Go with the flow

Charting your way through the process.

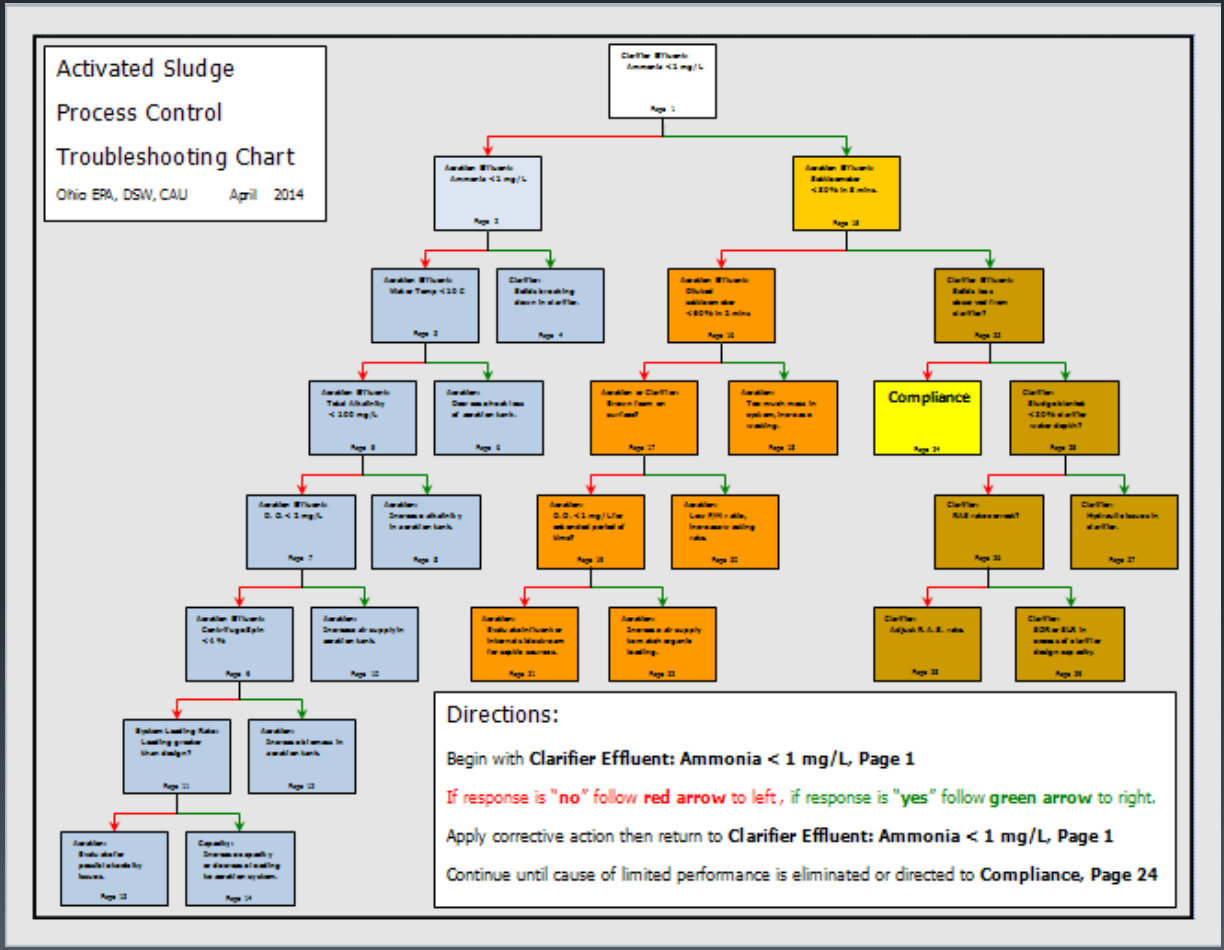
A Balancing Act

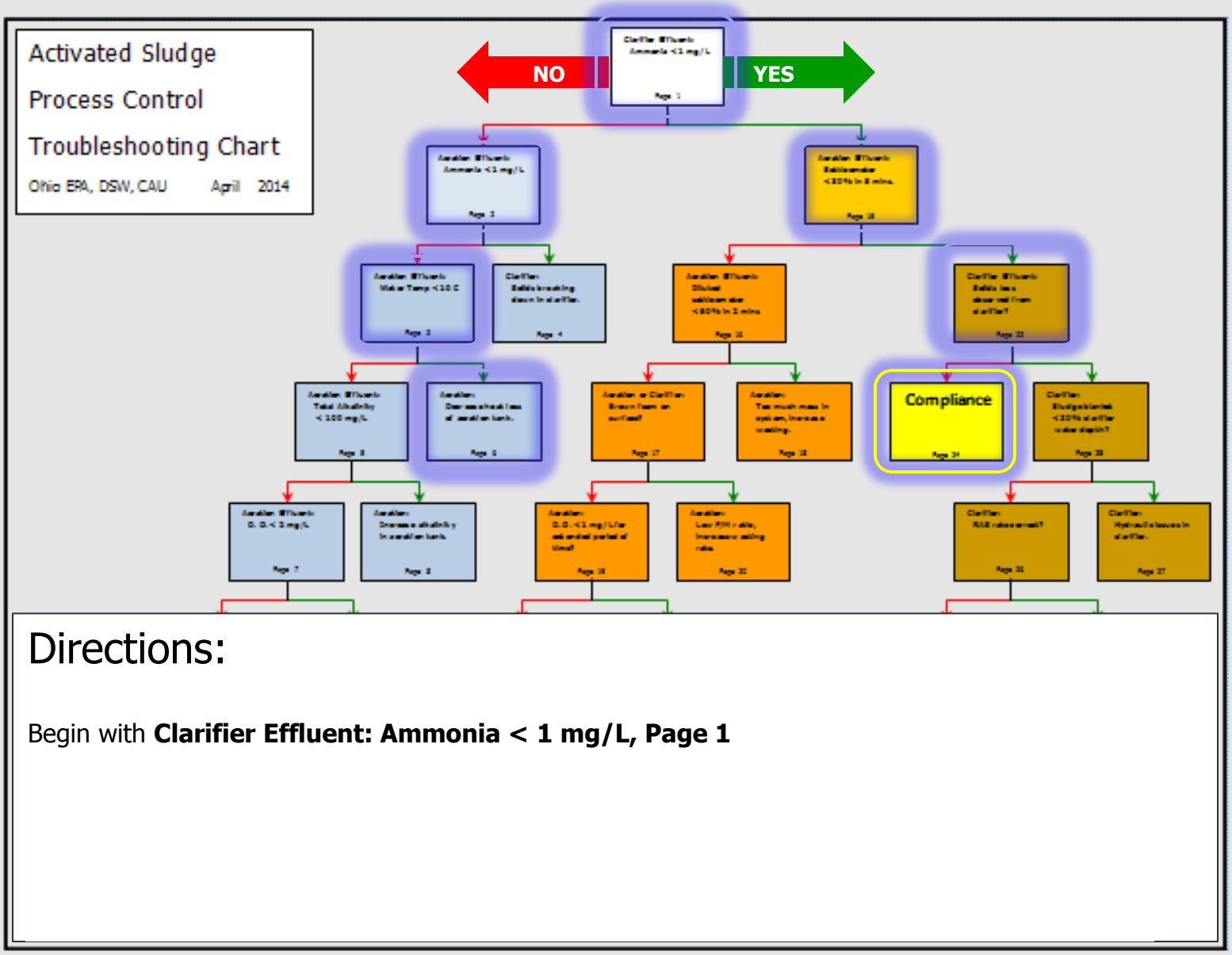
- Activated Sludge Process Control
  - Waste Sludge
    - too much, lose treatment
    - not enough, lose solids
  - Return Sludge
    - too fast, internal hydraulic pressure
    - too slow, lose solids
  - Aeration Applied
    - too much, waste energy
    - not enough, lose treatment
  - Mode of Operation
    - incorrect mode, lose treatment
    - incorrect mode, lose solids

A Tangled Web

- Activated Sludge process is interconnected
- Activated Sludge process is dynamic
  - Operators need to identify pressures on the system
  - Operators need to apply the "correct pressure" to the system
  - Over correction or misdiagnosis makes situation worse
- Use these interconnections to track down CAUSE of problem.
- Use these interconnections to monitor CORRECTIVE action.

Go with the flow



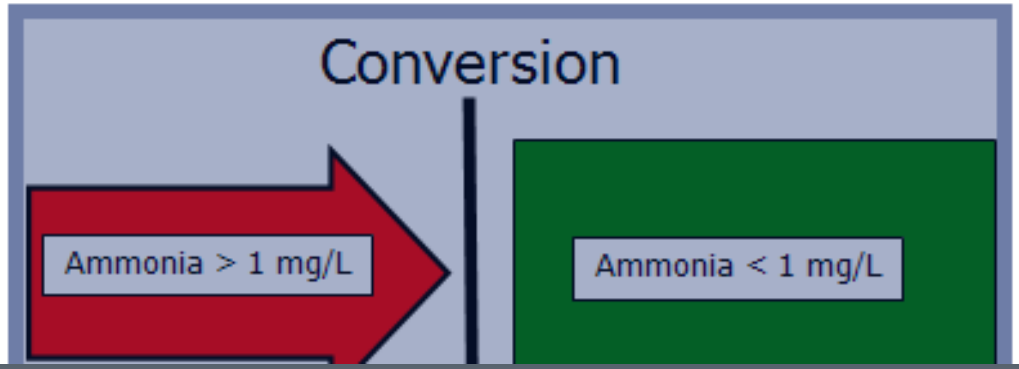


Directions:

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

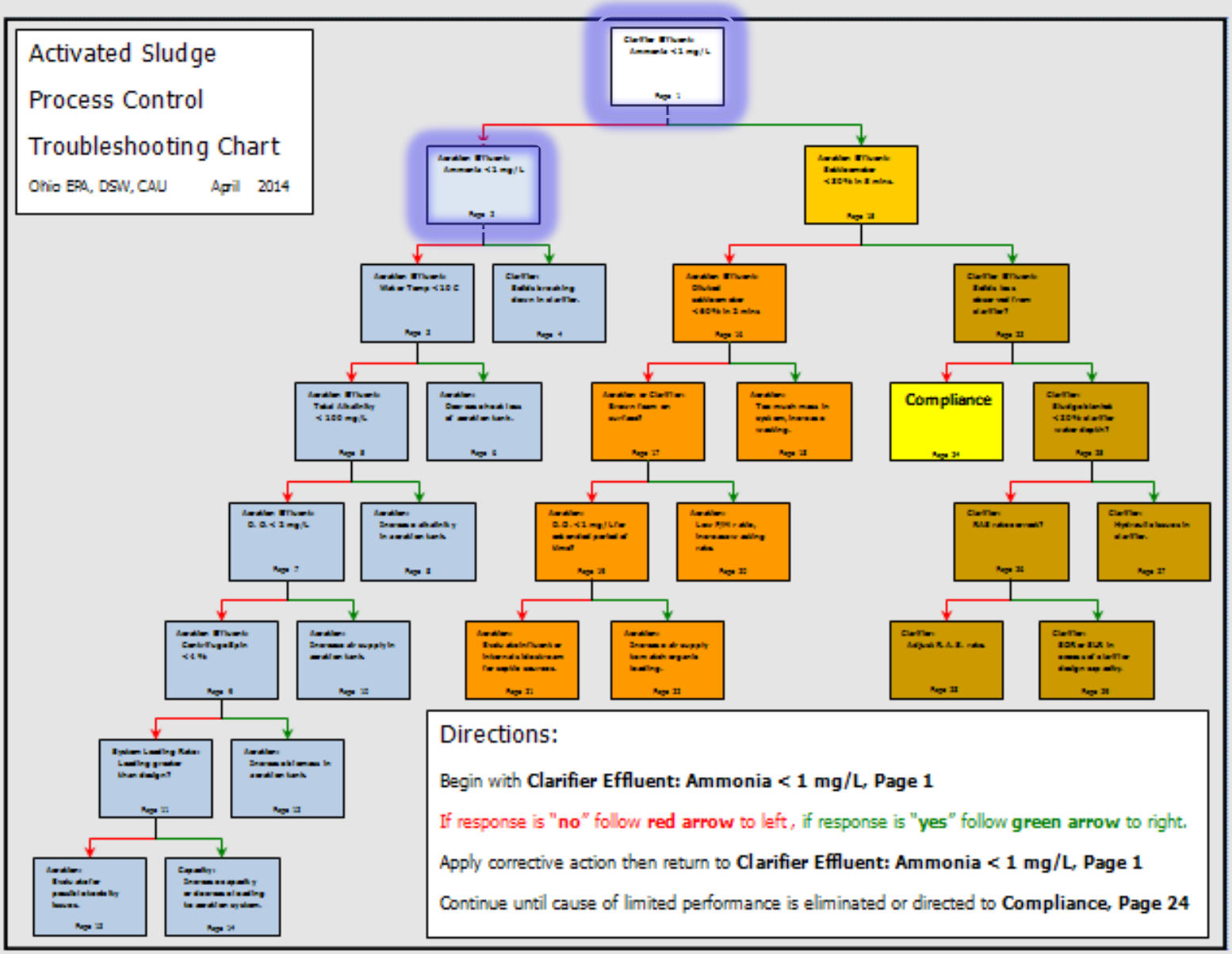
Clarifier Effluent Ammonia < 1 mg/L

- Wastewater contains pollutants in the form of carbon (cBOD) and ammonia nitrogen (NH_3).
- Bacteria in the aeration tank convert these pollutants into new bacterial cells (biomass) and more desirable forms of carbon (CO_2)and nitrogen (NO_3), thus preventing degradation of the receiving stream.
- Nitrifying bacteria in the aeration tank convert the incoming ammonia nitrogen to the less objectionable form of nitrogen called nitrate (NO_3). These nitrifying bacteria are very sensitive to environmental conditions for growth. Due to this sensitivity, monitoring the conversion of ammonia to nitrate provides an "early warning" indicator of when an adjustment to the process is necessary. Anything which limits the effectiveness of the nitrifying bacteria to convert ammonia to nitrate will cause the aeration tank effluent ammonia concentrations to increase, an indication of loss of control.
- Typically, if the ammonia nitrogen concentration from the aeration tank effluent is <1 mg/L, it is assumed that both of the major pollutants (cBOD and NH_3) have been successfully converted, therefore the treatment objective of the aeration tank (conversion) is now complete.



Activated Sludge Process Control Troubleshooting Chart

Ohio EPA, DSW, CAU April 2014



Directions:

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

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

Continue until cause of limited performance is eliminated or directed to **Compliance, Page 24**

Go with the flow

- Page 2

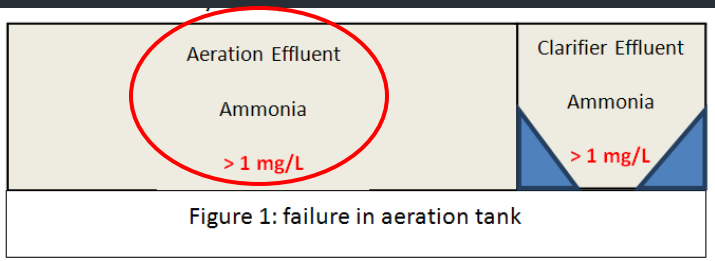


Figure 1: failure in aeration tank

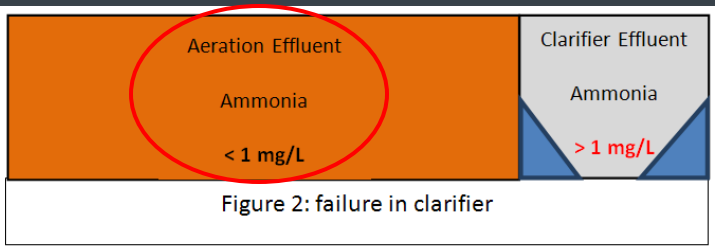


Figure 2: failure in clarifier

Aeration Effluent
Ammonia < 1 mg/L

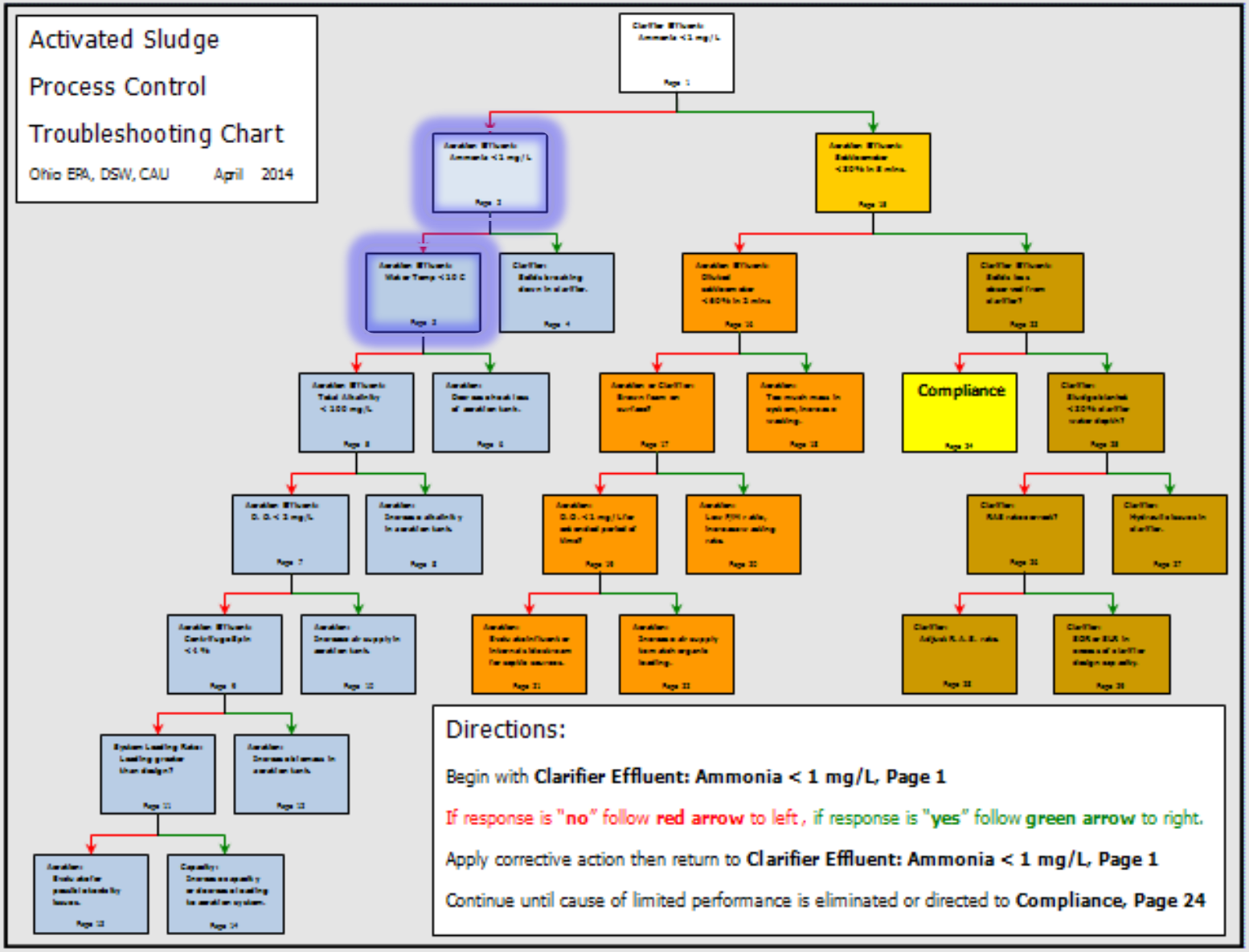
page 2

NO

YES

Activated Sludge Process Control Troubleshooting Chart

Ohio EPA, DSW, CAU April 2014



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Continue until cause of limited performance is eliminated or directed to **Compliance, Page 24**

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- Page 3

Aeration Effluent
Water Temp < 10 C

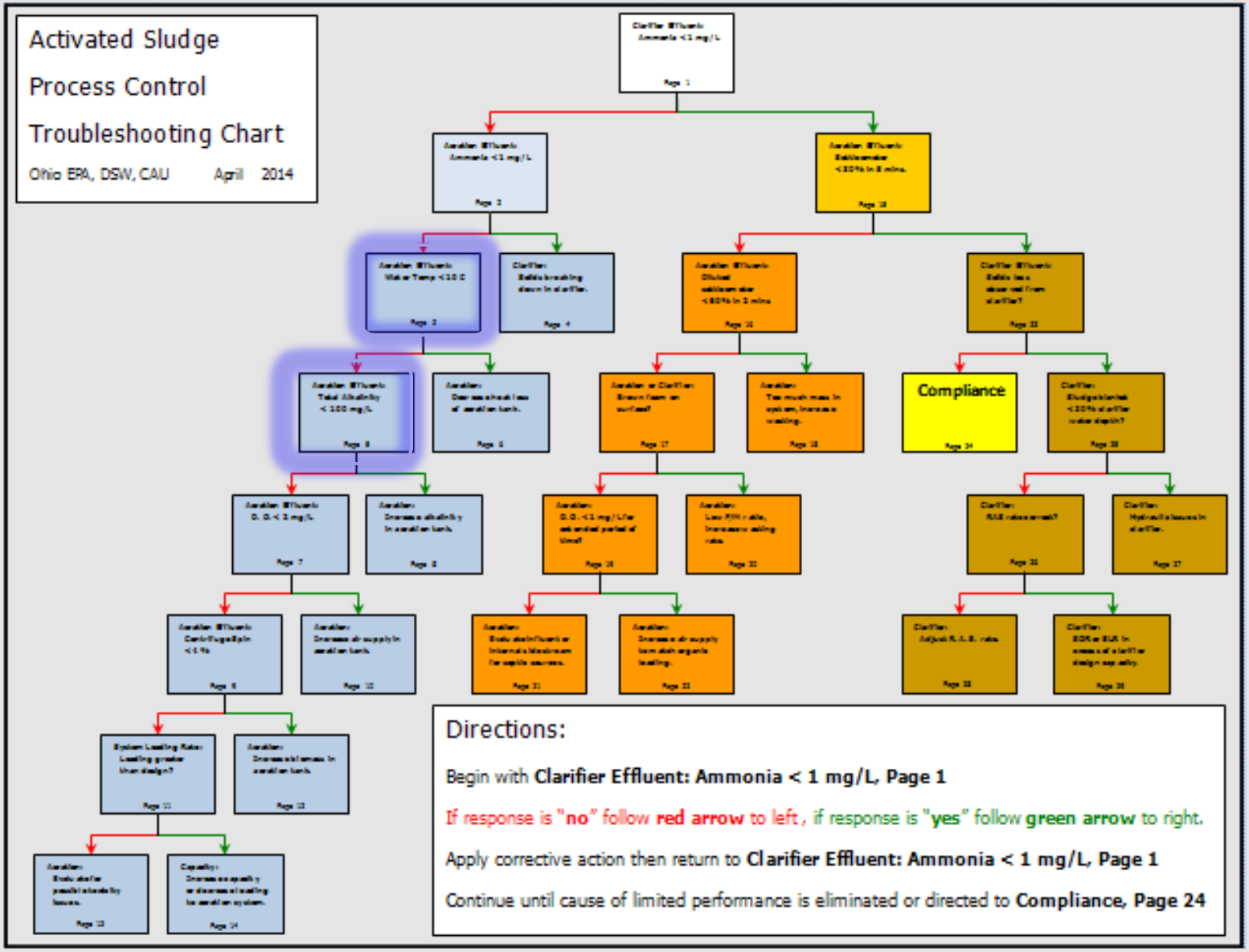
page 3

NO

YES

Activated Sludge Process Control Troubleshooting Chart

Ohio EPA, DSW, CAU April 2014



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- Page 5

Aeration Effluent
Total Alkalinity
< 100 mg/L

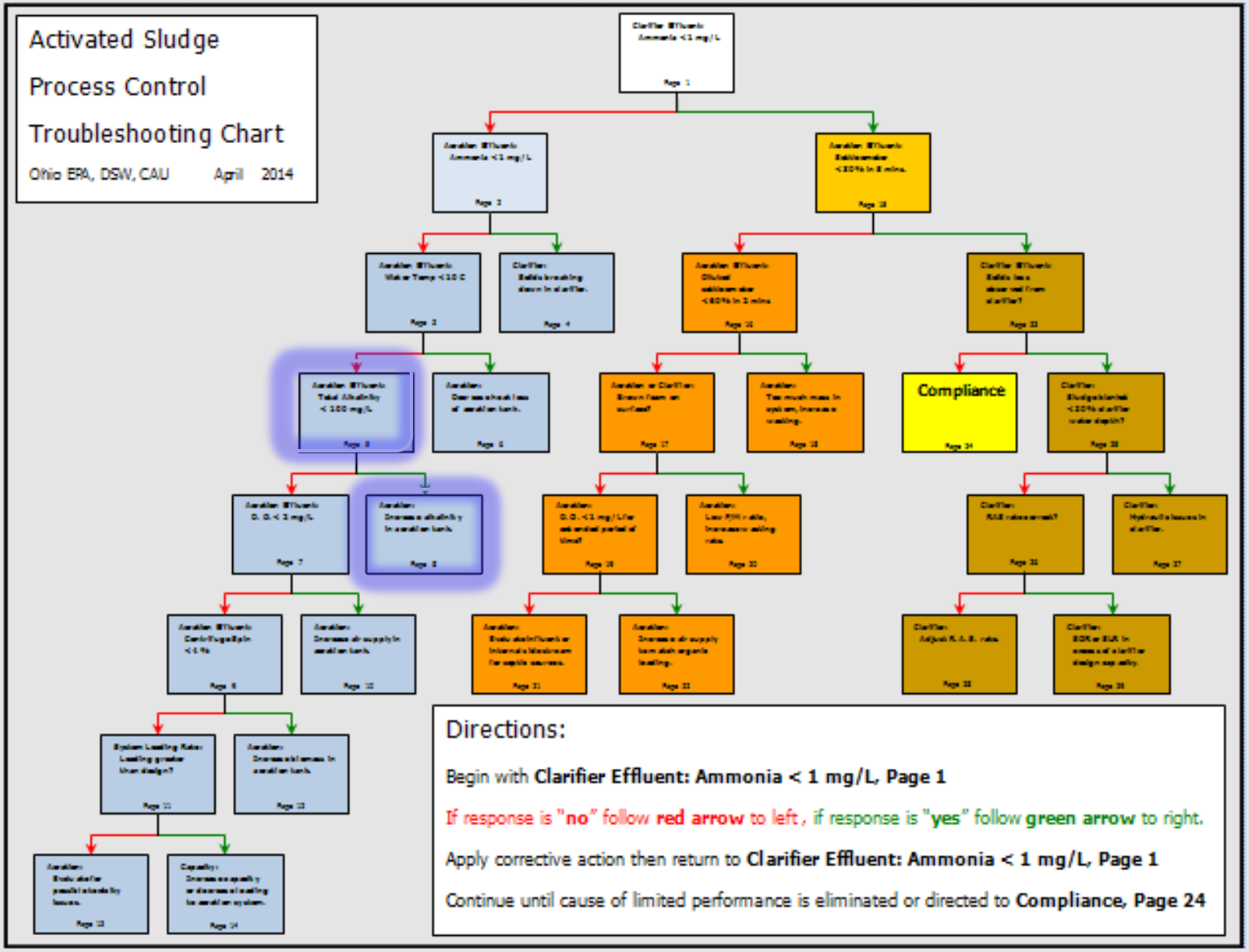
page 5

NO

YES

Activated Sludge Process Control Troubleshooting Chart

Ohio EPA, DSW, CAU April 2014



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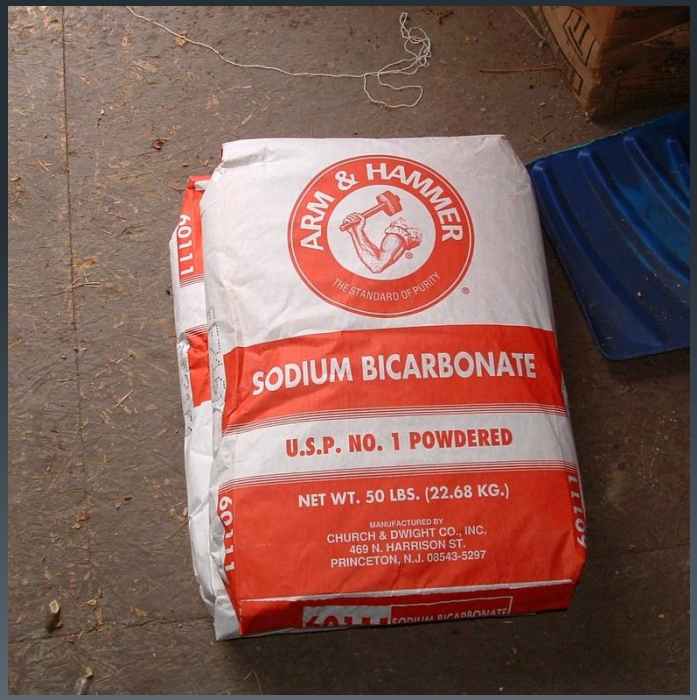
Go with the flow

- Page 8



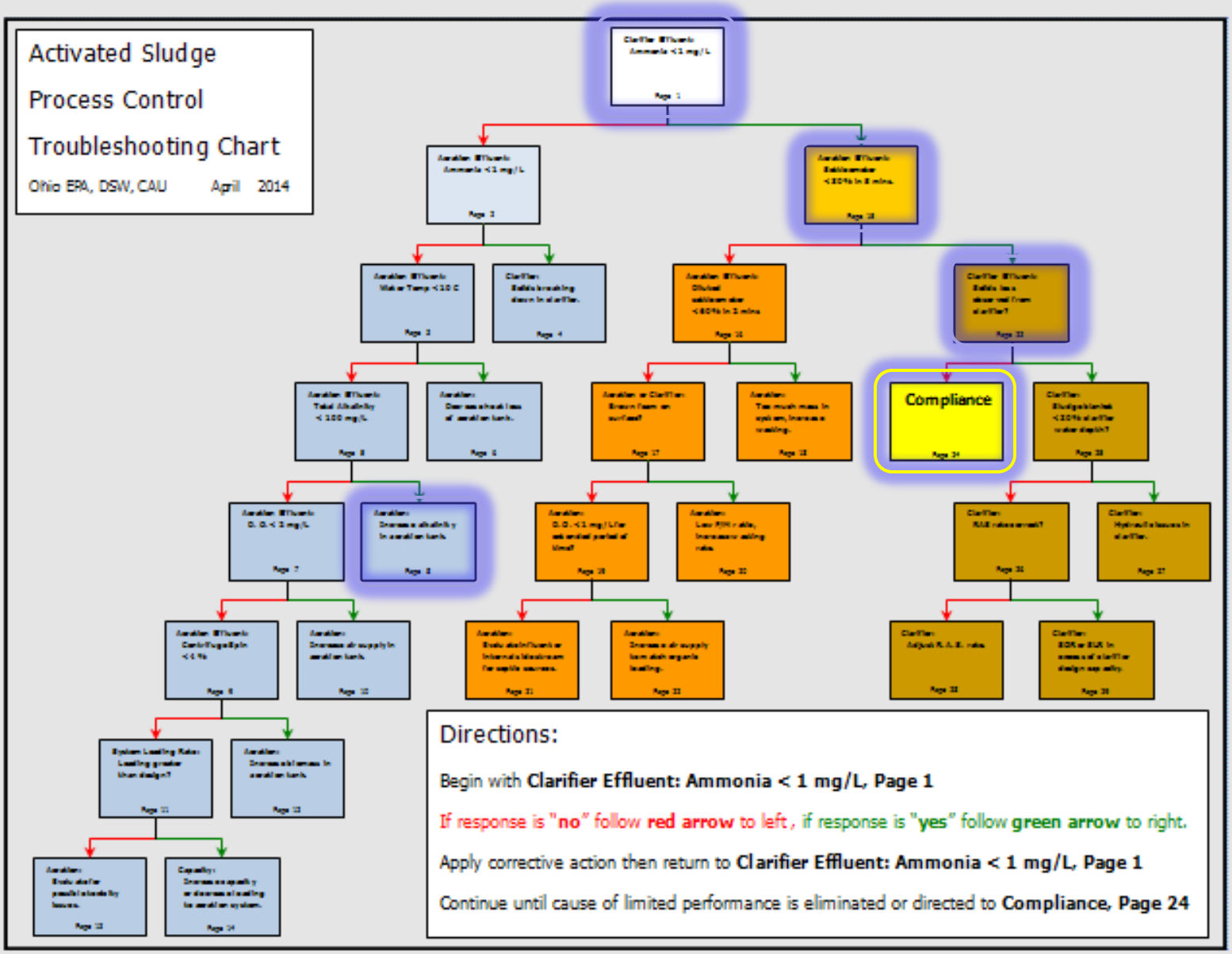
Aeration:

Increase alkalinity in aeration tank

page 8

Activated Sludge Process Control Troubleshooting Chart

Ohio EPA, DSW, CAU April 2014



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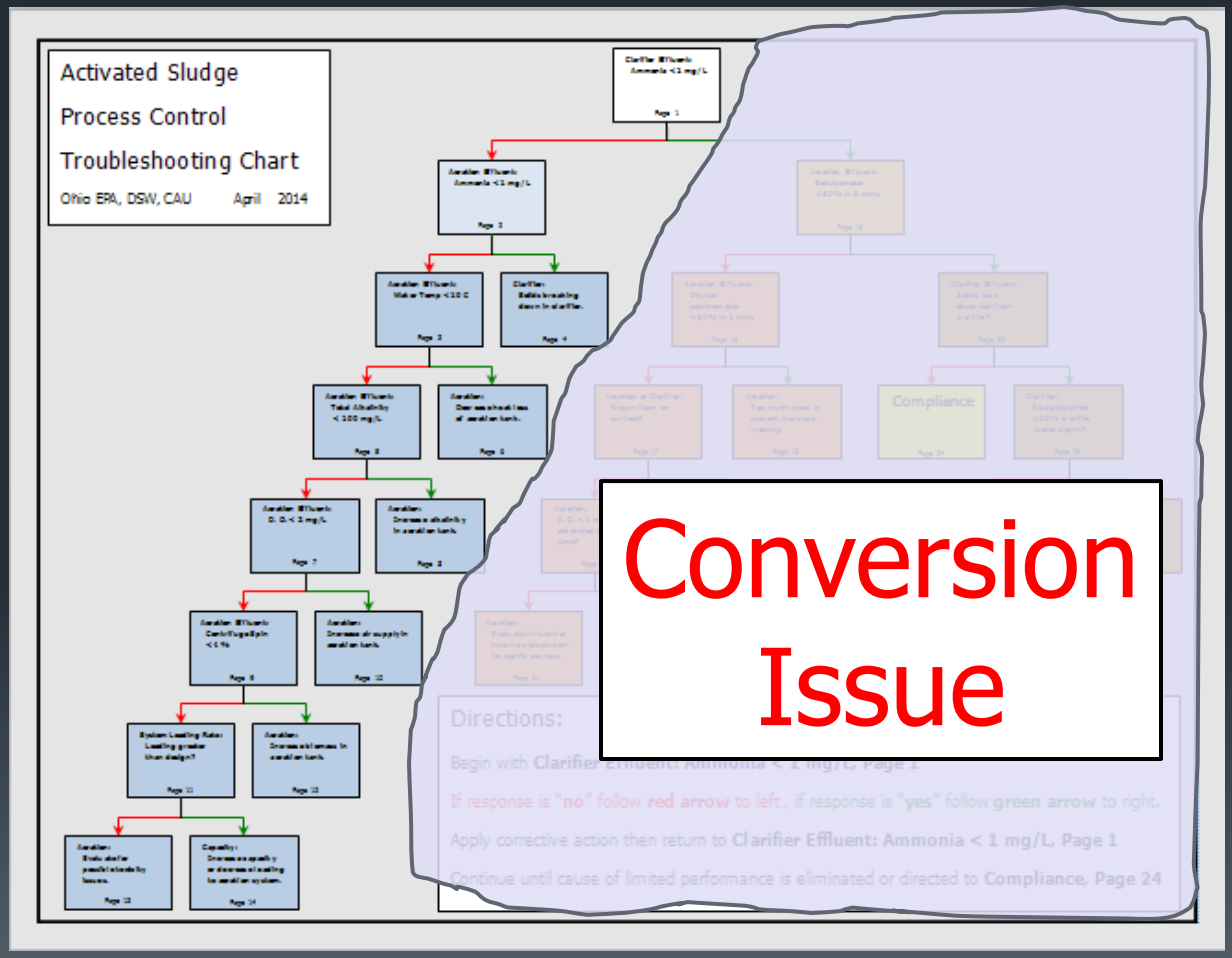

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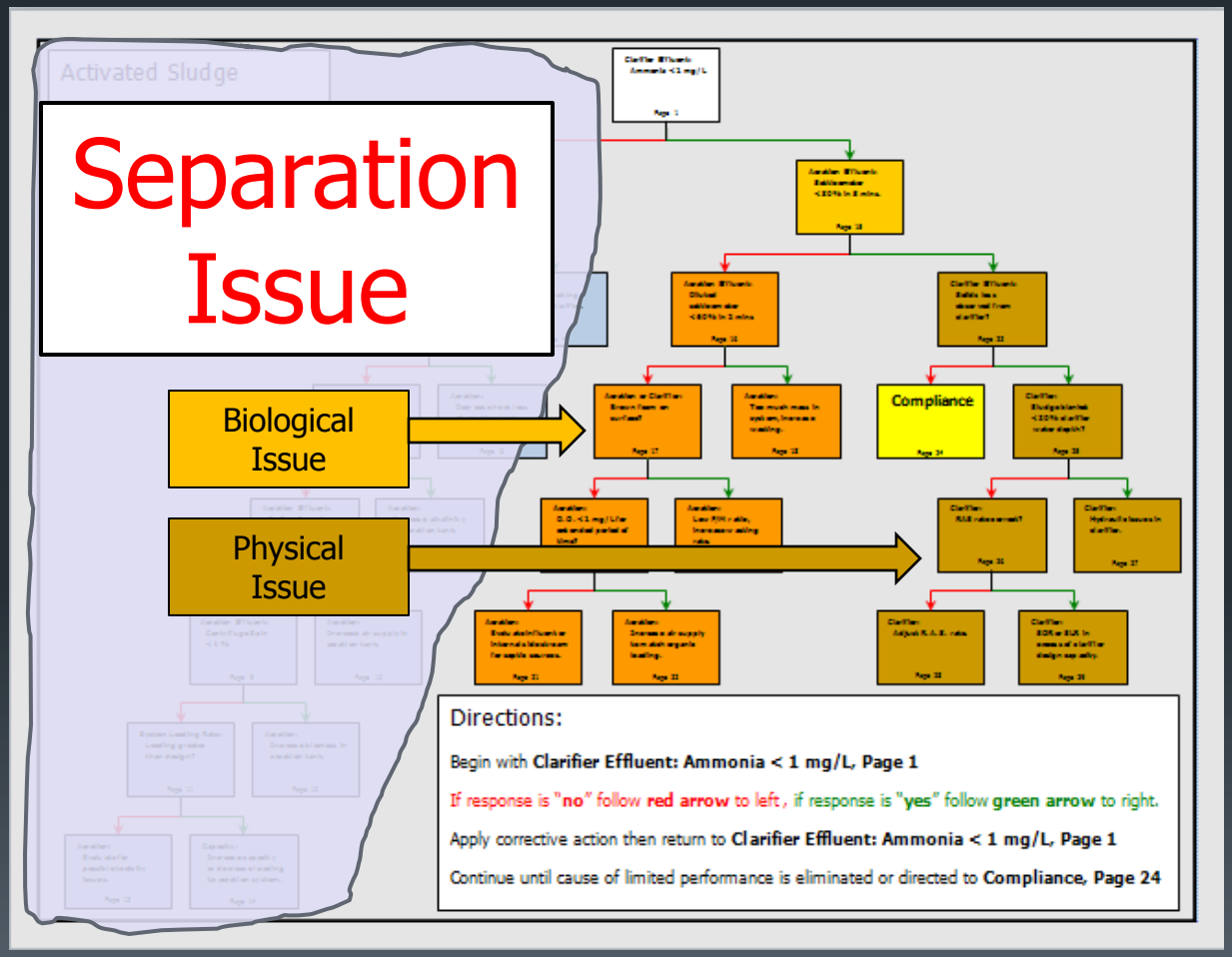

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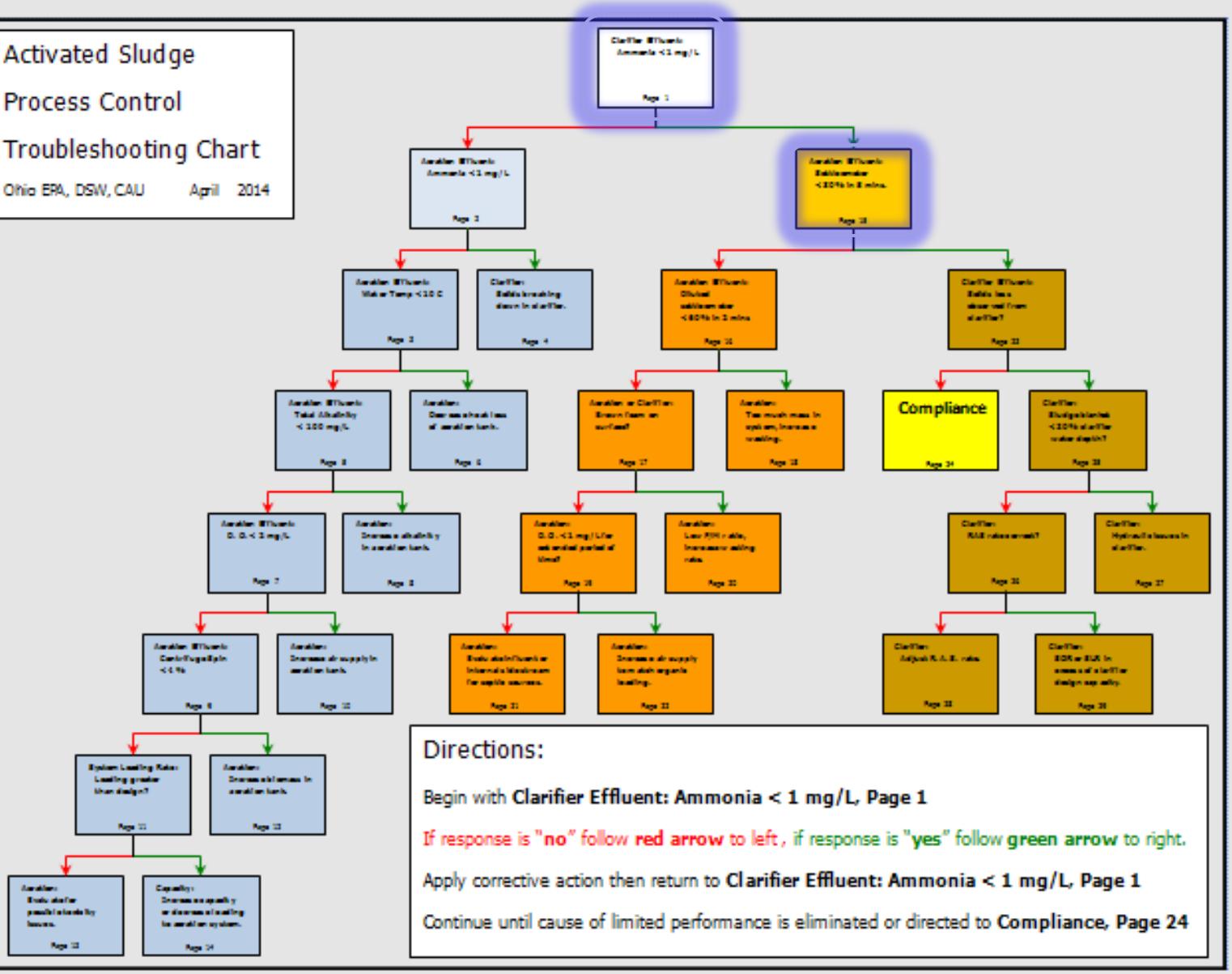

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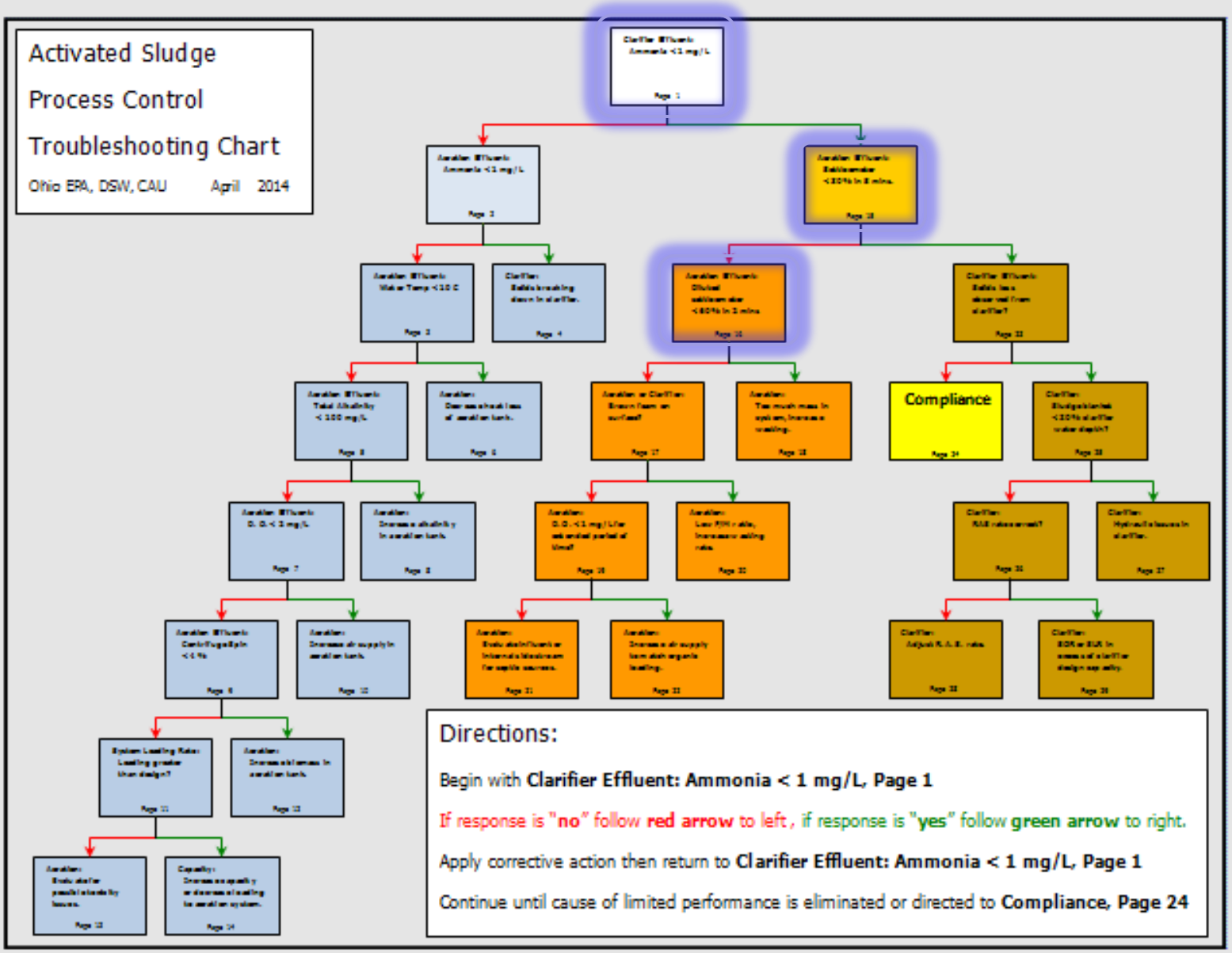
Aeration Effluent: Settleometer Analysis < 80% in 5 minutes

- If the aeration tank effluent ammonia concentration is < 1 mg/L, the conversion of all influent organic waste into bacterial cells has been achieved. In short, the aeration tank has properly performed its function. The focus now moves towards separating the bacteria from the clean water in the clarifier. This is a function of the settling rate of the biomass, which must be maintained at the proper concentration to assist gravity settling in the clarifier. An evaluation of the settling rate is the first analysis to perform.
- The settleometer test mimics the sludge setting characteristics within the clarifier. However, the settleometer represents a "perfect clarifier", meaning

Activated Sludge Process Control Troubleshooting Chart

Ohio EPA, DSW, CAU April 2014



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- Page 16

Aeration Effluent: Centrifuge > 4% or Diluted Settleometer < 60% in 2 mins.

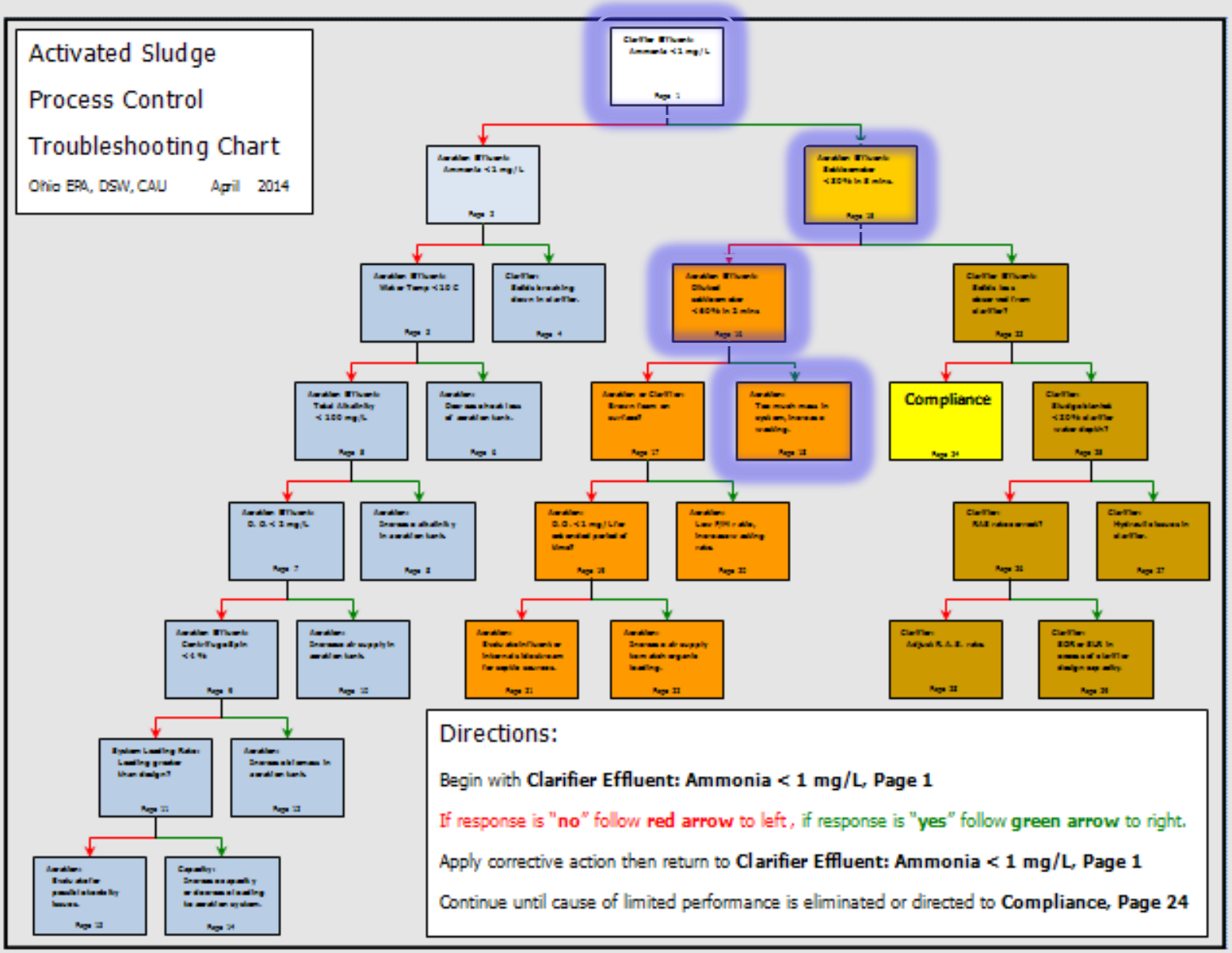
- If the biomass does not settle below the 80% mark within five minutes, there is a problem with the settling characteristics. This condition can lead to a loss of biomass from the secondary clarifier. The first step is to identify the cause for the slower settling biomass. There are typically two main causes, (1) the concentration of the biomass is too high, or (2) the density of the biomass is too low.

Diagnosis

If the aeration tank biomass is too concentrated (i.e. high MLSS) then settling will be impaired. Typically when the

Activated Sludge Process Control Troubleshooting Chart

Ohio EPA, DSW, CAU April 2014



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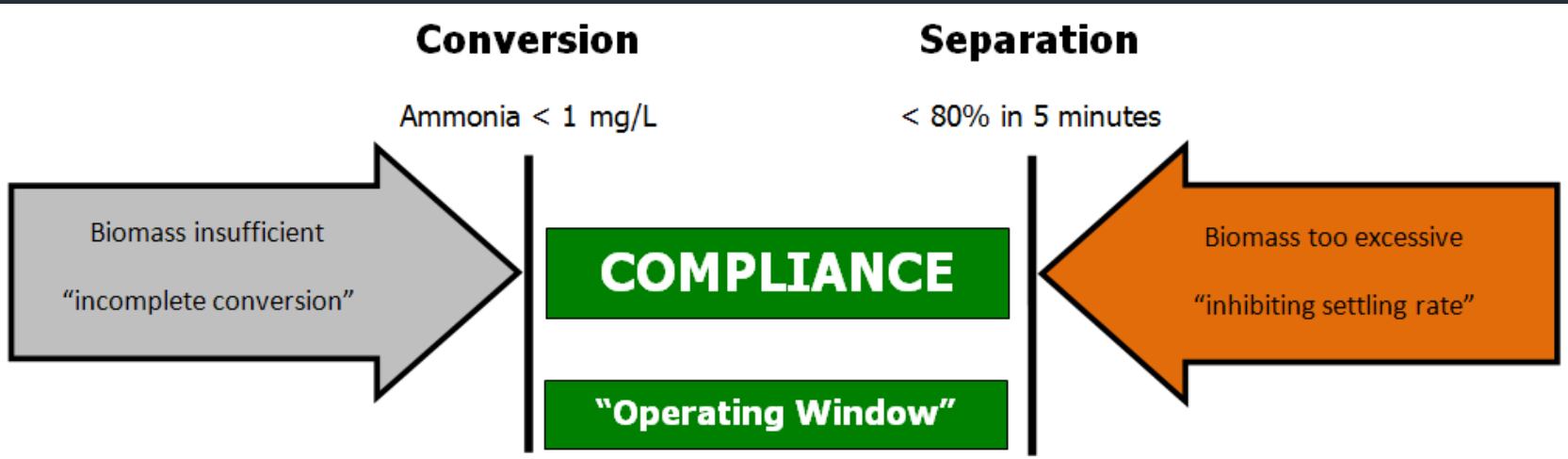
Go with the flow

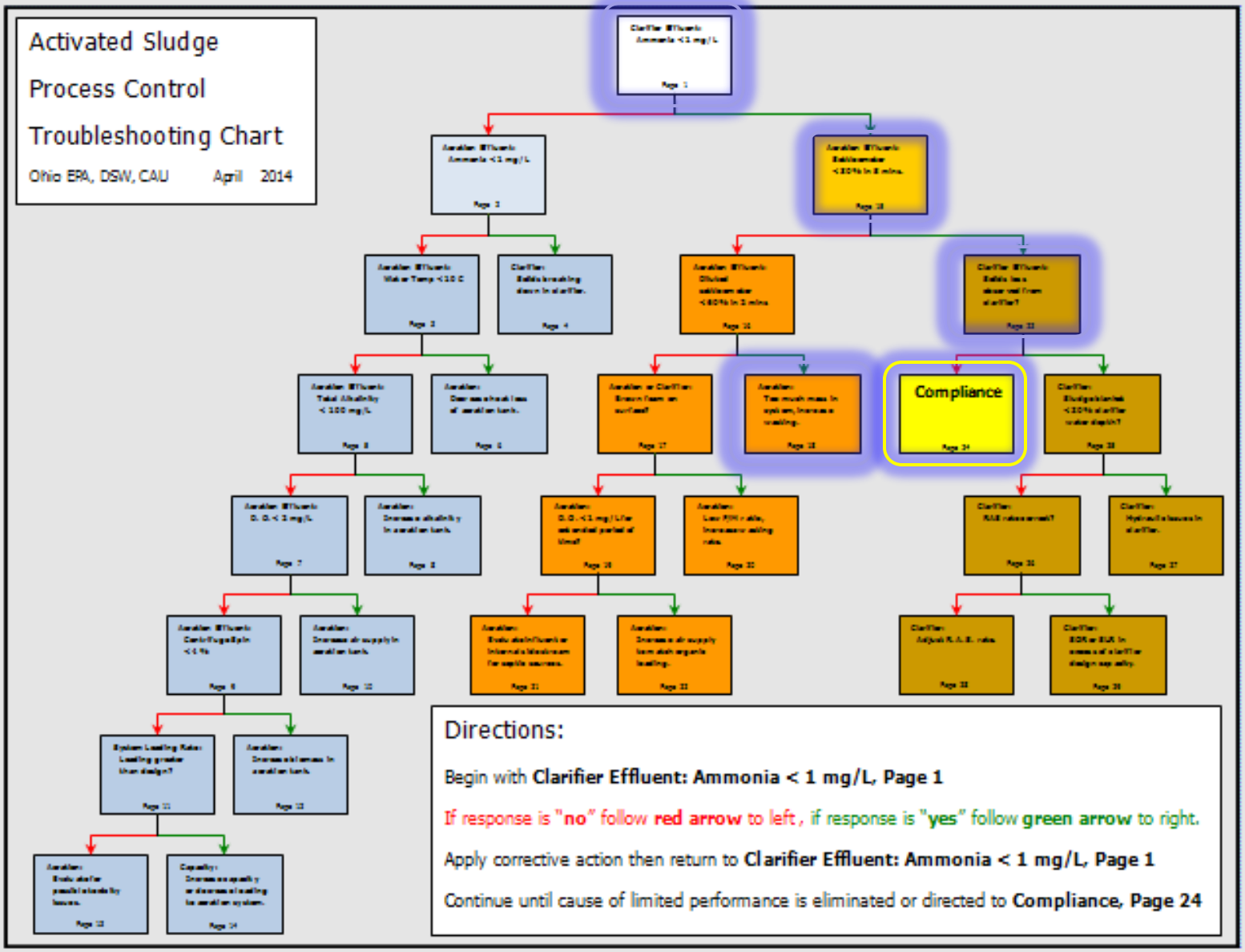
- Page 18



- 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).

Activated Sludge Process Control Troubleshooting Chart

Ohio EPA, DSW, CAU April 2014



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Questions?

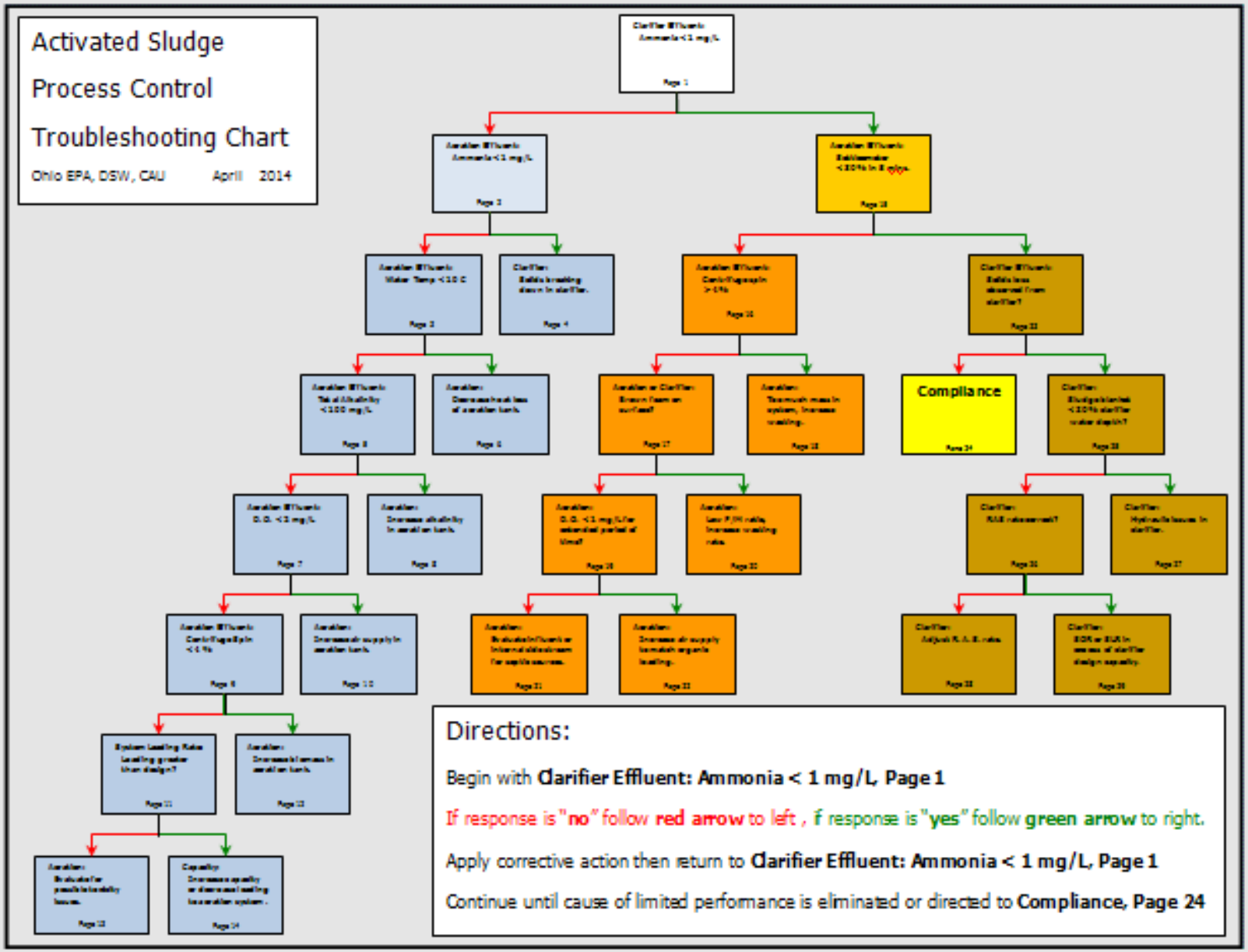
Go with the flow

Charting your way through the process.

www.epa.state.oh.us/dsw/compl_assist

Activated Sludge Process Control Troubleshooting Chart

Ohio EPA, DSW, CAU April 2014



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