

BNR/ENR Selector Setup (flow thru processes)

Example - 5 Stage Bardenpho Process Setup (page 1)

(Use as a general guide only)

BNR --- Effluent 5-8 mg/L TN; <2.0 mg/L TP

ENR --- Effluent < 3 mg/L TN; <0.6 mg/L TP

Stricter ENR TP requirements may require additional treatment such as Filtration.

- Anaerobic Selector (1.5 hours HRT) *(BNR/ENR variations 0.5 to 2.0 hrs.)*
 - Used for Bio-P Removal
 - D. O. and Nitrate as low as possible
 - Minimize Nitrates and Oxygen in recycle flows
 - Removes and requires Carbon
 - cBOD5 to TP ratio is important to maintain (20 to 25 to 1)
 - some designs require 10 lbs. (bio-gradable soluble) COD to 1 lb of TP
 - Monitor side streams such as dewatering filtrate and digester decant that contains Phosphorous

- Anoxic Selector (3.0 hours HRT) *(BNR/ENR variations 0.5 to 4.0 hrs.)*
(2016 MDE Guidelines 2-4 hrs.)
 - Used for Denitrification.
 - Consumes a portion of available BOD
 - cBOD5 to TKN ratio is important to maintain (3.0 - 4.0 to 1)
 - Internal Recycle (200 to 400%)
 - Keep dissolved oxygen levels low in all recycle and side stream flows entering selector
 - Complete Mixing Required and multiple smaller reactors are known to improve Denitrification over the use of 1 full size reactor
 - Simultaneous Nitrification/Denitrification possible with oversized selectors, higher MLSS and
 - 0.3 – 0.7 mg/L D. O. (recommended range varies)
 - ORP – 50 to + 125 mV (recommended range varies)

BNR/ENR Selector Setup (flow thru processes)

Example - 5 Stage Bardenpho Process Setup (page 2)

- 1st Aerobic Selector (12.0 hours HRT) (*typically BNR/ENR 12.0 to 20.0 hrs. HRT*)
(2016 MDE Guidelines 8-12 hrs.)
 - Typically sized for BOD removal in the first 4 to 8 hours then Nitrification follows.
 - D. O. Levels tightly controlled to avoid high D. O. in recycle and return flows
 - Higher front end D. O. level > 2.0 mg/L to enhance Bio-P removal
 - Then tapering off D. O. levels to reduce D. O. in recycle
 - simultaneous nitrification/de-nitrification is sometimes promoted by tapering off D.O. levels to (0.3 to 0.7 mg/L)
- 2nd Anoxic Selector (2.0 hours HRT) (*BNR/ENR variations 1.5 to 4.0 hrs.*)
(2016 MDE Guidelines 2-5 hrs.)
 - Clean carbon source is almost always required to achieve ENR level of treatment.
- 2nd Aerobic Selector (30 minutes) (*BNR/ENR variations 0.5 to 1.0 hrs.*)
(2016 MDE Guidelines 0.5 to 1.0 hrs.)
 - Return to oxic conditions before clarifiers.
 - Course bubble aeration can promote N₂ gas release by breaking up floc.

2016 MDE Guidelines Recommends a Total HRT of 16 to 23 hours for 4-Stage Bardenpho Processes. However, for facilities with high BOD loading and no Primary Treatment the 23 hours HRT is recommended.

Additional MDE Guidelines for 4-Stage Bardenpho Processes:

MLSS 3,000 – 5,000 mg/L

MCET 10-40 days

F/M Ratio 0.1 to 0.2

RAS (% of Forward flow) 100%

Internal Mixed Liquor Recycle 400% to 600%