TEMPLATE FOR TERTIARY DISINFECTED RECYCLED WATER

HIGHLIGHTED TEXT IS FOR REFERENCE ONLY AND REQUIREs UPDATING OR DELETION OF SECTION if it DOES NOT APPLY TO THE FACILITY BEING EVALUATED.

(DELETE ABOVE TEXT BEFORE PRINTING)

insert agency name

insert agency logo

HACCP PLAN

FOR

TERTIARY DISINFECTED RECYCLED WATER

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# Scope

This plan covers product quality control for the insert agency name insert facility name from the entry of raw sewage into the plant to the recycled water system into one of the following:

1. distribution system serving recycled water customers
2. recycled water reservoir(s)

# Background

insert facility name is designed to treat an annual average daily volume of insert volume million gallons per day of predominantly domestic sewage from the cities of insert name of cities and unincorporated areas of insert county name County. Insert facility name reclaims wastewater and produces recycled water to meet the nonpotable water demands of its customers and maintain adequate storage in the recycled water reservoir.

Recycled water is tertiary treated, disinfected, municipal wastewater complying with the insert state regulations for the highest treatment level for unrestricted, direct human exposure. Insert brief description of treatment processes such as: Treatment consists of screening, grit removal, primary sedimentation, and flow equalization followed by two parallel trains composed of: (1) nitrification–denitrification (NdN) activated sludge, secondary clarification, dual media filtration, and chlorination; and (2) membrane biological reactors (MBR) with NdN biological treatment and ultraviolet (UV) disinfection. Tertiary disinfected effluent from these two trains is blended and pumped to the recycled water distribution system.

# Regulatory Compliance

## Insert Regulatory Agency Name Permit

Insert facility name’s final effluent quality is generally better than that required by the insert name of regulating agency standards for recycled water. Insert facility name complies with the Waste Discharge and Producer/User Reclamation Requirements as established on insert date by the insert name of regulating agency, Orders No. insert permit #, National Pollutant Discharge Elimination System (NDPES) No. Insert permit #, entitled insert permit title. The permit effluent limits are as follows:

Insert parameters specified in facility’s permit

| **Parameter** | **Units** | **Average Monthly** | **Average Weekly** | **Maximum Daily** | **Instantaneous Minimum** | **Instantaneous Maximum** |
| --- | --- | --- | --- | --- | --- | --- |
| Biochemical oxygen demand,  5 days at 20° C | mg/L | X | X |  |  |  |
| Total suspended solids | mg/L | X | X |  |  |  |
| pH | standard units |  |  |  | X | X |
| Total chlorine residual | mg/L |  |  |  |  | X |
| Ammonia–nitrogen | mg/L | X |  |  |  |  |
| Turbidity | NTU |  |  | X |  | X |
| Total coliform | MPN/100 mL |  |  | X |  | X |
| Insert other parameter(s) as needed | Insert units: mg/L or  µg/L | X |  | X |  |  |

Compliance with the permit limits is a minimum standard of quality. The plant generally operates at optimum performance and produces higher quality recycled water than the permit requirements.

Recycled water is used for irrigation of agricultural areas, landscaping (e.g., parks, unrestricted access golf courses, school grounds, city street and highway medians, homeowner associations, and other public areas). Recycled water is also used for unrestricted access impoundments, toilet flushing and cooling towers in office buildings, and industrial uses, such as carpet dyeing and concrete making. Insert agency name maintains a completely separate recycled water distribution system of more than XX mi of pipe serving approximately XX metered connections.

## 3.2 The Product Quality Strategy

The mission of insert agency name is to provide high quality water and sewer services in an efficient and cost-effective manner. Insert agency name has a history of producing recycled water since insert year. Insert agency service area information.

Insert agency name’s recycled water consistently meets or exceeds the insert state name’s stringent recycled water quality criteria for reuse. The high quality recycled water that leaves the insert facility name can be used for almost every purpose except drinking.

# Roles and Responsibilities within insert agency name

Insert agency name’s insert title of person overseeing the facility (e.g., plant superintendent) oversees the insert facility name operations and reports to the insert title of person responsible (e.g., general manager of the agency).

Insert organizational chart information pertinent to facility; see example below. The delegation under the governmental body authorized by the agency (e.g., Board of Directors or City Council) is as follows:

General Manager

Assistant General Manager

Director of Administrative Services

Director of Planning

Director of Engineering and Construction

Director of Water Operations

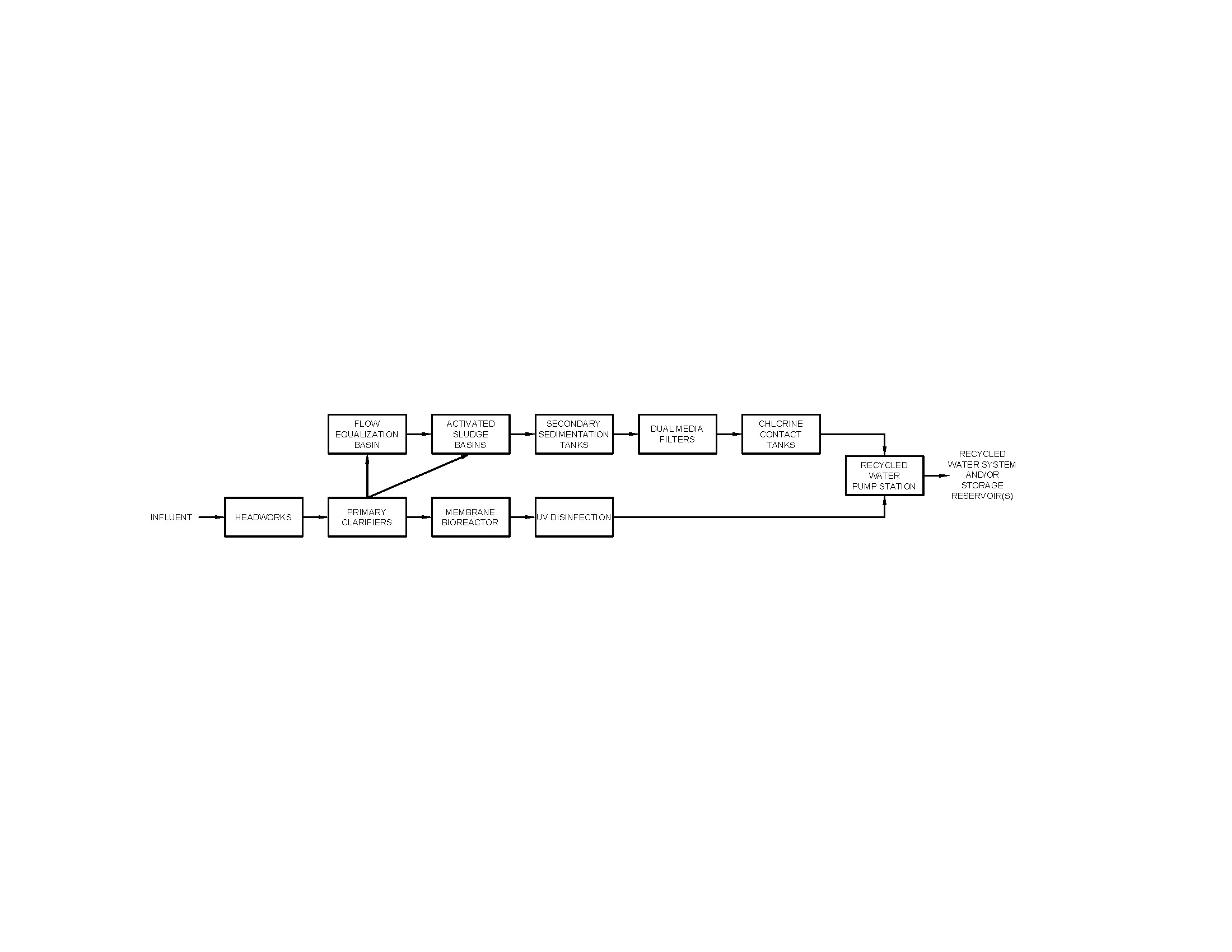
Director of Wastewater Operations

Director of Water Quality

# Process flow diagram

INSERT PROCESS FLOW DIAGRAM SCHEMATIC

A SIMPLE PROCESS FLOW DIAGRAM IS SHOWN AS AN EXAMPLE, DIAGRAM CAN BE AS COMPLEX AS DESIRED AND WOULD IDEALLY SHOW ALL KEY PROCESS STEPS, CHEMICAL INPUTS, AND MAIN SAMPLING POINTS.



# 

# Description of system

The insert facility name provides tertiary treatment and disinfection consisting of insert brief system description.

## Headworks

Raw sewage flows into the headworks structure via insert brief description of the influent sewer(s) and pump station. Flow is normally distributed to X of Y channels. X channels contain mechanical screens, and the Y channel features a manual screen and serves as a bypass designed to handle the flow capacity of one of the mechanical screens for redundancy. Screenings are washed, compacted, and hauled to disposal at insert name of landfill.

Grit chambers remove rocks, sand, and primarily inorganic debris. Grit is washed and stored in a dumpster until it is hauled to disposal at insert name of landfill.

## Primary Sedimentation

Screened and degritted wastewater flows from the headworks to the primary clarifiers. Sedimentation tanks removed biosolids and suspended solids, which are pumped to solids treatment facilities. Primary effluent is routed to flow equalization basins.

## Flow Equalization

The flow equalization facilities provide two basic functions: (1) diurnal equalization for primary effluent flows to deliver a fairly constant flow to downstream processes and (2) distribution of primary effluent to the activated sludge and MBR treatment trains.

## Activated Sludge Treatment

The activated sludge system provides carbonaceous biochemical oxygen demand (BOD) removal and nitrification and denitrification (NdN). The aeration basins are a key component of the activated sludge process and operate in a series of anoxic and oxic cells with recirculation and mixing to achieve NdN.

## Secondary Clarification

Secondary clarifiers are required to allow mixed liquor created in the activated sludge process to settle and produce a clear supernatant. A portion of the settled solids is returned to the activated sludge process, and the excess, or waste activated sludge, is discharged to the solids treatment facilities.

## Dual Media Filters

Dual media filters follow the secondary clarifiers, removing fine solids and turbidity. The media consists of graduated layers of sand and activated carbon on a gravel bed. As the filter media becomes clogged with solids, the water level above the media rises. Each filter has level indicators that initiate a backwash if head loss accumulation occurs before a preset backwash. Waste backwash water is discharged into the backwash flume and drained to the spent backwash waste equalization basin, where it is stored and then pumped to the primary sedimentation influent. Tertiary effluent produced by the filters flows to the chlorination facilities.

## Membrane Bioreactor Treatment

MBRs combine NdN activated sludge treatment with a membrane liquid–solid separation process. Primary effluent is screened by fine screens and pretreated in aeration basins before being pumped into the MBR trains. The MBR process provides both anoxic and oxic treatment, plus clarification and filtration. Microfilters in the final MBR cells remove solids and produce a low turbidity tertiary effluent.

## Disinfection

The plant features two parallel disinfection processes: chlorination and UV irradiation. Dual media filter effluent flows to the chlorine contact tank. Sodium hypochlorite solution is added and mixed by an induction mixer located at the end of the filter effluent pipe entering the contact tank. Upon entering the basin, the effluent flows through the serpentine passes before discharging over an adjustable weir into the recycled water pumping station wet well. The adjustable weir controls the level of water surface and hydraulic detention time in the chlorine contact tank.

MBR effluent is pumped to the UV system. Flow is equally divided between the open UV channels, where the MBR effluent is exposed to UV radiation to inactivate harmful microorganisms. UV-disinfected effluent is discharged to the pump station for recycled water distribution.

# HACCP team and workshops

At a hazard analysis critical control point (HACCP) workshop held on insert date, a hazard analysis of each step in the process flow diagram was carried out, and the critical control points (CCPs) were reviewed. The people who attended the workshops were experienced personnel with multidisciplinary knowledge and are listed in Appendix 1.

The ongoing HACCP team for insert agency name will be:

|  |  |  |
| --- | --- | --- |
| Member | Position | Expertise |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

The HACCP team will meet once per year or when there is a major change in the process.

# The Hazard analysis

The purpose of the hazard analysis is to look at each step in the treatment process and identify

* the main hazards (i.e., what are we trying to achieve at this step?)
* the components that can give rise to failure (i.e., what can go wrong at this step?)

## Critical Control Points

A risk ranking was undertaken for each of the identified hazards, including pathogens and chemical and radiological toxicants. At insert agency name, a decision tree (shown in Appendix 2) is used to determine whether the process step is considered a CCP or a quality control point (QCP). The HACCP guidance provides a generic definition of a CCP. Generally, a process step would be considered critical if, among other things:

* failure at that point is irreversible (e.g., disinfection).
* the step reduces risk to an acceptable level (e.g., denitrification).

Characteristics of a CCP include:

* measured continuously (e.g., using an online monitoring instrument in most cases)
* activity that controls one or more significant hazards
* is monitored in such a manner that failure to perform as intended would be detected, usually immediately downstream of the process
* corrective action for failure (e.g., manual response to alarms or automated responses, such as interlocks)
* records management (logged and retained as part of a formal system)

For each CCP there will be some type of critical limit that the process step must meet (e.g., a contact time for chlorine disinfection [CT] or an ammonia–nitrogen concentration). The setting of these limits must be valid; that is, the limits must be based on scientific data or a regulation or have an empirical justification.

## The Multiple Barrier Approach

The multiple barrier approach is adopted as an augmentation to HACCP. This means that process steps that are not critical (QCP) are also operated in an efficient or optimal manner to further reduce the risk of downstream failure.

## Hazard Analysis and Risk Assessment

| insert agency name | | | | **WATER QUALITY MANAGEMENT & HACCP PLAN** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **insert facility name** | | | |  | | | | | | | | |
| **Activity or**  **Process Step** | **Decision Tree** | | | | | | **CCP**  **or**  **QCP** | **Potential Hazards** | **Control Issues** | **Critical or Operational Limits** | **Monitoring and/or Control Measures** | **Corrective Actions** |
| **Q1** | **Q2** | **Q3** | | **Q4** | **Q5** |
| 1. Headworks | Y | Y | Y | |  |  | CCP | Damage to pumps and transfer equipment from blockage and abrasion by physical hazards |  |  |  |  |
|  |  |  |  | |  |  |  | Deterioration in influent quality caused by untreatable wastes, typically chemical hazards | Monitor incoming sewage and approved industrial discharges. | pH between 6 and 9 | pH analyzer online | Automated pH adjustment |
|  |  |  |  | |  |  |  | Interferences to biological process and deterioration of effluent/recycled water caused by chemical hazards | Investigate illegal dumping sources and contamination events. |  |  |  |
|  |  |  |  | |  |  |  | High flow rate physically disrupting the process | Implement wet weather procedures. | If peak flow rate >X mgd for X hours, report and alarm. | Flow metering | Utilize standby channel and equipment. |
| 1. Primary sedimentation | Y | Y | N | | Y | Y | QCP | High overflow rate, high weir loading rate, and low detention time in primary clarifiers  Higher BOD and total suspended solids (TSS) loading on downstream secondary processes | Monitor flow rate.  Maintain proper solids removal. | If peak overflow rate  >X gpd/sf for  X hours, report.  If hydraulic detention time <X hours for X hours, report. | Refer to procedure. | Refer to procedure  Utilize standby basin(s) |
| 1. Flow equalization | Y | Y | Y | |  |  | CCP | Peak flow and loadings on downstream processes  Failure of pumps or flow control devices | Operational procedures to control flow stored in and released from flow equalization basins | Equalized flow X mgd to downstream processes | Flow metering | Refer to procedure  Utilize standby pumps mixers, flow control devices |
| 1. Aeration basins (oxic/anoxic–NdN system) | Y | Y | Y | |  |  | CCP | Deterioration of effluent quality caused by suboptimal biological process | Procedures to control, interpret, and manipulate activated sludge process in aeration basins for nitrogen removal, BOD reduction, and optimal settling | Maintain dissolved oxygen concentration in oxic cells.  Maintain mixing, recirculation in anoxic cells.  If NH3>X mg/L for  >X hours, report.  If NO3->X mg/L for  >X hours, report.  If BOD>X mg/L, report. | Refer to procedure.  Maintain mixed liquor suspended solids (MLSS) and recirculation rate. | Refer to procedure.  Utilize standby blowers, mixers, recirculation pumps. |
| 1. Secondary clarification | Y | Y | Y | |  |  | CCP | Deterioration of effluent quality caused by poor solids settling, flow control, and solids management | Operational procedure to cover issues of flow control, solids control and settling | If effluent TSS>X mg/L, report.  Inspect clarifiers daily. | Refer to procedure. | Refer to procedure. |
| 1. Dual media filters | Y | Y | Y | |  |  | CCP | High influent turbidity  High effluent turbidity  Failure of chemical coagulant feed | Monitoring of process and backwash/surface air scour  Media plugging and backwash frequency  High filtration rate | If filter influent turbidity  >X NTU  If filter effluent turbidity  >X NTU  If high head loss (high filter water level) | Turbidimeter—check filter influent and effluent turbidity.  Increase alum or coagulant feed or both.  Refer to procedures for backwashing and air scour. | Check turbidimeter for proper operation.  Check alum or polymer coagulant feed.  Determine cause of high secondary effluent turbidity.  Check flow rate to each filter for balanced flow split.  Bring standby filter(s) online.  Refer to operations and maintenance (O&M) manual. |
| 1. MBR treatment | Y | Y | Y | |  |  | CCP | fouling membranes and poor effluent quality | Monitoring of process and cleaning of equipment | If MF feed turbidity >X NTU  ≥XX NTU (membrane warranty) >XX NTU for >4 hrs >XX NTU at any time  If MF transmembrane pressure  <X psi (calculated) >X psi (calculated)  if MF effluent>X NTU | Aeration blowers—check dissolved oxygen in oxic cells.  Recirculation pumps—increase rate.  effluent turbidimeter  Frequent backwashing—check need for chemical clean in place of membranes.  Refer to procedure | Check turbidimeter for proper operation Determine cause of high secondary effluent turbidity Refer to the O&M manual  Shut down MF unit and clean cell Possible membrane integrity breach: perform pressure decay test/air leak testing Refer to O&M manual |
| 1. Chlorination disinfection | Y | Y | Y | |  |  | CCP | Failure to reduce bacterial counts to permit/levels appropriate for current reuse requirements  Failure to provide required chlorine CT, hydraulic retention time, and chlorine residual  Generation of possibly harmful chlorinated organics | Operational procedures to ensure suitable sodium hypochlorite dosing, control, monitoring, and corrective action | If total coliform >X MPN/100 ml  If chlorine residual<X or >X mg/L at end of contact tank, report.  If hydraulic detention time <X minutes, report.  If chlorine dose (concentration x CT) <X mg/min/L at peak dry weather design flow, report. | Chlorine residual  Refer to procedure | Adjust sodium hypochlorite feed set point to match flow-paced demand to maintain desired recycled water chlorine residual  Refer to procedure |
| 1. UV disinfection | Y | Y | Y | |  |  | CCP | Failure to reduce bacterial counts to permit requirements  Failure to reduce bacterial counts to a level appropriate for current reuse requirements | Tertiary effluent turbidity and transmittance  UV intensity and flow  UV lamp output and outages  UV train flow | if UV train power<X kW per train  if UV transmittance<X% (at 254 nm)  if calculated UV dose per train<X mJ/cm2 | Monitor UV train power  Monitor UV transmittance  Refer to procedure | Replace UV lamps  Utilize standby UV train  Refer to procedure |
| 1. Recycled water pumping station | Y | Y | Y | |  |  | CCP | Service disruption caused by supply shortage | Inspection and maintenance of pumping equipment | Flow within range of set points, X–Y gpm  Total discharge head within range of set points, X–Y ft | Maintain flow meter, pumps, motors, drives  Refer to procedure | Utilize standby pump  Refer to procedure |
| 1. Biosolids thickening | N |  |  | |  |  | QCP | Low % solids | Dilute biosolids | >X% solids | % of thickened solids  Refer to procedure | Increase polymer addition  Confirm solids loading rate in proper range for equipment  Refer to procedure |
| 1. Anaerobic digestion | Y | Y | Y | |  |  | CCP | Unstabilized biosolids | Adequate solids retention time for stabilization  Heating and mixing  pH | >20 days solids retention time | Solids retention time  Biogas production  >35o C (95o F)  Neutral pH | Maintain proper temperature and mixing  Maintain proper solids recirculation |
| 1. Biosolids dewatering | Y | Y | N | | N |  | QCP | Failure to dewater solids to meet moisture specification for disposal | Operational procedures for the centrifuges | ≥22% solids required over two consecutive tests (operational limit only) | Refer to procedure | Increase polymer addition  Confirm solids loading rate in proper range for equipment  Refer to procedure |
| 1. Biosolids dryer | N |  |  | |  |  | QCP | Failure to dewater biosolids to meet moisture specification for intended reuse | Operational procedure for drying techniques | Pellets at >90% solids | Feed biosolids % solids  Dried pellets % solids | Adjust feed rates and temperature  Refer to procedure |
| 1. Computer control system |  |  |  | |  |  | supportprogram | Deterioration in effluent quality caused by failure of the computer control system | Access to expert system advice  Manual operation  Backup systems | NA | Internal technicians used for routine tasks | Outside expertise available for complex problems |
| 1. Infrastructure |  |  |  | |  |  | supportprogram | Deterioration in effluent quality caused by condition or design of infrastructure | Condition of structure | NA | Two yearly process inspections include infrastructure condition report | Process audits are followed up regularly |
|  |  |  |  | |  |  |  |  | Suitability of processes |  | Process audits carried out by engineers to review the adequacy of process steps | Recommendations for process modifications may be made following audits |
|  |  |  |  | |  |  |  |  | Plant capacities |  | Daily flow rates are monitored | Engineering and operations departments consider flow trends in planning expansion |
|  |  |  |  | |  |  |  |  | Backup power supply |  | Standby generators can operate the entire plant | Maintain standby generators |
| 1. Staff |  |  |  | |  |  | Supportprogram | Deterioration in effluent quality cause by staff problems | Availability and suitability of operational procedures |  | Procedures are available for all major process steps  Technical manuals are available for more detail | Reporting of HACCP excursions, regulatory notices, and audits ensure procedures are reviewed |
|  |  |  |  | |  |  |  |  | Relevant qualifications  Staff numbers |  | All operators are state-certified |  |
|  |  |  |  | |  |  |  |  | Adequate competencies and training |  | External competency assessments conducted |  |
| 1. Calibration and maintenance |  |  |  | |  |  | Supportprogram | Inaccurate data leading to poor operational decisions | Suitable care and calibration regimes for process and lab instruments |  | Relevant instruments are calibrated according to manufacturer’s specs | Product quality carries out random checks using reference instruments |
|  |  |  |  | |  |  |  | Deterioration in effluent quality caused by mechanical and electrical failure of system components | Inspection and maintenance schedules |  | O&M staff maintains equipment according to service level agreement | Refer to service level agreement |
| 1. After-hours control |  |  |  | |  |  | Supportprogram | Deterioration in product quality caused by the after-hours failure of plant processes | Adequate alarming  On-call roster |  | Various failure alarms generate callouts  On call roster in place |  |

## Insert Agency, Insert Facility: Critical, Operational, and Reporting Limits

| **Process Step** | **Critical or Operational Limit** | **Comments** |
| --- | --- | --- |
| **Headworks (screening and grit removal)** | **Peak flow rate** should be  <X mgd.  **pH** should be between 6 and 9. |  |
| **Primary sedimentation** | **Peak overflow rate** should be <X gpd/sf.  **Hydraulic detention time** should be between X and  Y hrs. | Poor quality primary effluent increases organics loading on secondary treatment processes. |
| **Flow equalization** | **Flow** sent to downstream processes should be fairly constant at approximately  X mgd. | impacts downstream processes |
| **Aeration basins (oxic/anoxic–NdN system)** | **Ammonia–nitrogen** should be <X mg/L.  **Nitrate–nitrogen** should be <X mg/L.  **BOD** should be <X mg/L. | Impaired nitrogen and organics removal could result in poor recycled water quality |
| **Secondary clarification** | **Effluent TSS** should be  <X mg/L. | Impacts dual media filters and final effluent quality |
| **Dual media filters** | **Influent turbidity** should be <X NTU.  **Effluent turbidity** should be <X NTU. | Impaired filter performance could result in poor recycled water quality |
| **MBR treatment** | **Ammonia–nitrogen** should be <X mg/L.  **Nitrate–nitrogen** should be <X mg/L.  **BOD** should be <X mg/L.  **Effluent turbidity** should be <X NTU. | Impaired nitrogen and organics removal could result in poor recycled water quality  Impaired MBR performance could result in poor recycled water quality |
| **Chlorination disinfection** | **Total coliform** count  >X MPN/100 mL.  **Chlorine residual** should be in the range of X to Y mg/L at end of contact tank.  **Hydraulic detention time** should be ≥X minutes.  **CT** should be ≥X mg/min/L at peak dry weather design flow. | Failure to reduce bacterial counts to permit/levels appropriate for current reuse requirements  Failure to provide required chlorine CT, hydraulic retention time and chlorine residual  Generation of possibly harmful chlorinated organics |
| **UV system** | **Average UV train power** should be ≥X kW per train.  **total coliform** count  >X MPN/100 mL | If the average UV train power <X kW, check the number of failed UV lamps and power usage for each train. Replace the failed lamps promptly. Shut down the affected UV train and switch flow to standby UV train. Refer to the O&M manual for more information. |
| **Recycled water system** | **Flow** pumped to distribution system and reservoir(s) should be in the range of X and  Y mgd.  **Total discharge pressure** should be in the range of X and Y ft. | Discharge recycled water to customers and storage at proper flow and pressure. |

## Supporting Programs

Essential activities to support product quality include:

* O&M manual
* Standard operating procedures

# Monitoring, Control, and Corrective Action

The monitoring, control, and corrective action for each process step are mentioned briefly in the hazard analysis. More detailed information is contained in the following. Update sections to apply to the facility being evaluated; Sections 9.1 through 9.12 are examples of processes.

## Calibration of Instruments

Control: Instruments will be calibrated according to manufacturers’ instructions. Online measuring equipment is calibrated to a traceable standard by the maintenance department.

Corrective action: Staff will recalibrate equipment and call manufacturer if needed.

## Collection System and Influent Monitoring

Control: Operational staff visit the headworks regularly. If staff notice that the influent has unusual characteristics (color, odor, appearance), sampling and testing of the influent is conducted. Influent characteristics are monitored regularly in accordance with the permit requirements. Insert more detail about this facility as needed.

Corrective action: Staff will collect sample, place the sample in the refrigerator, and call the Source Control Management Team. If deemed necessary, Source Control will characterize the sample. Otherwise, the sample can be discarded. Insert more detail about this facility as needed.

## Headworks (Screening and Grit Removal)

Control: Large solids, rags, and grit have the potential to damage or adversely impact downstream equipment and ultimately the quality of recycled water. To ensure the removal system is working efficiently, it will be physically inspected daily. Insert more detail or replace with text about how the process is controlled at this facility.

Corrective action: Staff will perform regular maintenance on equipment. Clean out any clogged equipment. Place standby units into service as needed. Insert specific corrective actions if the control levels are exceeded.

## Primary Sedimentation

Control: Observe the operation of the primary sedimentation tanks daily, and monitor the quality of the primary effluent and solids. Review the flow records and compare with design overflow rates, weir loadings, and hydraulic retention times. Look for rising or bulking sludge that would indicate anaerobic conditions, aging sludge, and improper solids removal rates. Review primary solids pump operating records. Insert how the process is controlled at this facility.

## Corrective action: Adjust weir gates to ensure flow is distributed equally among tanks in service. Clean overflow weirs, scum collection equipment, and any inlet/outlet ports that may be clogged. Adjust primary sludge pumping to prevent aging sludge blanket if bulking sludge is a problem. Insert specific corrective actions if the control levels are exceeded at this facility. Flow Equalization

Control: Inspect and wash down flow equalization storage basins. Observe aeration and mixing in basins. Maintain flow meters, pumps, and valves to maintain a constant design flow rate to the MBR facilities and an operator-adjusted set point flow to the NdN–activated sludge facilities. Confirm that the set point maintains a balanced equalized flow over the   
24 hr period such that the flow equalization gradually stores excess primary effluent during the day when plant flows are greater than average and then releases the stored primary effluent during the night when the plant flows are lower than average. Insert specifics about how the process is controlled at this facility.

Corrective action: Adjust set point flow to the NdN–activated sludge facilities to balance the daily diurnal flow to the downstream processes such that the flow equalization basins store and drain primary effluent within a 24-hr period, resulting in an equalized flow. Insert corrective actions if the control levels are exceeded at this facility.

## Activated Sludge (Nitrification–Denitrification)Treatment

Control: Observe oxic and anoxic basins for proper mixing and aeration (in oxic cells) with confirmation using DO meters. Observe color of mixed liquor and extent of foam and scum. Conduct microbiological sampling to determine the consistency of the sludge floc and any issues with filamentous organisms caused by insufficient DO levels. Monitor pH that may indicate low alkalinity issues. Monitor process performance by sampling secondary effluent from the clarifiers for BOD, TSS, ammonia, and nitrate levels. Insert how the process is controlled at this facility and add specific targets and ranges for proper operation.

Corrective action: Adjust aeration rates, mixer speeds, recirculation pump rates, return, and waste activated sludge pumping rates to improve secondary effluent quality by adding more oxygen to oxic cells and more nitrates to anoxic cells and mixing to promote homogeneous conditions and eliminate dead zones and short-circuiting. Excessive foam and scum levels can be controlled with sprays and mixing. Add methanol if an additional carbon source is needed for denitrification. Insert corrective actions if the control levels are exceeded at this facility.

## Secondary Clarification

Control: Observe the operation of the secondary clarifiers periodically during the day. Monitor the quality of the secondary effluent, especially for BOD, TSS, turbidity, ammonia and nitrate, and waste solids. Coordinate with the operation of the activated sludge (NdN) system because the secondary clarifiers are an important component of the secondary treatment process. Review the flow records and compare with design overflow rates, weir loadings, and hydraulic retention times. Look for rising or bulking sludge that would indicate anaerobic conditions, aging sludge, and improper solids removal rates. Review waste solids pump operating records. Insert specific information about how the process is controlled at this facility.

Corrective action: Adjust weir gates to ensure flow is distributed equally among the clarifiers in service. Clean overflow weirs, scum collection equipment, and any inlet/outlet ports that may be clogged. Adjust return and waste sludge pumping rates to maintain MLSS concentration in oxic cells and provide nitrate source for anoxic cells. Insert corrective actions if the control levels are exceeded.

## Dual Media Filters

Control: Monitor filter influent and effluent turbidity to comply with water recycling and permit requirements. Maintain proper flow split among filters in order to balance filtration rates and stay within permit requirements. Inspect launders and filters daily, particularly during a backwash cycle. Review backwash frequency records. Maintain alum or polymer filter aid coagulant storage tanks and pumps. Maintain backwash and spent backwash pumps. Insert specific details about how the process is controlled at this facility.

Corrective action: Coordinate with operation of secondary treatment system to maintain filter influent turbidity within requirements so as to not overload the filters. Adjust dosage of alum or polymer as needed. Adjust filter valves or flow control weirs to maintain proper filtration rates to each filter. Monitor filter effluent turbidity for permit compliance for water reuse. Investigate backwash air or water scrubbing issues if balls or clumping of media are observed. Observe backwash cycle, and adjust pumping rate if necessary to achieve fully expanded bed for proper cleaning. Insert corrective actions if the control levels are exceeded.

## Membrane Bioreactor Nitrification–Denitrification Treatment

Control: Maintain constant flow of primary effluent to the MBR facility. Maintain MLSS return from the membrane tank to the first anoxic tank to reduce its DO concentration and promote denitrification. Keep anoxic tank well mixed to keep solids in suspension. Check DO level in oxic cell for BOD oxidation and nitrification. Maintain return activated sludge flow rate at about six times the influent flow. Monitor BOD, ammonia, and nitrate concentrations to meet design targets. Monitor turbidity in the microfiltered effluent to meet recycled water turbidity standards. Maintain blowers, pumps, and mixers. Maintain citric acid and sodium hypochlorite storage and feed pumps for intermittent MBR (MF membrane) cleaning. Observe MF cell during air scour for uneven bubbles that could indicate fiber breaks. Insert specific details about how the process is controlled at this facility.

Corrective action: Maintain blowers, pumps, and mixers, and adjust rates of mixing, aeration, and return activated sludge RAS (MLSS) return as needed to produce targeted effluent quality. Add methanol if needed as a carbon source for proper denitrification. Insert corrective actions if the control levels are exceeded.

## Chlorination Disinfection

Control: Maintain sodium hypochlorite storage and feed pumps to deliver proper dose. Maintain mixer. Monitor final chlorine residual at discharge weir. Monitor flow rate and calculate CT for compliance with requirements. Sample and test total coliform count for compliance with disinfection requirements. Insert other information about how the process is controlled.

Corrective action: Adjust sodium hypochlorite feed pump dose as needed to achieve required chlorine residual and CT. Dechlorinate using sodium bisulfate if chlorine residual is too high. Resample and retest for total coliform count. Disinfect at storage reservoirs if needed. Insert other corrective actions if the control levels are exceeded.

## UV Disinfection

Control: Check UV lamps, power delivered to trains, UV intensity, and turbidity of effluent to confirm UV transmittance in design range. Monitor flow split between UV channels for equal division of flow. Sample and test total coliform count for compliance with disinfection requirements. Insert specifics about how the process is controlled at this facility.

Corrective action: Check for UV lamps that are not working and replace if necessary (check if expected lamp life has been exceeded). Clean UV lamps if intensity is low but lamp is working. Check sensor for UV intensity and train power. Check turbidity of MBR effluent and confirm that the percentage of UV transmittance is within target operating range. Adjust flow split between UV channels to equalize flow. Resample and retest for total coliform count. Insert other corrective actions if the control levels are exceeded for this facility.

## Recycled Water Pumping Station

Control: Maintain pumps to operate at the proper design flow rate and discharge pressure. Monitor final effluent (recycled water) quality per permit requirements. Insert specifics about the pumping facilities at the facility.

Corrective action: Utilize standby pump if duty pump is out of service. Notify regulatory agency(ies) if recycled water quality does not comply with the permit requirements, and state the reasons for the excursion and corrective measures taken. Notify recycled water customers of recycled water quality problems and provide information regarding when recycled water service will be reinstated or how alternative water supplies will be available. Insert specific information for this facility and agency.

## Excursion Reports

Excursion reports are 1-page templates that are automatically emailed to certain senior managers and the general or executive manager at insert name of agency. They must be submitted if any of the following occurs:

* Permit violation of any kind
* BOD in the effluent exceeds X mg/L
* Ammonia in the effluent exceeds X mg/L for more than X hours
* Nitrate in the effluent exceeds X mg/L
* Suspended solids in the effluent exceed X mg/L (grab sample)
* Turbidity in the effluent exceeds X NTU for more than X hours
* Chlorine residual is less than X mg/L or more than Y mg/L for more than X minutes
* UV dose is less than X mJ/cm2 for X minutes
* Total coliform of the effluent exceeds X MPN/100mL
* pH of the effluent is lower than 6.5 or higher than 8.5 units

## Standard Operating Procedures

Plant operators and maintenance personnel have access to the following O&M manuals: Modify for facility being evaluation, list is only an example.

* headworks system
* primary clarifiers system
* primary skimming and pumping system
* primary sludge pumping system
* primary effluent pumping system
* flow equalization system
* activated sludge (NdN) system
* secondary clarifiers system
* return and waste-Activated sludge pump station
* dual media filtration system
* MBR system
* chlorination disinfection system (NaOCl)
* UV system
* recycled water pump station
* biosolids thickening system
* anaerobic digestion
* biosolids dewatering system
* solids heat dryer system

# Awareness of HACCP

## Staff Awareness

The insert name of agency lead operator was given HACCP awareness training on insert date. All new staff members are required to have HACCP training.

## Contractor Awareness

Contractors must obtain permission from the lead operator before commencing work. The lead operator will ensure contractors are managed to comply with the HACCP plan.

## Planning Representation

During the planning of upgrades or major retrofitting, the design team must include at least one person familiar with HACCP.

# Communication

## Internal

The insert title of person overseeing the facility (e.g., plant superintendent) will inform the insert title of person responsible (e.g., general manager of agency) of any changes in operation that may impact recycled water quality.

The insert title of person overseeing the facility (e.g., plant superintendent) will inform the plant staff of issues affecting product quality that are suspected of impacting recycled water quality. This will include use of the excursion system.

## External

General communication with recycled water customers is handled by the insert title of person responsible for notifying recycled water customers (e.g., public relations manager). Customers are provided with product information and a contact number for enquiries. Complaints will be handled by the insert title of department that handles complaints (e.g., customer service department). Communications with the insert environmental regulating agency are handled by the insert title of person who communicates with the regulating agency.

# Nonconforming product

Should the plant effluent fail to meet permit requirements, the plant will be shut down. or flow will be stored and retreated. or flow will be diverted to X facility.

# Incident Management

Insert agency name has an Incident Management Plan under document control. According to the plan, any employee can declare an incident. The severity of an incident is categorized according to criteria, and there are procedures related to these categories.

All plant staff should be aware of how to access the Incident Management Plan. The reporting system covers deviations from optimal operating conditions; however, where the deviation from optimal is extreme or cannot be brought under control within a working day, the insert name of person responsible (e.g., lead operator) must consider declaring an incident.

If an incident is declared, the insert name of person responsible (e.g., plant superintendent) will be included in immediate contacts. The Incident Management Team will consider the need for customer or regulator notification and whether to recall or isolate faulty product. The insert name of person responsible (e.g., plant superintendent) may make unilateral decisions in this regard if a decision is required before an incident management team can be convened.

# Validation

The validity of the process controls adopted through this HACCP plan has been endorsed by the insert name of person responsible (e.g., design consultant experienced in validation of treatment process trains) and insert name of oversight authority (e.g., regulatory office responsible). The report can be found at the insert reference for scheme validation report.

# Continuous Improvement

Insert agency name has several mechanisms of continuous improvement, but two of these mechanisms are designed to capture improvements in a timely manner from a wide selection of staff.

## Excursion Reports

Excursion reports must be completed when critical limits are outside the accepted range. The excursion report is a controlled 1-page template document available online from the quality system. Excursion reports should be emailed to management within 24 hrs of the completion of the event.

Management can examine excursions to assess if the event is indicative of systemic failure (e.g., equipment, resources, training). As a minimum, the following people will be on the excursion report email list. (Insert names of staff that will be on the excursion report email list. Below is an example.)

* director of wastewater operations
* operations and maintenance manager and customer services manager
* water quality manager, public information officer, and source control manager

Other parties with reasonable interest in performance may be added on request.

It is the responsibility of the insert name of person responsible for completion of excursion reports (e.g., lead operator) to complete internal excursion reports as required. The insert name of person responsible for completion of external notifications (e.g., treatment plant manager) must complete the external notifications.

## Work Improvement Notices

Workplace improvement notices are used for any staff to submit their suggestions for opportunity for improvement. The Work Improvement Notices can be submitted through a template in the Quality System.

Once a work improvement notice is lodged, it will be followed through to completion by a insert name of person responsible for completion of work improvement notices (e.g., quality officer). The initiator will receive a formal response from the respondent, and this will be signed off by the relevant manager.

# Training Awareness and Competence

Insert facility name operators have many years of experience with operation of wastewater treatment facilities. The insert facility name operations staff includes the lead operator, who is certified to the highest certification in the state of insert name of state; other operators supporting the facility are also certified by the state.

Newly hired O&M technicians are thoroughly trained on the insert facility name and the HACCP plan.

# Internal Audit and Management Review

In accordance with the requirements of HACCP, this plan will be audited from time to time. The auditor will:

* be familiar with the insert facility name treatment process
* check water quality trend reports
* check accuracy of online monitoring equipment
* check plant alarms to ensure they are working properly

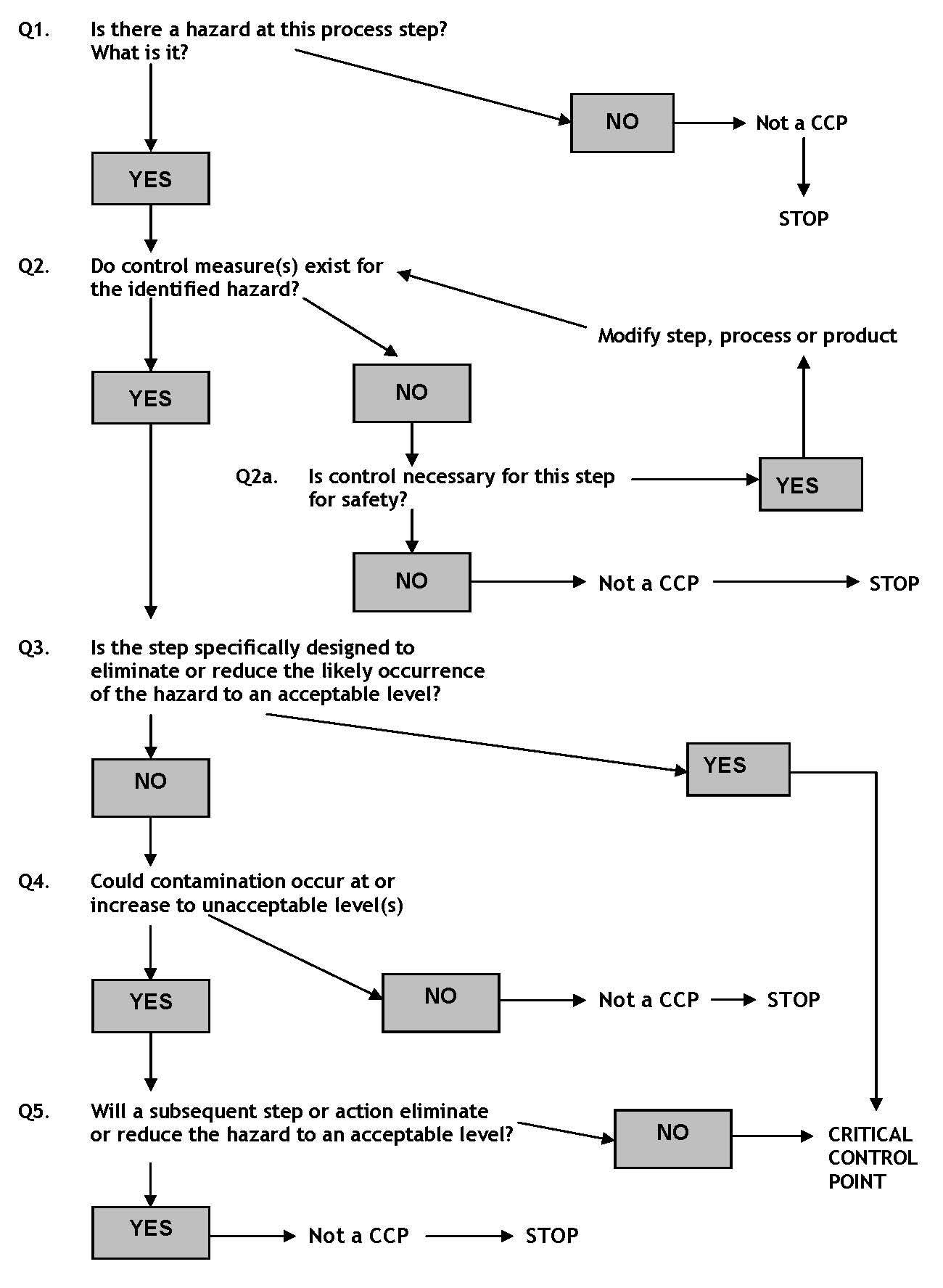
The auditor may:

* select random equipment and check that maintenance is up to date
* check staff records for training, certifications, and competency
* carry out safety and environmental training audits as requested by the (insert regulatory agency)

Appendix 1: HACCP Workshop Attendees

Enter date, time, and location of workshop.

|  |  |
| --- | --- |
| **Attendee** | **Position/Department** |
| Enter attendee’s name | Enter position, department, or both. |
|  |  |
|  |  |
|  |  |

Appendix 2: HACCP Decision Tree