

REQUIRED RANGE OF KNOWLEDGE – Collection System Operator, Grade 1

Applicants are not expected to have a complete mastery of all subjects but at least should have heard of them in the context of wastewater collection. Ability in basic arithmetic and an understanding of basic conversions is requisite. Introduction to regulatory concepts.

SECTION	TOPIC	REFERENCE
Regulatory Knowledge	Pollution prevention; Discharge permits – APP, NPDES, AZPDES; Wastewater Sources – industrial, commercial, domestic, runoff, inflow/infiltration; Clean Water Act - Water Quality Standards; 503 regulations; ADEQ classes of reuse water; Define: facility, On-site operator, on-site representative, sewage;	Arizona Administrative Code, Title 18, Chapter 4, Articles 1 – 8 and Title 18, Chapter 5, Article 1; Chapter 9, 'R18-9-B204.A.1(A-D); 'R18-5-104.C.E; 'R18-5-107.B and C; 'R18-5-108.A; 'R18-5-114.1; 'R18-9-101; 'R18-9-B201.D.E
Water Reclamation and Reuse	Irrigation; Recharge; Natural reclamation – microstaining, polishing ponds; Distribution and storage; Surface disposal – drainfield, mounds, tile drain, deep well injection, pretreatment; Oxygen starvation (methemoglobinemia) in infants;	Questions to be Added
Disinfection	Purpose of disinfection; Disinfectant types; Characteristics of chlorine and chlorine compounds; Available chlorine in various compounds; Chlorine demand; Residual; Hazards and safety requirements for all types of disinfectants Define: Hypochlorous acid, Hydrochloric acid, Hypochlorite ion, Elemental chlorine, chlorine dioxide	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed. Handbook of Chlorination and Alternative Disinfectants, 4th Ed. Or other Chlorination and Disinfection reference material.

SECTION	TOPIC	REFERENCE
Chemistry	Elements; Sulfur Compounds; Definition of an organic compound; hydrogen sulfide gas production; molecular structure of elemental chlorine; chemical symbol for chlorine; chemical name for Cu; chemical of control grease and soap;	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5 th Ed.; Any Student Chemistry Handbook
Microbiological and Chemical Quality	Bacteria, viruses, and protozoan; Coliform group; occurrence, significance;; Potential waterborne diseases; Microbiological; Organic; Inorganic; Radiological; Mineral; Physical	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5 th Ed.
System Operation	Sewer pipe system - materials, sanitary hazards, Pumps and water pressure; pump characteristics, Pneumatic Diaphragm Pump; Air Bubbler System; Lift Station operation and maintenance, positive displacement vs. centrifugal, calculation of pump output; Define:Static head; 'Suction head; Dynamic head; Instrumentation; Diagnosis of minor electrical problems; Sewer Line Cleaning; Smoke Test; CCTV Inspection; Cross-Connection Contol; Define infiltration/exfiltration	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol 2, 5 th Ed. http://www.cheresources.com/centrifugalpumps3.shtml
Pretreatment and Industrial Waste	Monitoring and reporting requirements – federal and local; Point source and non-point source contamination; Conventional and priority pollutants; Baseline monitoring; Pollution prevention	Questions to be Added

SECTION	TOPIC	REFERENCE
Safety	Common hazards; Sanitary hazards; Equipment; Emergencies; Lock out/Tag out; Confined space entry; Backflow and cross connection control; Confine space procedures; Hazard recognition in Trenching and shoring, ladder and climbing devices, soil types and spoil placement; utility location	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5 th Ed. http://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html#2
Mapping	Importance of Mapping; east/west axis; Define types of Maps: grid; master; section; base; block, System map types and use, engineering drawings, stationing, plan and profile;	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol2, 5th Ed. Ch. 12

SECTION	TOPIC	REFERENCE
Introduction to Security concerns,	Define: Vulnerability Assessment, Preparedness, Recovery, Mitigation, Detection, Delay and Response, Emergency Response Plan ~ Contingency Plan R18-9-A204	.Reference: Water and Wastewater Security Product Guide, "Visual Surveillance Monitoring," USEPA, April 20, 2004 ~ Protecting Your Community's Assets: A Guide for Small Wastewater Systems, NETCSC, Nov. 2002, page 38 ~ Emergency Planning Interactive Guide, Illinois Section American Water Works Association and Midwest Technology Assistance Center, www.isawwa.org (click on "Emergency Planning CD"), Mutual Aid Overview page. ~ Emergency Preparedness U.S.A., FEMA, Unit 1, pages 1-2 ~ Guarding Against Terrorist and Security Threats: Suggested Measures for Drinking Water and Wastewater Utilities, Appendix B of Emergency Response Plan Guidance for Small and Medium Community Water Systems to Comply with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, USEPA, April 7, 2004
Math Concepts	Formulas; Units and conversion factors; Water measurements; Concentrations; Volume; Area; Flow rates and feed rates; Percentage; Fractions	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5 th Ed.

REQUIRED RANGE OF KNOWLEDGE – Collection System Operator, Grade 2

Applicants are expected to be familiar with all subjects listed under Grade 1. They are not expected to have complete mastery of all subjects but at least should have some familiarity of them in the context of wastewater collection. The ability to make common water works measurements, calculations, and conversion is expected. Enhanced knowledge of regulatory concepts.

SECTION	TOPIC	REFERENCE
Regulatory Knowledge	Pollution prevention; Discharge permits – APP, NPDES, AZPDES; Wastewater Sources – industrial, commercial, domestic, runoff, inflow/infiltration; Clean Water Act - Water Quality Standards; 503 regulations; ADEQ classes of reuse water; Define: facility, On-site operator, on-site representative, sewage;	Arizona Administrative Code, Title 18, Chapter 4, Articles 1 – 8 and Title 18, Chapter 5, Article 1; Chapter 9, 'R18-9-B204.A.1(A-D); 'R18-5-104.C.E; 'R18-5-107.B and C; 'R18-5-108.A; 'R18-5-114.1; 'R18-9-101; 'R18-9-B201.D.E
Water Reclamation and Reuse	Irrigation; Recharge; Natural reclamation – microstaining, polishing ponds; Distribution and storage; Surface disposal – drainfield, mounds, tile drain, deep well injection, pretreatment; Oxygen starvation (methemoglobinemia) in infants;	Questions to be Added
Disinfection	Purpose of disinfection; Disinfectant types; Characteristics of chlorine and chlorine compounds; Available chlorine in various compounds; Chlorine demand; significance, Residual measurement methods, and interferences; Chlorine storage, feeding, and measurements; Hazards and safety requirements for all types of disinfectants Define: Hypochlorous acid, Hydrochloric acid, Hypochlorite ion, Elemental chlorine, chlorine dioxide	CSUS ~Operation of Wastewater Treatment Plants. Vol. 1, 5th Ed. Vol. 2, 6th Ed. Handbook of Chlorination and Alternative Disinfectants, 4th Ed. Or other Chlorination and Disinfection reference material.

SECTION	TOPIC	REFERENCE
Chemistry	Elements; Sulfur Compounds; Definition of an organic compound; hydrogen sulfide gas production; molecular structure of elemental chlorine; chemical symbol for chlorine; chemical name for Cu; chemical of control grease and soap;	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed.; Any Student Chemistry Handbook
Microbiological Quality Control	Bacteria, viruses, and protozoan; Coliform group; occurrence, significance;; Potential waterborne diseases; Microbiological; Organic; Inorganic; Radiological; Mineral; Physical	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5 th Ed.
System Operations	Sewer pipe system - materials, sanitary hazards, Pumps and water pressure; pump characteristics, Pneumatic Diaphragm Pump; Air Bubbler System; Lift Station operation and maintenance, positive displacement vs. centrifugal, calculation of pump output; Define:Static head; 'Suction head; Dynamic head; Instrumentation; Diagnosis of minor electrical problems; Sewer Line Cleaning; Smoke Test; CCTV Inspection; Cross-Connection Contol	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed. http://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html#2
Pretreatment and Industrial Waste	Monitoring and reporting requirements – federal and local; Point source and non-point source contamination; Conventional and priority pollutants; Baseline monitoring; Pollution prevention	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5 th Ed.

SECTION	TOPIC	REFERENCE
Safety	Common hazards; Sanitary hazards; Equipment; Emergencies; Cl ₂ gas safety training, Lock out/Tag out; Confined space entry; Backflow and cross connection control; Confine space procedures; Hazard recognition in Trenching and shoring, ladder and climbing devices, soil types and spoil placement utility location	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5 th Ed. http://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html#2
Mapping	Importance of Mapping; east/west axis; Define types of Maps: grid; master; section; base; block, System map types and use, engineering drawings, stationing, plan and profile;	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol2, 5th Ed. Ch. 12

SECTION	TOPIC	REFERENCE
Introduction to Security concerns	Define: Vulnerability Assessment, Preparedness, Recovery, Mitigation, Detection, Delay and Response, Emergency Response Plan ~ Contingency Plan R18-9-A204	Reference: Water and Wastewater Security Product Guide, "Visual Surveillance Monitoring," USEPA, April 20, 2004 ~ Protecting Your Community's Assets: A Guide for Small Wastewater Systems, NETCSC, Nov. 2002, page 38 ~ Emergency Planning Interactive Guide, Illinois Section American Water Works Association and Midwest Technology Assistance Center, www.isawwa.org (click on "Emergency Planning CD"), Mutual Aid Overview page. ~ Emergency Preparedness U.S.A., FEMA, Unit 1, pages 1-2 ~ Guarding Against Terrorist and Security Threats: Suggested Measures for Drinking Water and Wastewater Utilities, Appendix B of Emergency Response Plan Guidance for Small and Medium Community Water Systems to Comply with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, USEPA, April 7, 2004
Math Concepts	Formulas; Units and conversion factors; Concentrations; Area and Volume; Flow rates and feed rates; Percentage and fractions	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5 th Ed.

REQUIRED RANGE OF KNOWLEDGE – Collection System Operator, Grade 3

Applicants are expected to have mastered all items listed under Grades 1 and 2, and a familiarity with the subjects listed under Grade 3. Must have the ability to make a wide range of water treatment calculations. Well-developed knowledge of national and local drinking water regulations.

SECTION	TOPIC	REFERENCE
Regulatory Knowledge	Pollution prevention; Discharge permits – APP, NPDES, AZPDES; Wastewater Sources – industrial, commercial, domestic, runoff, inflow/infiltration; Clean Water Act - Water Quality Standards; 503 regulations; ADEQ classes of reuse water; Define: facility, On-site operator, on-site representative, sewage; direct responsible charge; operator	Arizona Administrative Code, Title 18, Chapter 4, Articles 1 – 8 and Title 18, Chapter 5, Article 1; Chapter 9, 'R18-9-B204.A.1(A-D); 'R18-5-104.C.E; 'R18-5-107.B and C; 'R18-5-108.A; 'R18-5-114.3; 'R18-9-101; 'R18-9-B201.D.E
Water Reclamation and Reuse	Irrigation; Recharge; Natural reclamation – microstaining, polishing ponds; Distribution and storage; Surface disposal – drainfield, mounds, tile drain, deep well injection, pretreatment; Oxygen starvation (methemoglobinemia) in infants;	Questions to be Added
Disinfection	Purpose of disinfection; Disinfectant types; Characteristics of chlorine and chlorine compounds; Available chlorine in various compounds; Chlorine demand; significance, Residual measurement methods, and interferences; Chlorine storage, feeding, and measurements; Hazards and safety requirements for all types of disinfectants Define: Hypochlorous acid, Hydrochloric acid, Hypochlorite ion, Elemental chlorine, chlorine dioxide	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed. Handbook of Chlorination and Alternative Disinfectants, 4th Ed. Or other Chlorination and Disinfection reference material.
Chemistry	Elements; Compounds; Alkalinity; Hardness; pH; Significance of changes in pH and alkalinity	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed.; Any Student Chemistry Handbook

SECTION	TOPIC	REFERENCE
Microbiological Quality Control	Bacteria, viruses, and protozoan; Coliform group; occurrence, significance;; Potential waterborne diseases; Microbiological; Organic; Inorganic; Radiological; Mineral; Physical	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed.
System Operation	Sewer pipe system - materials; Repairs; Sanitary Hazards, Pumps and water pressure; pump characteristics, operation and maintenance, positive displacement vs. centrifugal, calculation of pump output; types of casings Define Static head; Total Dynamic Head ;meaning significance; Instrumentation; Diagnosis of minor electrical problems; Hydrogen Sulfide control; peaking factor	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5 th Ed. http://www.cheresources.com/centrifugalpumps3.shtml
Pretreatment and Industrial Waste	Monitoring and reporting requirements – federal and local; Point source and non-point source contamination; Conventional and priority pollutants; Baseline monitoring; Pollution prevention	Questions to be Added
Safety	Common hazards; Sanitary hazards; Equipment; Emergencies; Cl2 gas safety training, Lock out/Tag out; Confined space entry; Backflow and cross connection control; Confine space procedures; Hazard recognition in Trenching and shoring, ladder and climbing devices, soil types and spoil placement utility location	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed. http://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html#2
Mapping	Importance of Mapping; east/west axis; Define types of Maps: grid; master; section; base; block, System map types and use, engineering drawings, stationing, plan and profile;	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol2, 5th Ed. Ch. 12

SECTION	TOPIC	REFERENCE
Introduction to Security concerns	Define: Vulnerability Assessment, Preparedness, Recovery, Mitigation, Detection, Delay and Response, Emergency Response Plan ~ Contingency Plan R18-9-A204	Reference: Water and Wastewater Security Product Guide, "Visual Surveillance Monitoring," USEPA, April 20, 2004 ~ Protecting Your Community's Assets: A Guide for Small Wastewater Systems, NETCSC, Nov. 2002, page 38 ~ Emergency Planning Interactive Guide, Illinois Section American Water Works Association and Midwest Technology Assistance Center, www.isawwa.org (click on "Emergency Planning CD"), Mutual Aid Overview page. ~ Emergency Preparedness U.S.A., FEMA, Unit 1, pages 1-2 ~ Guarding Against Terrorist and Security Threats: Suggested Measures for Drinking Water and Wastewater Utilities, Appendix B of Emergency Response Plan Guidance for Small and Medium Community Water Systems to Comply with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, USEPA, April 7, 2004
Math Concepts	Formulas; Units and conversion factors; Concentrations; Area and Volume; Flow rates and feed rates; Percentage and fractions	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed.

REQUIRED RANGE OF KNOWLEDGE – Collection System Operator, Grade 4

Applicants are expected to have mastered all items listed under Grades 1, 2, and 3 plus a practical familiarity with treatment plant design, water utility management, safety, and public health. Must have the ability to make a wide range of water utility calculations. Extensive knowledge of all drinking water regulations.

SECTION	TOPIC	REFERENCE
Regulatory Knowledge	Pollution prevention; Discharge permits – APP, NPDES, AZPDES; Wastewater Sources – industrial, commercial, domestic, runoff, inflow/infiltration; Clean Water Act - Water Quality Standards; 503 regulations; ADEQ classes of reuse water; Define: facility, On-site operator, on-site representative, sewage;	Arizona Administrative Code, Title 18, Chapter 4, Articles 1 – 8 and Title 18, Chapter 5, Article 1; Chapter 9, 'R18-9-B204.A.1(A-D); 'R18-5-104.C.E; 'R18-5-107.B and C; 'R18-5-108.A; 'R18-5-114.1; 'R18-5-116. C; 'R18-9-101; 'R18-9-B201.D.E
Water Reclamation and Reuse	Irrigation; Recharge; Natural reclamation – microstaining, polishing ponds; Distribution and storage; Surface disposal – drainfield, mounds, tile drain, deep well injection, pretreatment; Oxygen starvation (methemoglobinemia) in infants;	Questions to be Added
Disinfection	Purpose of disinfection; Disinfectant types; Characteristics of chlorine and chlorine compounds; Available chlorine in various compounds; Chlorine demand; significance, Residual measurement methods, and interferences; Chlorine storage, feeding, and measurements; Hazards and safety requirements for all types of disinfectants Define: Hypochlorous acid, Hydrochloric acid, Hypochlorite ion, Elemental chlorine, chlorine dioxide	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed.. Handbook of Chlorination and Alternative Disinfectants, 4th Ed. Or other Chlorination and Disinfection reference material.
Chemistry	Elements; Compounds; Alkalinity; Hardness; pH; Significance of changes in pH and alkalinity	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Ch. 6

SECTION	TOPIC	REFERENCE
Microbiological Quality Control	Bacteria, viruses, and protozoan; Coliform group; occurrence, significance;; Potential waterborne diseases; Microbiological; Organic; Inorganic; Radiological; Mineral; Physical	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed.
System Operation	Sewer pipe system - materials, sanitary hazards, Pumps and water pressure; pump characteristics, operation and maintenance, positive displacement vs. centrifugal, calculation of pump output; Static head; meaning significance; Instrumentation; Diagnosis of minor electrical problems	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol 2, 5th Ed. http://www.cheresources.com/centrifugalpumps3.shtml
Pretreatment and Industrial Waste	Monitoring and reporting requirements – federal and local; Point source and non-point source contamination; Conventional and priority pollutants; Baseline monitoring; Pollution prevention	Questions to be Added
Safety	Common hazards; Sanitary hazards; Equipment; Emergencies; Cl2 gas safety training, Lock out/Tag out; Confined space entry; Backflow and cross connection control; Confine space procedures; Hazard recognition in Trenching and shoring, ladder and climbing devices, soil types and spoil placement utility location; Define LEL and UEL.	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th http://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html#2
Mapping	Importance of Mapping; east/west axis; Define types of Maps: grid; master; section; base; block, System map types and use, engineering drawings, stationing, plan and profile;	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol2, 5th Ed. Ch. 12

SECTION	TOPIC	REFERENCE
Introduction to Security concerns	Define: Vulnerability Assessment, Preparedness, Recovery, Mitigation, Detection, Delay and Response, Emergency Response Plan ~ Contingency Plan R18-9-A204	Reference: Water and Wastewater Security Product Guide, "Visual Surveillance Monitoring," USEPA, April 20, 2004 ~ Protecting Your Community's Assets: A Guide for Small Wastewater Systems, NETCSC, Nov. 2002, page 38 ~ Emergency Planning Interactive Guide, Illinois Section American Water Works Association and Midwest Technology Assistance Center, www.isawwa.org (click on "Emergency Planning CD"), Mutual Aid Overview page. ~ Emergency Preparedness U.S.A., FEMA, Unit 1, pages 1-2 ~ Guarding Against Terrorist and Security Threats: Suggested Measures for Drinking Water and Wastewater Utilities, Appendix B of Emergency Response Plan Guidance for Small and Medium Community Water Systems to Comply with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, USEPA, April 7, 2004
Math Concepts	Formulas; Units and conversion factors; Concentrations; Area and Volume; Flow rates and feed rates; Percentage and fractions	CSUC ~Operation and Maintenance of Wastewater Collection Systems Vol. 1, 6 th Ed., Vol2, 5th Ed.