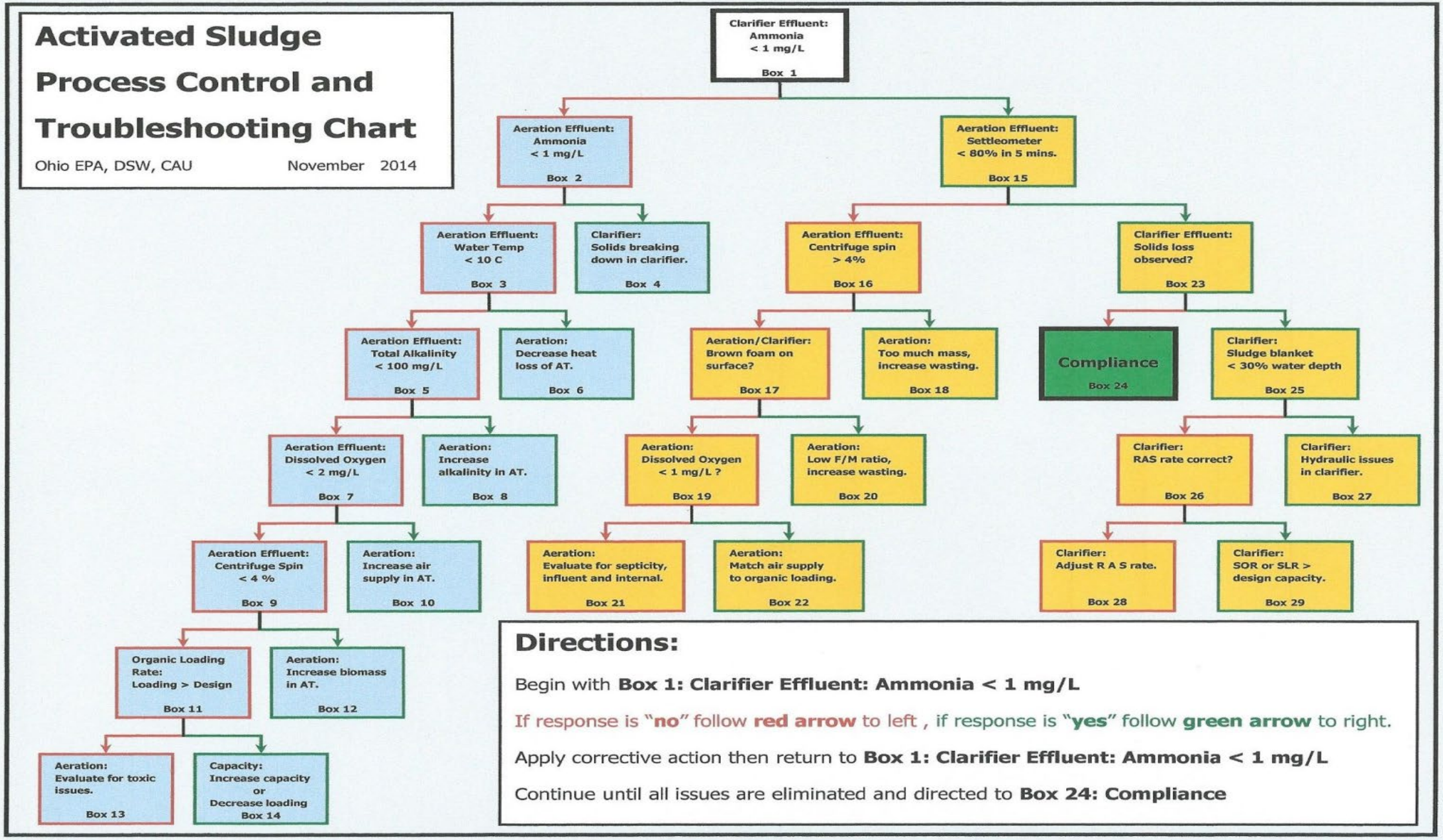
Clarifier, NH_3	0.1 mg/L	AT, dissolved oxygen	_____ mg/L
AT, effluent NH_3	_____ mg/L	AT, concentration	_____ %
AT, water temperature	_____ °C	AT, OLR > design	_____ y/n
AT, total alkalinity	_____ mg/L	AT, toxicity evaluation	_____ y/n

Settleometer, < 80%	_____ %	AT, dissolved oxygen	_____ mg/L
AT, concentration	_____ %	AT, corrosion/septicity	_____ y/n
AT, excess brown foam	_____ y/n		

Clarifier, solids loss observed	_____ y/n	Clarifier, SOR/SLR over design	_____ y/n
Clarifier, blanket depth	_____ %	Clarifier, RAS rate correct	_____ y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**

What if . . . ?

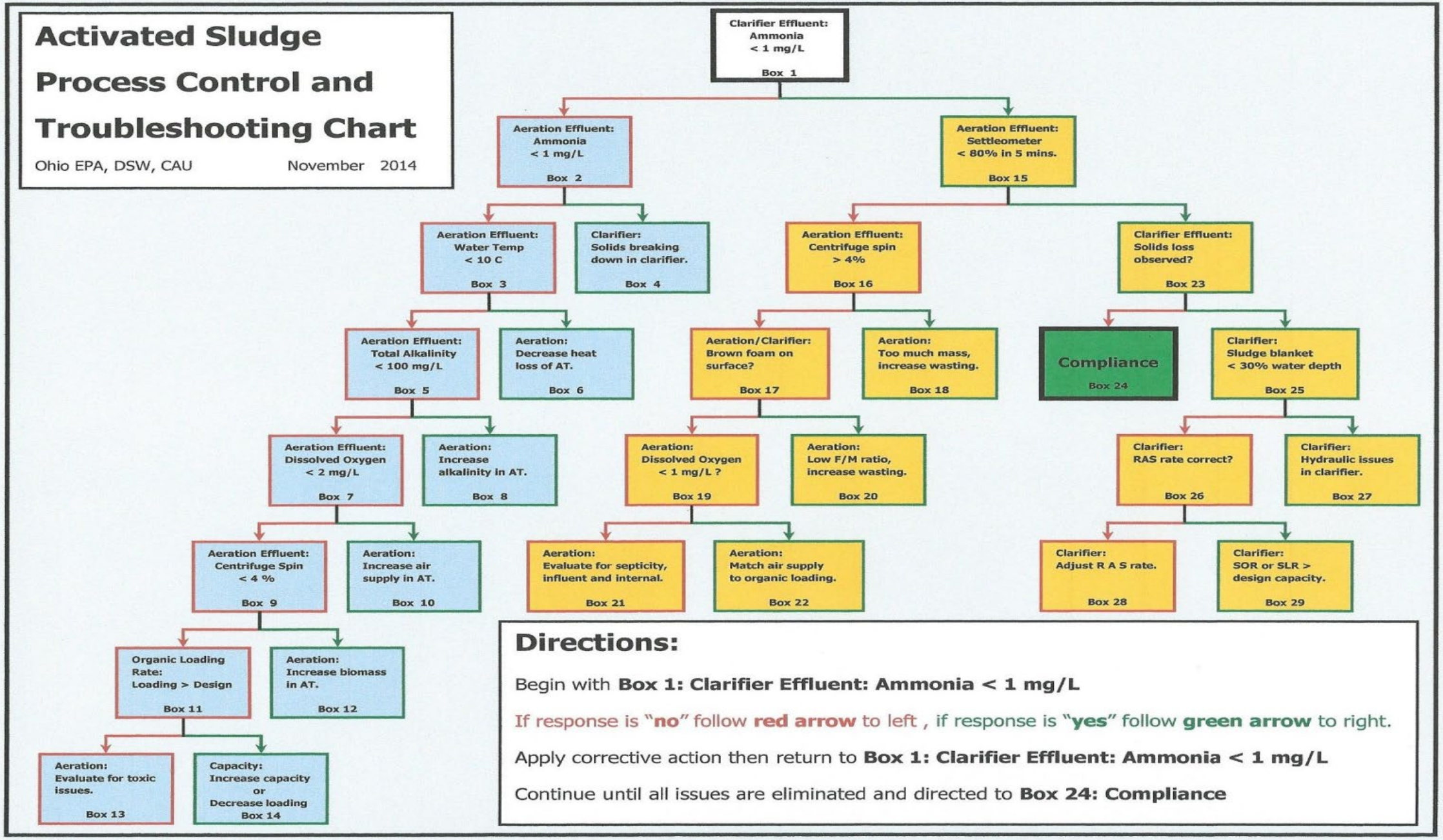
Clarifier, NH_3	0.1	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	_____	mg/L	AT, concentration	_____	%
AT, water temperature	_____	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	_____	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	95	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	_____	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	_____	y/n			

Clarifier, solids loss observed	_____	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**

What if . . . ?

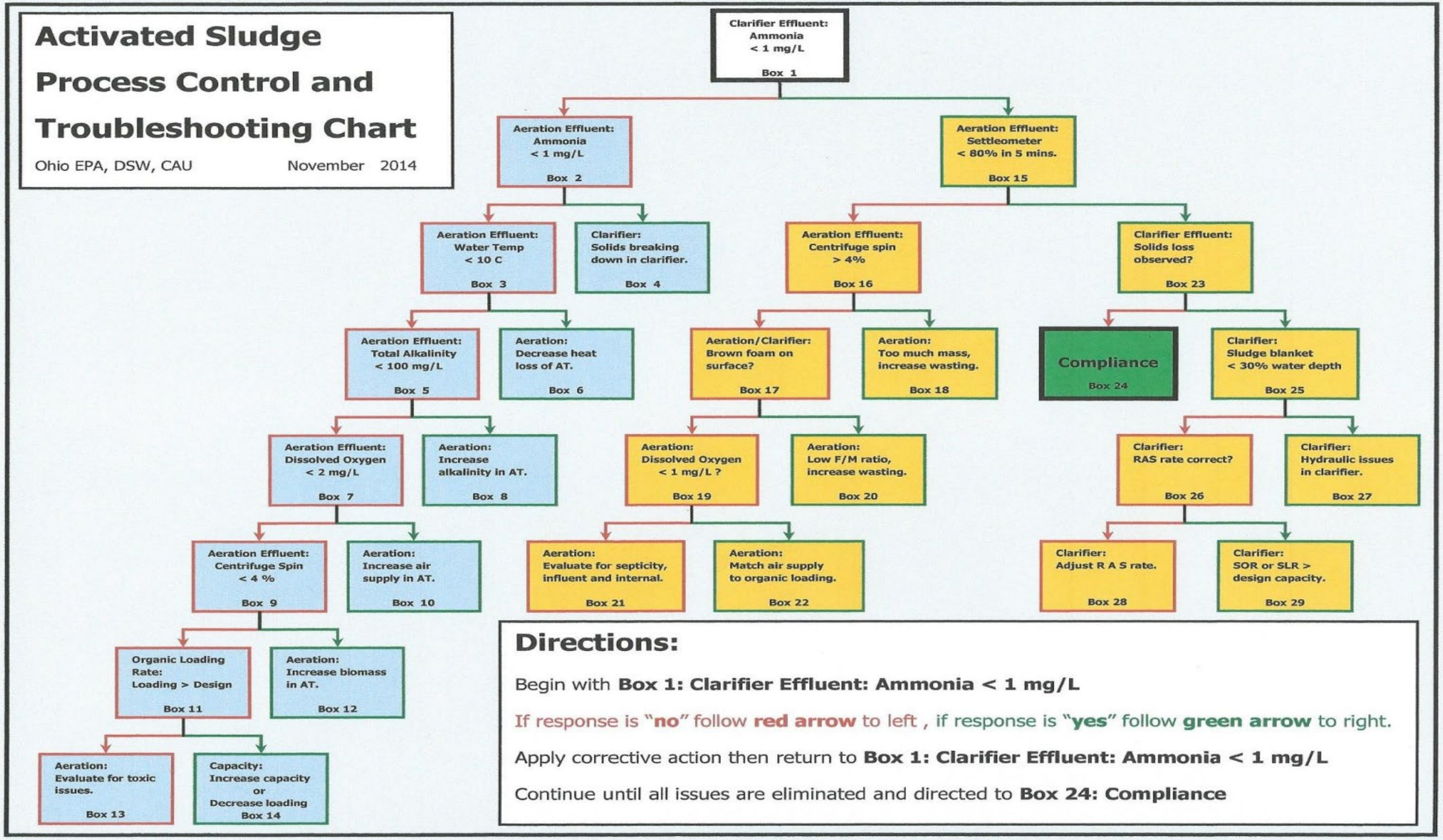
Clarifier, NH_3	0.1	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	_____	mg/L	AT, concentration	_____	%
AT, water temperature	_____	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	_____	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	95	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	3.2	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	_____	y/n			

Clarifier, solids loss observed	_____	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**

What if . . . ?

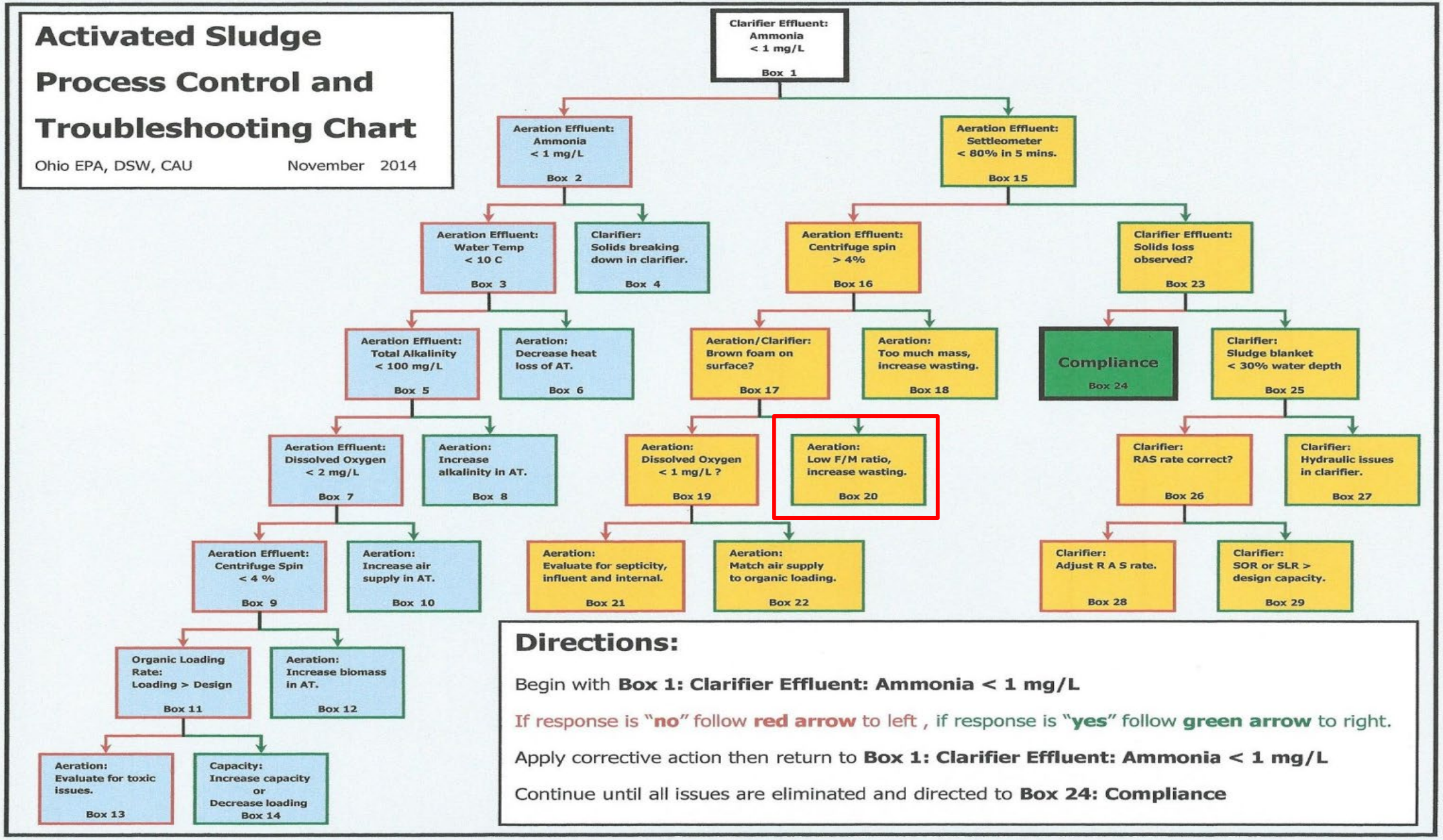
Clarifier, NH_3	0.1	mg/L	AT, dissolved oxygen	_____	mg/L
AT, effluent NH_3	_____	mg/L	AT, concentration	_____	%
AT, water temperature	_____	°C	AT, OLR > design	_____	y/n
AT, total alkalinity	_____	mg/L	AT, toxicity evaluation	_____	y/n

Settleometer, < 80%	95	%	AT, dissolved oxygen	_____	mg/L
AT, concentration	3.2	%	AT, corrosion/septicity	_____	y/n
AT, excess brown foam	Yes	y/n			

Clarifier, solids loss observed	_____	y/n	Clarifier, SOR/SLR over design	_____	y/n
Clarifier, blanket depth	_____	%	Clarifier, RAS rate correct	_____	y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**

Other signs of filaments

What if . . . ?

Clarifier, NH_3	6.4 mg/L	AT, dissolved oxygen	_____ mg/L
AT, effluent NH_3	_____ mg/L	AT, concentration	_____ %
AT, water temperature	_____ °C	AT, OLR > design	_____ y/n
AT, total alkalinity	_____ mg/L	AT, toxicity evaluation	_____ y/n

Settleometer, < 80%	_____ %	AT, dissolved oxygen	_____ mg/L
AT, concentration	_____ %	AT, corrosion/septicity	_____ y/n
AT, excess brown foam	_____ y/n		

Clarifier, solids loss observed	_____ y/n	Clarifier, SOR/SLR over design	_____ y/n
Clarifier, blanket depth	_____ %	Clarifier, RAS rate correct	_____ y/n

What if . . . ?

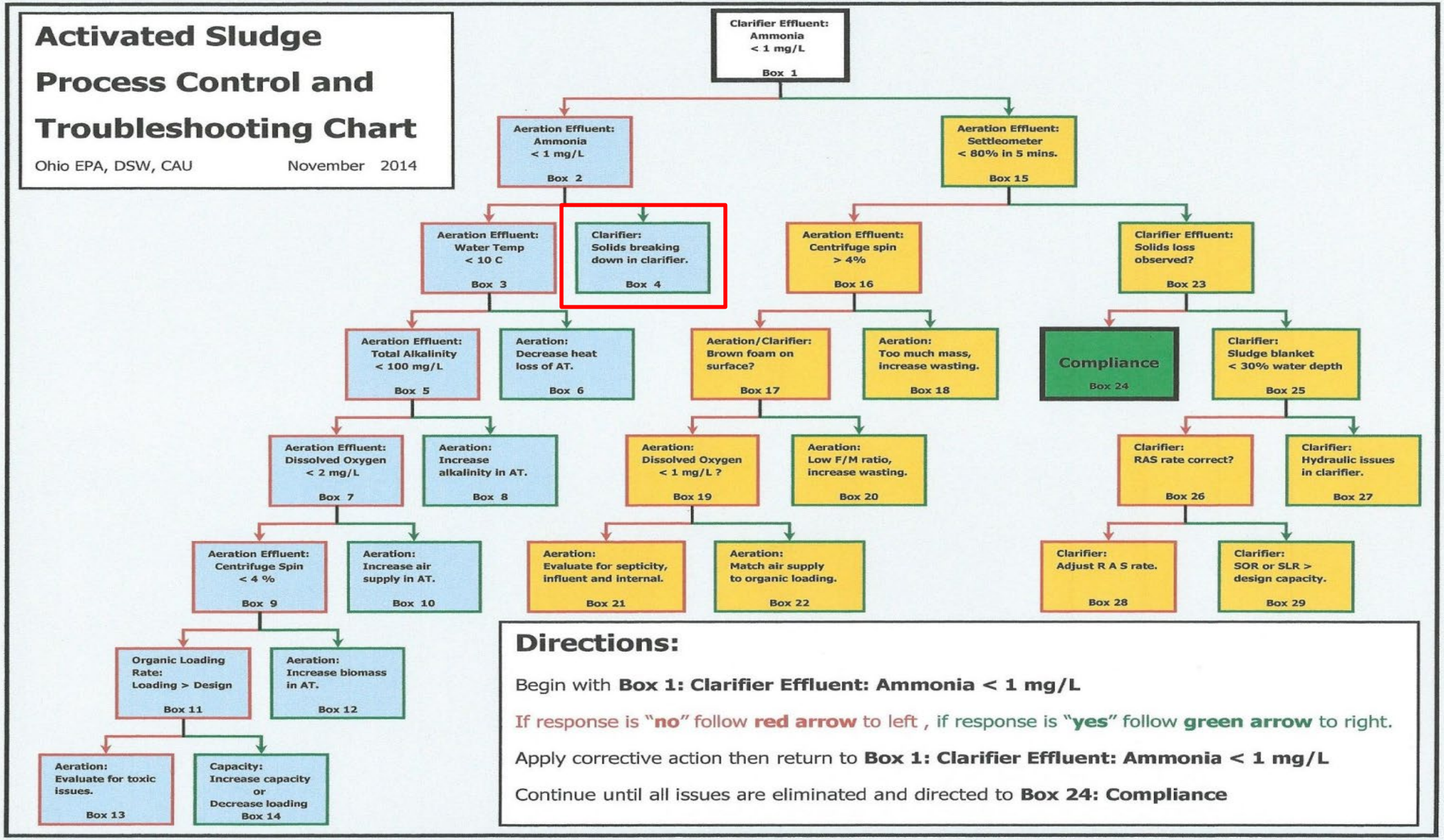
Clarifier, NH_3	6.4 mg/L	AT, dissolved oxygen	_____ mg/L
AT, effluent NH_3	0.5 mg/L	AT, concentration	_____ %
AT, water temperature	_____ °C	AT, OLR > design	_____ y/n
AT, total alkalinity	_____ mg/L	AT, toxicity evaluation	_____ y/n

Settleometer, < 80%	_____ %	AT, dissolved oxygen	_____ mg/L
AT, concentration	_____ %	AT, corrosion/septicity	_____ y/n
AT, excess brown foam	_____ y/n		

Clarifier, solids loss observed	_____ y/n	Clarifier, SOR/SLR over design	_____ y/n
Clarifier, blanket depth	_____ %	Clarifier, RAS rate correct	_____ y/n

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DSW, CAU November 2014



Directions:

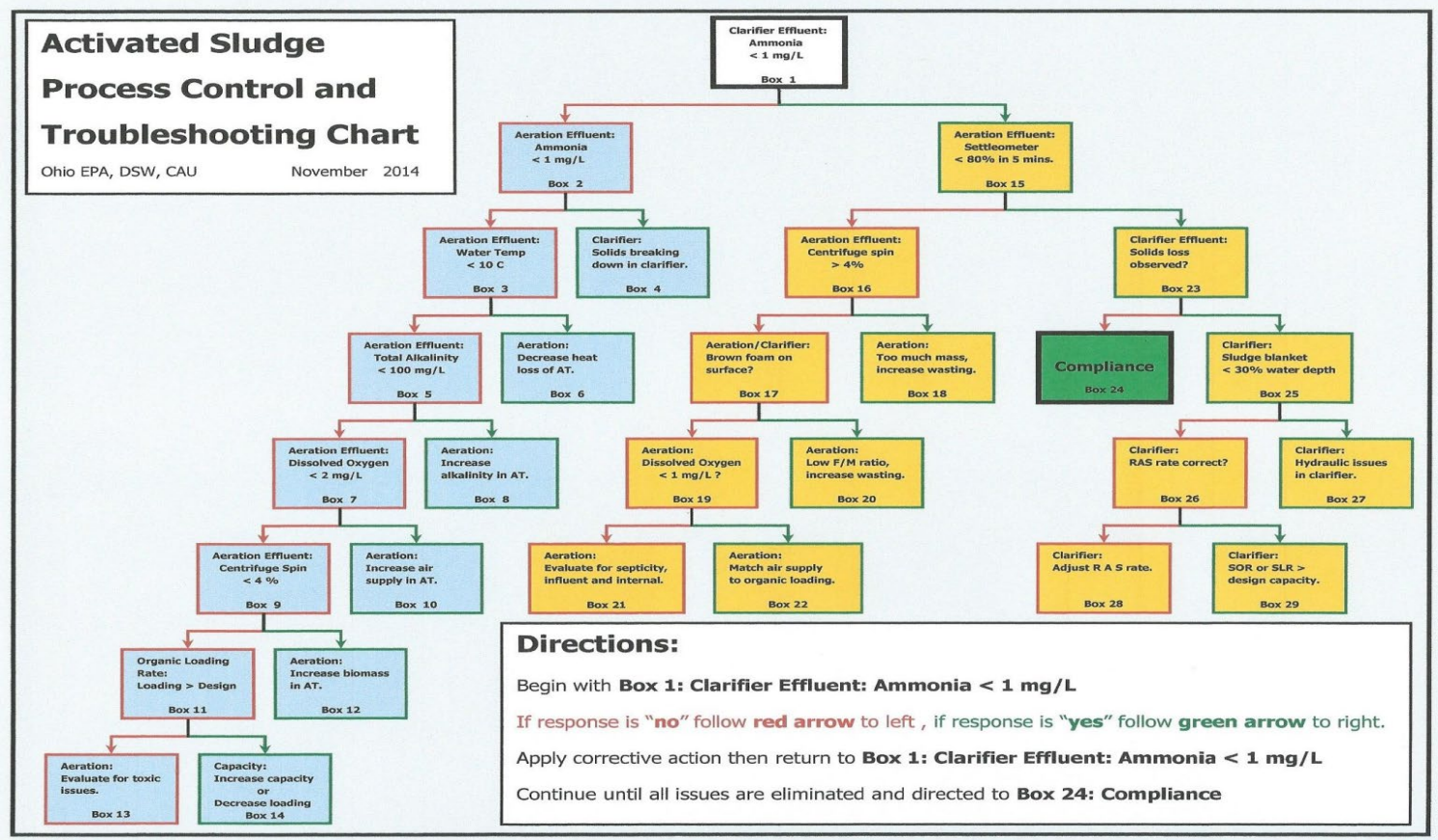
Begin with **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

If response is "**no**" follow **red arrow** to left , if response is "**yes**" follow **green arrow** to right.

Apply corrective action then return to **Box 1: Clarifier Effluent: Ammonia < 1 mg/L**

Continue until all issues are eliminated and directed to **Box 24: Compliance**

What if . . .


Activated Sludge
Process Control and
Troubleshooting Chart
Ohio EPA, DSW, CAU November 2014
Clarifier Effluent: Ammonia < 1 mg/L Box 1
Aeration Effluent: Ammonia < 1 mg/L Box 2
Aeration Effluent: Settleometer < 80% in 5 mins. Box 15
Aeration Effluent: Water Temp < 10 C Box 3
Clarifier: Solids breaking down in clarifier. Box 4
Aeration Effluent: Centrifuge spin > 4% Box 16
Clarifier Effluent: Solids loss observed? Box 23
Aeration Effluent: Total Alkalinity < 100 mg/L Box 5
Aeration: Decrease heat loss of AT. Box 6
Aeration/Clarifier: Brown foam on surface? Box 17
Aeration: Too much mass, increase wasting. Box 18
Compliance Box 24
Clarifier: Sludge blanket < 30% water depth Box 25
Aeration Effluent: Dissolved Oxygen < 2 mg/L Box 7
Aeration: Increase alkalinity in AT. Box 8
Aeration: Dissolved Oxygen < 1 mg/L ? Box 19
Aeration: Low F/M ratio, increase wasting. Box 20
Clarifier: RAS rate correct? Box 26
Clarifier: Hydraulic issues in clarifier. Box 27
Aeration Effluent: Centrifuge Spin < 4 % Box 9
Aeration: Increase air supply in AT. Box 10
Aeration: Evaluate for septicity, influent and internal. Box 21
Aeration: Match air supply to organic loading. Box 22
Clarifier: Adjust R A S rate. Box 28
Clarifier: SOR or SLR > design capacity. Box 29
Organic Loading Rate: Loading > Design Box 11
Aeration: Increase biomass in AT. Box 12
Aeration: Evaluate for toxic issues. Box 13
Capacity: Increase capacity or Decrease loading Box 14
Directions:
Begin with Box 1: Clarifier Effluent: Ammonia < 1 mg/L
If response is "no" follow red arrow to left , if response is "yes" follow green arrow to right.
Apply corrective action then return to Box 1: Clarifier Effluent: Ammonia < 1 mg/L
Continue until all issues are eliminated and directed to Box 24: Compliance