Drinking Water Incident Sampling

Kentucky Department for Environmental Protection
Standard Operating Guideline

May 2011

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Section 1 Scope and Applicability

At the time of this writing, the Kentucky Department for Environmental Protection (DEP) Division of Water (DOW) regulates over four hundred sixty (460) Public Water Systems (PWS), fifty (50) semi-public water systems and seven (7) bottled water facilities. The majority (70%) of the PWS are considered "surface water" systems (source water is a lake, reservoir, river or spring). The remaining PWS (30%) are classified as "groundwater" systems with source water from drilled groundwater wells and, in some cases, abandoned mines.[1]

The Drinking Water Incident Sampling Standard Operating Guideline (SOG)[2] is written to provide basic information regarding site characterization, sample collection, handling, preservation, preparation and analysis. It does not contain an exhaustive review of all necessary protocols, procedures and policies required for sampling and analysis at a drinking water incident. It is intended that the user be able to quickly reference basic safety, sampling and analysis guidelines for a wide variety of incidents affecting potable water supply with footnotes and references leading to more comprehensive protocols and departmental policies. Additionally, it is strongly recommended that this guideline be reviewed annually at a minimum, and at the conclusion of any incident that impacts drinking water in the Commonwealth.

[1] Taken from "*Kentucky Public Water System Statistics*" compiled by Julie Roney in November 2010.
[2] The purpose of this SOG is consistent and complementary with existing DEP policies, procedures and guidelines.

Section 2 Summary of Guideline

The Drinking Water Incident Sampling Standard Operating Guideline (SOG) contains the following sections and elements to assist the user prepare for and conduct sampling at a drinking water incident:

Section 1 *Scope and Applicability*: contains the intended uses for this SOG

Section 2 *Summary of Guideline*: provides a summary of the entire document

Section 3 *Acronyms and Definitions*: includes a listing of common acronyms and definitions for terms typically associated with sampling at a drinking water incident

Section 4 *Health and Safety*: provides an overview of basic health and safety guidelines applicable to drinking water incident sampling. This document does not supersede nor replace DEP employee safety and health program procedures or policies.

Section 5 *Personnel Responsibilities/Qualifications*: identifies certain responsibilities and basic training requirements for employees and supervisors who are or may be involved in conducting sampling at a drinking water incident. A summary of the steps to take for Employee Injury/Accident/Exposure Reporting is also included in this section.

Section 6 *Equipment and Supplies*: includes a brief checklist of sample preparation and collection equipment, field monitoring devices and personal protective equipment. This list can be adapted based on requirements for each specific site.

Section 7 *Standard Operating Guideline*: takes the reader from site characterization, through sample collection, handling, preservation, preparation and analysis, and finally to data management, quality assurance and quality control. Again, emphasis is on providing succinct guidelines for conducting these activities and should be viewed as a supplement to hands-on training and detailed procedures, not a replacement.

Section 8 *References*: compiles all referenced documents, policies and publications throughout the text and footnotes in one location.

Section 9 *Appendices*: contains additional documents developed by DEP that may be useful for conducting sampling at a drinking water incident including the Worksite Hazard Assessment Form, Partial Listing of HAZMAT Teams in Kentucky, DEP Environmental Services Branch Sampling Guidelines, DEP Chain of Custody, Kentucky Drinking Water Certified Laboratory List.

Section 10 *Attachments*: contains additional relevant documents developed external to DEP including reference pages from USEPA publication No. EPA-815-R-05-004 “Manual for the Certification of Laboratories Analyzing Drinking Water”.

Section 3 Acronyms and Definitions

Acronyms

The following list presents some acronyms typically associated with drinking water incidents:

AL	Action level
AOC	Assimilable organic carbon
AWOP	Area-wide Optimization Program
AWWA	American Water Works Association
BAC	Biologically active carbon
BAF	Biologically active filtration
BAT	Best available technology
Br^-	Bromide
BrO_3^-	Bromate
CAA	Clear Air Act
CCP	Composite Correction Program
CCR	Consumer Confidence Report
CD	Capacity Development
CDC	Centers for Disease Control
CFE	Combined filter effluent
CFR	Code of Federal Regulations
ClO_2	Chlorine dioxide
ClO_2^-	Chlorite
CPE	Comprehensive performance evaluation
C-T	Concentration of disinfectant residual multiplied by contact time
CTcalc	CT/log removal as calculated using plant data
$CT_{99.9}$	CT/log removal for a 3-log removal from CT tables
$CT_{99.99}$	CT/log removal for a 4-log removal from CT tables
CTA	Comprehensive Technical Assistance
CWA	Clean Water Act
C (or CWS)	Community water system
D/DBP	Disinfectant and disinfection by-product
D/DBPR	Disinfectant and disinfection by-product rule (Stage 1)
DBP	Disinfection by-product
DEP	Kentucky Department for Environmental Protection
DOC	Dissolved organic carbon
DOW	Kentucky Division of Water
DW	Drinking Water
DW SRF	Drinking water state revolving fund
EBCT	Empty bed contact time
EC	Enhanced coagulation
EDC	Endocrine-disrupting compounds

ERP	Enforcement Response Protocol
EPA	Environmental Protection Agency
EEC	Energy and Environment Cabinet
EPTDS	Entry Point To the Distribution System
ERP	Emergency Response Plan
ERT	Kentucky DEP's Environmental Response Team
ETT	Enforcement targeting tool
GAC	Granular activated carbon
GAC10	Granular activated carbon with an EBCT of 10 minutes and reactivation frequency of 180 days
GAC20	Granular activated carbon with an EBCT of 20 minutes and reactivation frequency of 180 days
GW	Groundwater
GWP	Groundwater Purchaser
GWPP	Groundwater protection plans
GWR	Groundwater Rule
GWUDI	Groundwater under the direct influence (of surface water)
HAA_5	Haloacetic acids (chloroacetic acid, dichloroacetic acid, trichloroacetic acid, bromoacetic acid and dibromoacetic acid)
HAN	Haloacetonitriles
HPC	Heterotrophic plate count
ICR	Information Collection Rule
IDSE	Initial Distribution System Evaluation
IFE	Individual filter effluent
IESWTR	Interim Enhanced Surface Water Treatment Rule
IOC	Inorganic contaminant
KAR	Kentucky Administrative Regulations
KRS	Kentucky Revised Statutes
KPDES	Kentucky Pollution Discharge Elimination System
LCR	Lead and Copper Rule
Log	Logarithm (common, base 10)
LOW	Letter of warning
LRAA	Locational running annual average
LTESWTR	Long Term Enhanced Surface Water Treatment Rule
LT1	Long Term 1 Enhanced Surface Water Treatment Rule
LT2	Long Term 2 Enhanced Surface Water Treatment Rule
M/DBP	Microbial/disinfection by-products
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal
MF	Membrane filtration
ug/L	Micrograms per liter
mg/L	Milligram per liter
MGD	Million gallons per day
MIEX	Magnetic resin (trademark name for a resin specific for DOC removal)

MIOX	Mixed oxidant (disinfectant)
MOR	Monthly operating report
M/R (or M&R)	Monitoring and reporting
MRDL	Maximum residual disinfectant level
MRDLG	Maximum residual disinfectant level goal
MDL	Minimum detection level
MRL	Minimum reporting level
NC (or TNCWS)	Transient, non-community water system
NDWAC	National Drinking Water Advisory Council
NPDWR	National primary drinking water regulations
NSF	National Sanitation Foundation
NTU	Nephelometric turbidity unit
NTNC (or NTNCWS)	Non-transient, non-community water system
NOM	Natural organic matter
NOV	Notice of violation
OSHA	Occupational Safety and Health Act (KOSH in KY)
O_3	Ozone
PAC	Powdered activated carbon
PACl	Polyaluminum chloride (a coagulant)
PBT	Performance-Based Training
PE	Performance evaluation
pCi/liter	Picocuries per liter
PN	Public notification (or public notice)
PODR	Point of diminishing return
ppb	Parts per billion
ppm	Parts per million
ppt	Parts per trillion
PPCP	Pharmaceutical and personal care products
PWS	Public water system
QA	Quality assurance
QC	Quality control
RAA	Running annual average
RMP	Risk Management Plans (for Clean Air Act compliance)
RO	Reverse Osmosis
RT	Routine
RTC	Return to compliance
RP	Repeat
SCADA	System Control and Data Acquisition
SDWA	Safe Drinking Water Act (as amended in 1996)
SDWIS	Safe Drinking Water Information System
SEC	Secondary drinking water contaminants
SNC	Significant non-compliance
SOC	Synthetic organic contaminant
SP	Semi-public water system (KY)
SPAP	Special Appropriations Grant
SRF	State Revolving Loan Fund

SS	Sanitary Survey
Stage 2	Stage 2 Disinfection/Disinfection By-Products Rule
Subpart H	Systems falling under the SWTRs
SUVA	Specific UV absorbance at wavelength 254 (˜m) divided by dissolved organic carbon (mg/L) then multiplied by 100 (with units of L/mg-m)
SW	Surface water
SWP	Surface water purchaser
SWTR	Surface Water Treatment Rule
TA	Technical Assistance
TC	Total coliform(s)
TCR	Total Coliform Rule
THM	Trihalomethane
TNCWS	Transient non-community water system
TOC	Total organic carbon
Treated Water	Considered no later than the combined filter effluent
TT	Treatment technique
TTHM	Total trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane and bromoform)
USGS	United States Geological Survey
UV	Ultraviolet light
UV_{254}	Ultraviolet wavelength at 254 nanometers (˜m)
VA	Vulnerablitity Assessment
VOC	Volatile Organic Compound
WEA	Water Environment Association
WHPA	Wellhead Protection Area
WHPP	Wellhead protection plan
WQP	Water quality parameters
WTP	Water treatment plant

Definitions

The following list presents some definitions typically associated with drinking water incidents:

Bottled Water System: (401 KAR 8:010) means a public water system that provides bottled drinking water and includes the sources of water, and treatment, storage, bottling, manufacturing, or distribution facilities. The term excludes:
(a) A public water system that provides only a source of water supply for a bottled water system; and
(b) An entity providing only transportation, distribution, or sale of bottled water in sealed bottles or other sealed containers.

Consumer Advisory: (401 KAR 8:010) means a notice to the consuming public through radio, television, direct mail, electronic mail, posting, newspaper, or other media to convey in the quickest and most effective manner possible:
(a) Information that water provided by a system may cause adverse human health effects if consumed and what action the public is advised to take; or
(b) Other information that the public needs to know about its water.

One specific type of Consumer Advisory is a
Boil Water Advisory: provides notice to the consuming public:
(a) Information that water provided by a system may cause adverse human health effects due to possible biological contamination if consumed, unless it is first boiled for three (3) minutes at a rolling boil; and
(b) What action the public is advised to take.

Hazardous Substances: (KRS 224.01-400) means any substance or combination of substances including wastes of a solid, liquid, gaseous, or semi-solid form which, because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, or pose a substantial present or potential hazard to human health or the environment. The substances may include but are not limited to those which are, according to criteria established by the cabinet, toxic, corrosive, ignitable, irritants, strong sensitizers, or explosive, except that the term "hazardous substance" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under this section, and shall not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel, or mixtures of natural gas and synthetic gas.

Public Water System [PWS]: (40 CFR 141.2 incorporated by reference in 401 KAR 8:020) means a system for the provision to the public of water for human consumption through pipes or, after August 5, 1998, other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Such term includes: any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system; and any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. Such term does not include any ‘‘special irrigation district.’’ A public water system is either a ‘‘community water system’’ or a ‘‘noncommunity water system.’’

Community Water System: (40 CFR 141.2 incorporated by reference in 401 KAR 8:020) means a PWS which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Non-community Water System: [NCWS] (adapted from 40 CFR 141.2 incorporated by reference in 401 KAR 8:020) means one of two designations:

Non-Transient: means a NCWS that regularly serves at least 25 of the same persons over 6 months of the year.
Transient: means a NCWS that does not regularly serve at least 25 of the same persons over 6 months of the year.

Semipublic Water System: (401 KAR 8:020) means a water system made available for drinking or domestic use that does not qualify as a private or public water system. *(Note – KDOW classification as water systems that include more than 3 residences but less than the PWS designated number of service connections or population served)*

Surface Water Source: (401 KAR 8:010) means ponds, reservoirs, streams of all sizes, free-flowing springs, a source of water supply for a public water system that has a free water surface exposed to the atmosphere, or groundwater under the direct influence of surface water.

Section 4 Health and Safety[3]

Human Health[4]

All field staff should be trained in 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER), Cardiopulmonary Resuscitation (CPR), First Aid and Bloodborne Pathogens in accordance with DEP Policy SSE-711. Field staff working in and around potentially contaminated surface waters should receive immunization shot for Hepatitis A in accordance with DEP Policy SSE-708. In addition, staff should receive immunization for Hepatitis B and tetanus, to aid in the prevention of contracting those pathogens.

The use of personal protective equipment (PPE) shall be used when collecting surface water samples in response to emergency conditions. All field staff should review "DEPs Personal Protective Equipment Program" document located at the following intranet website: http://eppcintra.ky.gov/EEC/dep/depsafety

The following items are examples of PPE that may be used during sampling:

- Personal flotation device – when working from a boat, steep bank or bridge
- Hard hat – when overhead hazards exist or heavy equipment is present
- Steel-toed boots – when working from a bridge or from the bank
- Eye protection
- Powderless latex or nitrile gloves
- Neoprene gloves – in cold water
- Appropriate outdoor clothing for existing and potential weather conditions

Job Specific Training[5]

Each employee will be individually trained by his/her supervisor, or designee, to perform assigned job tasks safely. Each employee will be trained in the safety aspects of assigned tasks by the subject matter expert prior to his/her performing the task. Supervisors will document all training provided. Supervisors should use the following methods to increase employee comprehension:

[3] Section 4 *Health and Safety* information is adapted from Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2) and associated DEP policy documents.
[4] Section 4 *Human Health* is excerpted from Kentucky Department for Environmental Protection *Standard Operating Procedures – The Collection of Surface Water Samples from Flowing Systems during Emergency Response Conditions* – April 15, 2011 (Revision No.1) pp. 9-12 and associated DEP policy documents.
[5] Section 4 *Job Specific Training* is excerpted from Kentucky Department for Environmental Protection *Standard Operating Procedures – The Collection of Surface Water Samples from Flowing Systems during Emergency Response Conditions* – April 15, 2011 (Revision No.1) pp. 9-12 and associated DEP policy documents.

- Employees will receive verbal instructions and specific directions on how to perform functions safely.
- Employees will receive a demonstration of job tasks, using known safe work practices.
- Supervisors, or designee, will observe employees performing the work previously demonstrated. If necessary, remedial instruction will be provided to correct training deficiencies prior to final release to perform unsupervised work.
- Employees will be given safe operating instructions prior to the use and operation of new equipment or processes.
- Supervisors shall be responsible for reviewing safe work practices with employees before permitting new, non-routine, or specialized procedures to be performed.
- General Safety Rules and Procedures: Supervisors will make employees aware of Kentucky DEP rules, policies, and procedures.
- All emergency responders will carry a cell phone with them to ensure that communication between supervisor and responder can be maintained.

Additional General Safety Considerations[6]

Field staff collecting samples for a drinking water incident should also reference additional DEP guidance, policies and procedures including:

- Boat Safety Training (OSHA Act of 1970)
- Bridge Sampling Safety
- Bank Sampling Safety
- Heat and Cold Stress
- Site-specific safety guidelines at drinking water facility/distribution systems

[6] Section 4 *Additional General Safety Considerations* is excerpted from Kentucky Department for Environmental Protection *Standard Operating Procedures – The Collection of Surface Water Samples from Flowing Systems during Emergency Response Conditions* – April 15, 2011 (Revision No.1) pp. 9-12 and associated DEP policy documents.

Section 5 Personnel Responsibilities/ Requirements

Employee Responsibilities[7]

DEP will provide safety training and personal protective equipment to all employees as required by 101 KAR 2:150. It is the responsibility of each employee to take all necessary precautions to protect themselves and others from any safety or health hazards. The DEP Employee Safety and Health Program will provide training through in-house sources and outside contractors. Training resources are also available on the DEP Safety Webpage at: **http://eecintra.eppc.pri/DEP/HS/default.aspx**. Employees shall review and follow all safety and health guidelines, including the following brief excerpts:

- Report all unsafe conditions and/or unsafe acts to your supervisor
- Make safety your primary responsibility in performing job duties.
- Be individually responsible to keep themselves, other employees, and equipment free from mishap.
- Obey all Commonwealth of Kentucky and DEP safety rules, regulations and procedures.
- If any doubt exists about the safety of performing any task, stop the task immediately and get instructions from the supervisor before continuing work.
- Report all injuries, no matter how minor, and all near misses immediately following the incident. (See Employee Injury/Accident/Exposure Reporting below)
- Be aware of how and where to obtain required medical assistance.
- Always wear required Personal Protective Equipment (PPE) and know its limitations.
- Be able to recognize hazards pertinent to the employees' specific job.

Employee Requirements[8]

All employees that are required to work in the field environment as part of their job duties are required to complete and maintain the following:

- 40-hour HAZWOPER training class with an annual 8-hour refresher class (OSHA Standard 29 CFR 1910.120 and Policy # PER-418)
- CPR, First-Aid and Bloodborne Pathogens classes (OSHA Standard 29 CFR 1910.151/1910.1030 and DEP Policy # SSE-711)
- Worksite Hazard Assessment training (OSHA Standard 29 CFR 1910.120 and DEP Policy # SSE-711)

[7] Section 5 *Employee Responsibilities* is excerpted from Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2) and associated DEP policy documents.
[8] Section 5 *Employee Requirements* is excerpted from Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2) pp. 9-22 and associated DEP policy documents.

Employees will be informed by their supervisor of additional safety and health training they are required to complete. A full listing of safety and health training classes offered to DEP employees is available in the DEP *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2).

Supervisor Responsibilities[9]

The Supervisor is responsible for the safety of employees under his/her direction and the safe operation of machines and equipment within his/her area. Supervisors shall review and follow all safety and health guidelines, including the following brief excerpts:

- Assume responsibility for safe and healthful working conditions for employees.
- Ensure full compliance with all safety rules and procedures.
- Ensure that each employee is fully trained for each task he/she is assigned and ensure he/she is familiar with published safety rules and procedures applicable to each task.
- Halt operations/activities in which an imminently dangerous condition exists.
- Remove employees from jobs when they are not wearing or using prescribed Personal Protective Equipment (PPE).
- Instruct all employees on the reporting procedures for all accidents and the necessity of receiving first aid treatment even in the case of minor injury.
- Complete First Injury Accident Reports and Kentucky Accident Reports when applicable (see Section C). Forward all documentation related to the incident to the division safety officer, the DEP safety administrator, appropriate representatives within EEC, and the Workers Compensation Branch of the Personnel Cabinet at the following address:

  Workers Compensation Branch, Personnel Cabinet
  State Office Building, 3rd Floor, Frankfort, KY 40601
  Phone: 502-564-6847 or 888-860-0302, Fax: 502-564-9119.

Supervisor Requirements[10]

The supervisor will inform each assigned employee of the types of safety and health training classes necessary to satisfy Kentucky Occupational Safety and Health (KOSH) and federal Occupational Safety and Health Administration (OSHA) requirements. The division safety officer will coordinate with their division's supervisors the types of training programs required for each position under the supervisor's direction. The DEP safety administrator will coordinate with each division safety officer the requirements that have been mandated by federal and State Agencies and the DEP. The DEP Commissioner directs the safety administrator to coordinate the DEP Employee Safety and Health Program.

[9] Section 5 *Supervisor Responsibilities* is excerpted from Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2) pp. 7-8 and associated DEP policy documents.
[10] Section 5 *Supervisor Requirements* is excerpted from Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2) pp. 9-22 and associated DEP policy documents.

Employee Injury/Accident/Exposure Reporting[11]

All DEP employees shall report immediately any injury, accident or exposure incident that occurs, regardless of how minor the incident may seem at the time.

The employee must complete the First Report of Injury and Illness Form (IA-1) and the Accident Investigation Form and submit this documentation to their supervisor immediately. Both forms are located on the DEP Health and Safety SharePoint site at **http://eecintra.eppc.pri/DEP/HS/default.aspx.**

The supervisor, upon receiving notification, shall immediately report any incident to the Kentucky Personnel Cabinet by completing certain forms online or by calling the Workers Compensation Branch at (502) 564-6847 or (888) 860-0302. A fax copy of the IA-1 report is acceptable to meet this timeline requirement and the Workers Compensation Branch fax number is (502) 564-9119. The supervisor shall then have 48 hours to forward all reports to the division safety officer and the department safety administrator.

[11] Section 5 *Employee Injury/Accident/Exposure Reporting* is excerpted from Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2) pg. 26.

Section 6 Equipment and Supplies

Action Item: Sample Preparation and Collection Equipment

The following checklist indicates minimum requirements for this activity. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident. Tasks may be delegated to staff as appropriate.

Field Resource Documents

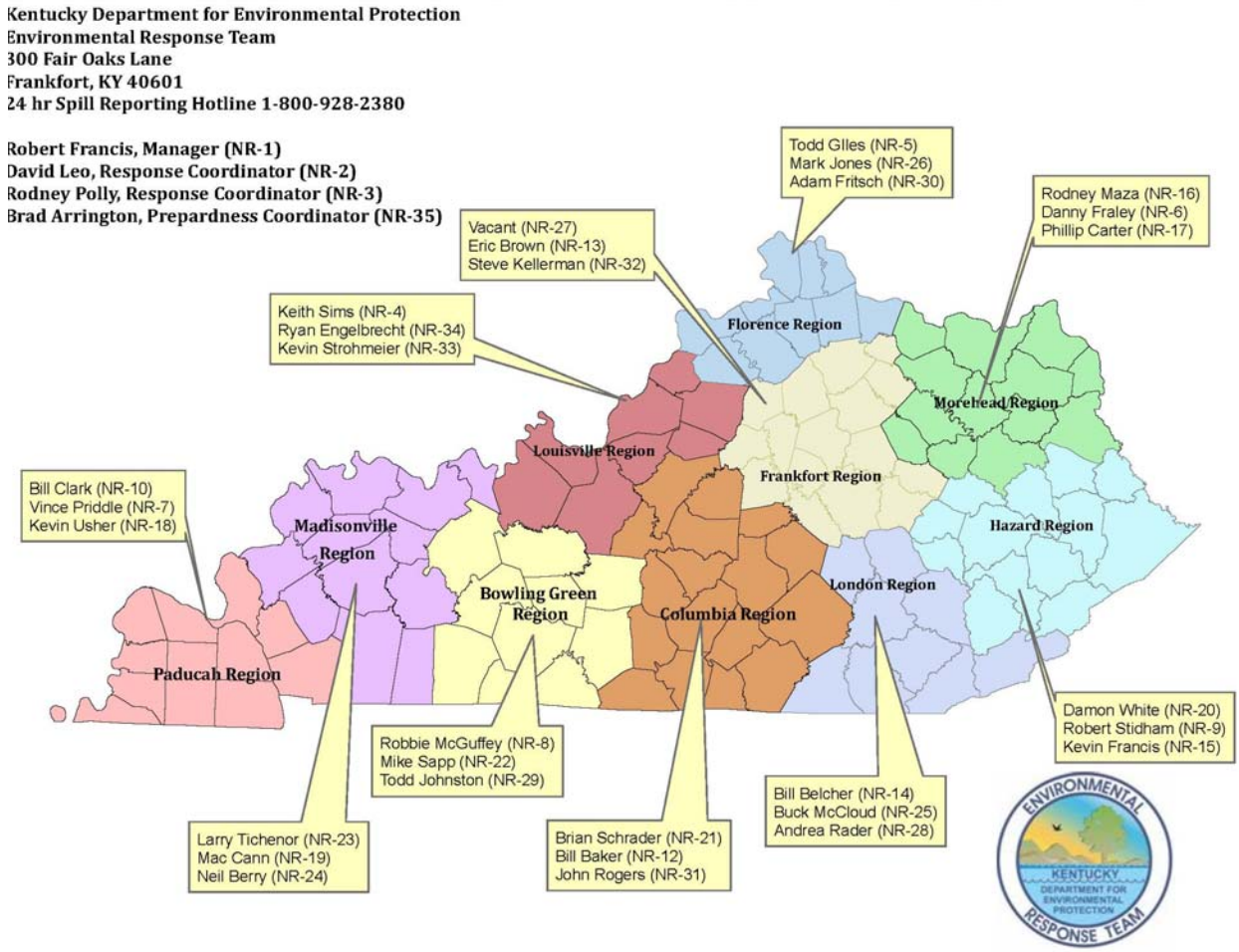
- ❒ Field sampling guidance documents, field logbook
- ❒ Site-specific health and safety plan (if required)
- ❒ Sample documentation forms, sample labels, permanent marker (eg. Sharpie)
- ❒ Chain of Custody Materials (custody tape or seals, chain of custody forms)

General Sampling Supplies

- ❒ Sample containers (refer to Appendix C *Environmental Services Branch Sampling Guidelines*)
  - Device for grab sampling
  - 10 liter HDPE container, miscellaneous glassware
  - Rigid shipping container (cooler)
  - 1 qt. zippered freezer bags
  - Provisions for ice (if needed)
- ❒ Pathogen Sampling Supplies
  - 120 ml HDPE Sterile container with 10 mg Sodium Thiosulfate tablet
  - Tubing/clamp/stopwatch/ graduated cylinder (if needed)
  - Ultrafiltration apparatus (if needed)
- ❒ Monitoring and Field Screening Supplies
  - pH probe/pH paper in ranges from 0 - 4 and 10 - 14
  - Pocket colorimeter
  - Turbidity meter, multimeter, etc.
- ❒ Reagents (refer to Appendix C *Environmental Services Branch Sampling Guidelines*)
  - Laboratory grade water
  - Sodium thiosulfate crystals
  - Ascorbic acid
  - Sodium sulfite crystals
  - Potassium dihydrogen citrate
  - Sulfuric Acid (H2SO4)
  - 6 Molar ACS grade hydrochloric acid (HCl)
  - 6 Molar trace metal-grade nitric acid (HNO3)
  - 10 Normal Sodium hydroxide (NaOH)
  - pH paper in ranges from 0 - 4 and 10 - 14
- ❒ Safety Supplies/Personnel Protective Equipment
  - Protective eyewear (eg. splash resistant goggles)
  - Disposable gloves and boot covers
  - Appropriate clothing covers (Tyvec, Saranex, etc)
- ❒ General Supplies
  - Global Positioning System (GPS), camera/video
  - Flashlight/headlamp
  - First aid kit
  - Clear, heavy duty plastic trash bags

Section 7 Standard Operating Guidelines

Figure 1
Kentucky Department for Environmental Protection
Environmental Response Team Regional Map



7.1 Site Characterization

Site characterization is the first step in field operations where responders define the nature and magnitude of threats to potable water supply posed by contamination. These threats could include release of hazardous substances[12], radiological materials or petroleum products. Characterization activities include site investigation and documentation, field screening, collection and analysis of samples. Sampling associated with site characterization will be covered in a subsequent section. To determine if a threat is credible, DEP will need physical evidence to identify/categorize the potential contaminant involved and determine the risks in terms of public health. A Hazardous Material (HAZMAT) response team may be needed to provide trained personnel and equipment to safely identify and deal with the threat. While many HAZMAT teams provide site characterization capabilities, some threats will require advanced knowledge, skill, and abilities available through specialized personnel. A Site Characterization Team may require responders from the water utility, environmental response teams of government agencies, public health officials, state and federal criminal investigators, the Kentucky National Guard Civil Support Team, and others. Field personnel involved in site characterization activities should meet all necessary safety and training requirements outlined in OSHA 29 CFR 1910.120 (http://www.osha.gov) that deal with hazardous waste and incident response operations.

DEP employees working in the field are required to obtain training in relation to completing the DEP Worksite Hazard Assessment[13] per the OSHA and DEP Policy #SSE-712.[14] Additional DEP requirements include:

1) A qualified person, as outlined in Section 5 *Employee Responsibilities/Requirements*, shall evaluate site characteristics prior to site entry. Immediately after initial entry, a more detailed evaluation shall be performed to further aid in the selection of appropriate engineering controls and Personal Protective Equipment (PPE) for the tasks to be performed.
2) All suspected conditions that may pose hazards Immediately Dangerous to Life or Health (IDLH) or other conditions that may cause death or serious harm shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.

[12] Hazardous substances as defined by Kentucky Revised Statutes (KRS) 224.01-400 *Reportable quantities and release notification requirements for hazardous substances, pollutants, or contaminants -- Variation of requirements by administrative regulations -- Emergency plan -- Powers of cabinet -- Remedial action to restore environment -- Lien of cabinet for costs of cleanup -- Liability of financial institution acquiring property or serving as fiduciary.*
[13] The DEP Worksite Hazard Assessment form is included as an Appendix and found in the Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2) pp. 23-24 and is presented in Appendix B.
[14] Section 7.1 *Site Characterization* reference to Worksite Hazard Assessment is adapted from Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2) pp. 21-22 and associated DEP policy documents.

3) The following information, to the extent available, shall be obtained by the employer prior to allowing employees to enter a site:

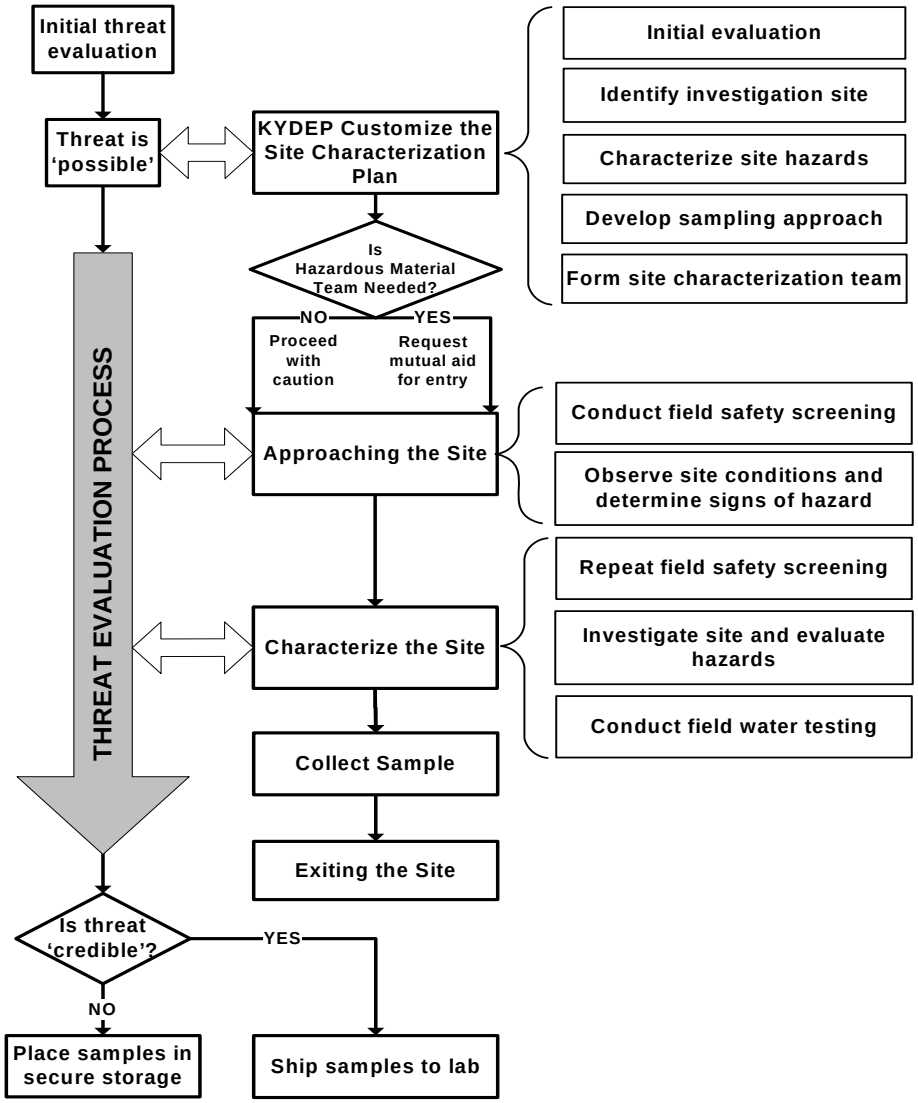
- Location and approximate size of the site.
- Description of the response activity and/or the job task to be performed.
- Duration of the planned employee activity.
- Site topography and accessibility by air and roads.
- Safety and health hazards expected at the site.
- Pathways for hazardous substance dispersion.
- Present status and capabilities of emergency response teams that would provide assistance to on-site employees at the time of an emergency.
- Hazardous substances and health hazards involved or expected at the site and their chemical and physical properties.

Site Investigation

Prior to entry, the Site Characterization Team should develop a site-specific entry plan for investigating and characterization the threat. While each threat and incident type will vary, general site characterization plans should be developed to address personnel safety and entry activities even if done verbally. Specific challenges presented by sample collection should also be addressed to the degree possible. With these objectives in mind, the site characterization plan should contain the following five elements:

1) Hazard Evaluation (including pre-entry assessment and evaluation during entry)
2) Site Approach/Ingress
3) Site Characterization (gather information and document activities)
4) Sample Collection
5) Site Exit/Egress

Figure 2[15]
Sample Thought Process



The Incident Commander and/or Sample Team Leader manage site characterization and sampling activities. The Site Characterization Team—in coordination with the appropriate law enforcement entity—carries out the investigation. Utility representatives will remain involved, but their role may change as the investigation develops. The first step in developing a site-specific characterization plan is to determine if the site is safe to enter. This is done through the initial hazard assessment before entry is initiated. The

[15] *Sample Thought Process* diagram is adapted from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents* Module 3: Site Characterization and Sampling Guide – pg. 14. December 2003.

Incident Commander should develop the initial hazard assessment using all available information and the initial threat evaluation. A decision is made regarding the potential need for specialized hazardous material handling techniques or equipment to promote safety and effectively characterize the site. As the Incident Commander develops more information from the site characterization and sampling, the initial hazard assessment may need to be revised. The following are broad categories of potential hazards:

Radiological Hazards

Radiological isotopes or emitters are identified at the site or in the water through the use of a field radiation detector. Other sources of information, including law enforcement intelligence, containers or packaging at the site, may indicate the presence of radionuclides. The difficulty in responding to a nuclear or radiological incident is compounded by needs to identify the type of radiation. Emissions may occur as charged alpha or beta particles, neutral neutrons, or high-energy gamma rays. In addition, involvement of radioactive materials in explosions may not be obvious, depending on the type explosive device used. Radiological sampling methods are not covered in this guidance document and should not be conducted without direct oversight of an experienced health physicist. Refer to Section 7.2 *Collecting Samples for Suspected Radiological Contamination*.

Chemical Hazards

Hazardous chemicals, including toxic industrial chemicals (TIC) and chemical warfare agents (CWA), can be introduced via aerosol devices (including munitions, sprayers, aerosol generators, etc.), container failure, and by more covert dissemination techniques. An agent attack involving CWAs (such as a nerve or blister agent) or TIC will likely have serious consequences. Different chemical agents can be persistent or non-persistent. Persistent agents remain in the affected area for hours, days, or weeks. Non-persistent agents are volatile, have high evaporation rates, are generally lighter than air, and disperse more rapidly. Their ability to cause harm is drastically reduced after a few minutes, although they may persist longer in small unventilated areas. Refer to Section 7.2 *Collecting Samples for Suspected Chemical Contamination*.

Biological Hazards

The presence of pathogens may be identified at the site or in water. Living organisms or materials derived from them cause disease and may be harmful to humans, animals, and/or plants. Recognition of biological hazards may occur by: (1) discovering bioterrorism evidence (i.e., devices, agents, clandestine labs), (2) isolating the organism/toxin or metabolites related to an agent, (3) public health surveillance data, or (4) routine water testing. Refer to Section 7.2 *Collecting Samples for Suspected Biological Contamination*.

Explosive and Incendiary Device Hazards

The presence of explosive materials may be identified at the site's infrastructure. Hazmat may be dispersed during an explosion or subsequent fire regardless of whether the incident was accidental or terrorism-based. Hazmat responders should be aware of the hazards to themselves and to the public as well as clues to the origin of the event. Explosive materials are not covered in this guidance document.

Petroleum Products

Petroleum products are usually readily identifiable, especially in surface water sources, but can also turn up as unpleasant odors or taste in finished water. Releases, other than the aforementioned visible spills on surface water, can lead to in-depth investigations to identify the source(s) of contamination. These investigations can eclipse water testing and extend into sediments, soils, benthic organisms and/or biota. Refer to Section 7.2 *Collecting Samples for Suspected Petroleum Contamination*.

Low Hazard Contaminants

There are no obvious signs of radiological, chemical, or biological contaminants in the air or on surfaces on site. Contaminants that may be present in the water are assumed to be dilute and confined to the water.

The following Hazard Evaluation Flow Chart for Unknowns and the Action Item Checklist are designed to be informative for DEP representatives responding to drinking water contamination emergencies:

Figure 4
Hazard Evaluation Flow Chart for Unknowns

Insert Appropriate Logo Here

Hazard Evaluation Flow Chart for Unknowns

Early Considerations!
Approach uphill/upwind/upstream—Evaluate the scene and situation—Delineate the Hotzone (wind direction and intensity)—Evacuate and/or protect in-place—Isolate the scene—Collect intelligence—Document signs and symptoms of victims—Disable power supply and HVAC—Use local bomb squad to evaluated potential explosives—Use radiation meter during entry—Follow H&S Plan, Sampling Plan, and Decontamination Procedures for personnel/samples/containers/equipment—Consult IC and law enforcement on response actions.

Calibrate instruments/Collect background readings

Team dons Level A or B PPE (Consult with H&S Manager)

Team enters hot zone (Photo/video documentation)

Gas/Vapor	Liquid/Solid
1st Entry: CGI/O_2*, Radiation Meter, PID/FID, AP2Ce or CAM, MultiRAE or Multiwarn (CGI/O_2, CN, CO, HF, Cl_2, NH_3, H_2S, PID)	**1st Entry**: CGI/O_2*, Radiation Meter, PID/FID, MultiRAE or MultiWARN, pH Paper, Spilfyter, Smart-Strip, AP2Ce or CAM, M8/M9 Paper
2nd Entry: Drager CMS/Tubes, SAM 935, MultiRAE or Multiwarn, GasID FTIR or Travel IR, PID/FID, Drager CDS, SPM, Chemical-Specific Detectors, Digital Camera ***Collect Samples As Appropriate***	**2nd Entry**: Drager CMS/Tubes, M-256 Kit, SAM 935, Ratemeter w/ Pancake Probe, First Defender, MultiRAE or Multiwarn, HazmatID FTIR, Drager CDS, Digital Camera ***Collect Samples As Appropriate***
Additional Monitoring: Portable GC/MS, Particulate Monitor (RAM), Area RAE, Single-Gas Detectors based on results of 1st Entry	**Additional Monitoring**: Portable GCMS, PCR, BioCapture, Industrial Chemical Field Tests based on results of 1st Entry

*** Use intrinsically safe equipment in potentially explosive atmospheres.**

Combustible Atmosphere and Oxygen
O_2 Normally 20.8%

CGI> 10% LEL
O_2<19.5% or O_2>23.5%

STOP!
Exit Hot Zone or Reevaluate Before Proceeeding

Radiological
Radiation Background Normally 5-15µR/hr

>0.1 mR/hr
>100 µR/hr
Continuous ambient reading

STOP!
Tech Support
Consult EPA RERT
Consult DOE RAP
Continue Operations with Monitoring

>2 mR/hr
>2,000 µR/hr

STOP!
Exit Hot Zone
Await Arrival of State/ Federal Health Physicist

Chemical
Chemical Agents Tests

(POS)
If not in level A, exit and don level A

(NEG)

Biological
Potential Biological Agent

Re-assess situation and send to appropriate lab

(POS) Biological Potential
(POS) Chemical Agents

Industrial Chemical Field Tests

(NEG)
(POS)

Biological Unlikely
(POS) Chemical Agents

(NEG) Biological
(NEG) Chemical Agents
(POS) Industrial Chemical tests

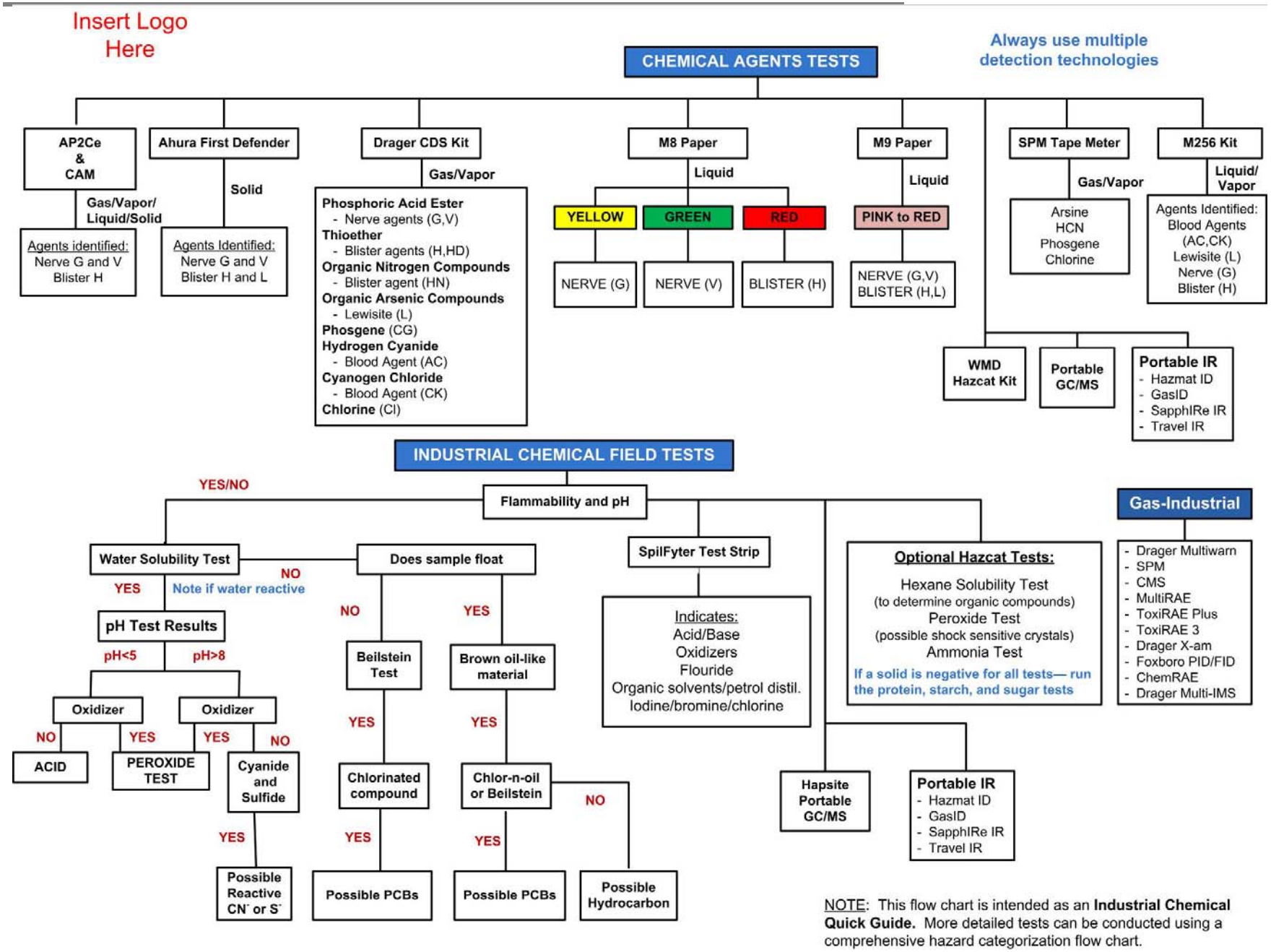
(POS) Biological
(NEG) Chemical Agents

Send to Chemical Agent Lab

Send to commercial chemical lab

Send to Biological Lab

Source: Adapted from the U.S Environmental Protection Agency's Hazard Evaluation Flow Chart for Unknowns
Notes: 1. If the situation is suspicious send samples to the biological lab.
2. Send to laboratory if radiation is less than 3 times background. If above, consult with lab prior to shipping.



NOTE: This flow chart is intended as an **Industrial Chemical Quick Guide.** More detailed tests can be conducted using a comprehensive hazard categorization flow chart.

Action Item: Establish Incident Command

The following checklist indicates minimum requirements for this activity. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident. Tasks may be delegated to staff as appropriate.

Incident Command and Scene Security:

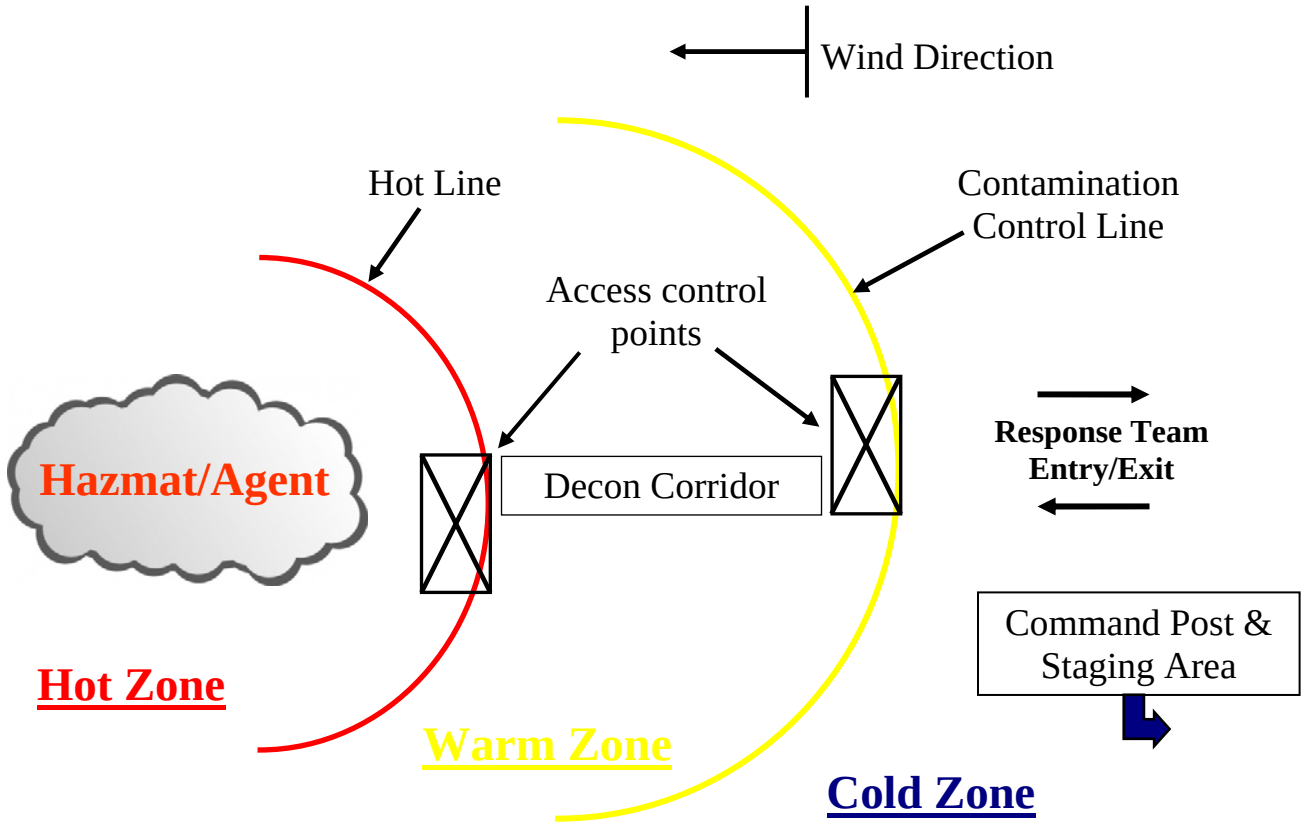
- ❒ Identify incident commander.
  Incident Commander: _____
- ❒ Establish an Incident Command Post uphill/upwind/upstream and fully implement the Incident Command System (ICS).
- ❒ Initiate Incident Action Plan: ICS Forms 202, 203, 204, 205, 205, and 207
- ❒ Isolate the scene, mark hazard zones, and deny entry to all unauthorized personnel, vehicles, and equipment.
- ❒ Notify appropriate emergency response agencies:
  - Fire agencies.
  - EMS units (ambulances).
  - Area hospitals.
  - Law enforcement including local police/sheriff, Kentucky State Police, US EPA Criminal Investigative Division (CID) and/or Federal Bureau of Investigations (FBI).
  - Emergency management including local city and/or County agency and Kentucky Division of Emergency Management.
  - Environmental health/management including local city and/or County agency and Kentucky Department for Public Health.
  - Hazardous materials response teams including KY State Police Hazardous Devices Unit, EPA Region IV, and 41st Civil Support Team.
- ❒ Designate an Environmental Sampling Unit Leader to initiate site characterization.

The initial hazard assessment is important for determining composition of the Site Characterization Team, because the team should have the skills, experience, and equipment needed to deal with all on-site hazards. If the site appears to be a Low Hazard site, water utility staff or DEP representatives may perform site characterization duties. If there are clear signs of greater hazards (radiological, chemical, or biological hazard), response professionals trained in specialized techniques may be required. On a case by case basis, dilute concentrations of certain contaminants may be sampled by qualified DEP personnel. Refer to the list of specialized teams in Appendix A of this guidance document.

Establish Site Control

One initial step is to define the perimeter of the site before larger response operations begin. The site should be marked using incident control zones based on the degree of exposure/contamination that will be permitted for responders. The three most commonly used are the Exclusion Zone (Hot Zone); Contamination Reduction Zone (Warm Zone); and Support Zone (Cold Zone). The following figure illustrates a typical control zone configuration for hazmat incident response.

Figure 5
Incident Control Zones



The size and configuration of the control zones are not static and must be constantly re-evaluated based site conditions. Change in environmental conditions can affect the behavior of the release and require reconfiguration of control zones. Any significant changes in the release (e.g., rate, appearance, phase changes, sound, etc.) or site conditions (e.g., wind direction/intensity, precipitation, etc.) should be reported to all responders on site. Any affects on response operations should be evaluated by incident managers and addressed immediately.

Action Item: Establish Site Control

The following checklist indicates minimum requirements for this activity. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident. Tasks may be delegated to staff as appropriate.

Establish Control Zones:

- ❒ Secure the scene.
- ❒ Ensure that a Health and Safety Plan is in place.

- ❒ Identify location(s) and route(s) to medical treatment center(s).
- ❒ Ensure the safety and requisite control of emergency services personnel and operations.
- ❒ Clearly delineate control zones with signage and physical barriers (if available).
- ❒ Prevent personnel, vehicles, and other resources from entering potentially hazardous areas.
- ❒ Initiate site credentialing at access control points.

Crime Scene Preservation

In the event there is substantial evidence of deliberate acts to contaminate the site, the threat will likely be deemed credible by utility manages and law enforcement. In this case, law enforcement may take control of the site and limit on-site activities performed by other organizations. Substantial physical evidence of intentional contamination might include discarded PPE, equipment (i.e., pumps, hoses, out of place tools, etc.), and emptied containers. Special care should be taken to avoid moving or disturbing any potential evidence. Water sampling activities may precede collection of physical evidence; however, care must be taken not to disturb the crime scene while performing these activities. If samples can be collected from outside the boundaries of the suspected crime scene, concerns about the crime scene's integrity may be avoided. Photographs and videos, and associated written logs of each, should be taken during the site characterization for use in later criminal investigations. Law enforcement should be consulted on procedures for proper site documentation—including sampling procedures—to ensure validity of the evidence collected and preservation of the crime scene.

Initial Screening and Monitoring

The first step in selecting monitoring and detection equipment is to gather information about the release. Observations of the physical state (e.g., gas, liquid, solid, or vapor), container type/size, sign/symptoms of victims, and the materials behavior and general appearance may be important. These factors will help determine required equipment and sampling strategies for the incident.

Action levels for hazardous substances detected differ according to potential harm of those substances. Reference materials should be used to identify action levels for the hazmat/agent of concern. Action levels typically include Occupational Safety and Health Administration (OSHA) Permissible Exposure Levels (PEL), National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Levels (REL), and the American Conference of Governmental Industrial Hygienist's (ACGIH) Threshold Limit Values (TLV) and immediately dangerous to life or health (IDLH) concentrations.

Action Item: Initial Screening and Monitoring

The following checklist indicates minimum requirements for this activity. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident. Tasks may be delegated to staff as appropriate.

Scene Approach:

- ❒ Approach incident location from an upwind, uphill, and/or upstream direction.
- ❒ Position vehicle heading away from the incident location.
- ❒ Assign duties to site personnel.
- ❒ Begin air monitoring on arrival, including screens for radioactivity and volatile organic chemicals. This includes identifying results from any air monitoring conducted before your arrival.
- ❒ From a safe distance, identify the material involved if possible.
- ❒ Establish control zones (isolate area and deny entry).
- ❒ Select appropriate personal protective equipment (PPE).
- ❒ Identify and test/review communications to be used (radio, cell phone, hand signals, etc.).
- ❒ Set up decontamination corridor.
- ❒ Enter incident area slowly. Do not exceed three feet per second.
- ❒ Continually monitor Cold Zone to ensure safe environment.

Initial Assessment:

- ❒ Evaluate the incident from a safe distance.
- ❒ Consider all containers and released products (including smoke) as a hazardous material until positively identified as non-hazardous.
- ❒ Avoid contact with product (puddles, vapors/smoke, residue).
- ❒ Identify the type of incident, e.g., what conditions exist?
    - Fire
    - Spilled material
    - Water contamination
    - Vapor, mist, smoke
    - Unusual odor
    - Containers
- ❒ Conduct initial Air Monitoring in order to:
    - Aid in the selection of appropriate PPE
    - Aid in the determination of control zones
    - Assist with the identification of unknown hazards
- ❒ Decisions shall be based upon the following table of Air Monitoring Action Levels:

Table 1
Air Monitoring Action Levels

Type Monitoring	Responder Protective Action Level	Public Protection Action	Possible Actions
pH of vapors in air	Acidic or Alkaline	Acidic or Alkaline	• Responders: Consider the need for Level A PPE based upon operational conditions. • Public: evacuate or in-place shelter to avoid exposures.
Radiation	3X background indicates radioactive material. Establish hot zone at this level.	General public should be maintained below 2 mrem/hr and 100 mrem total dose. (Source: CDC Radiation Safety Manual)	• Employ time, distance, and shielding. FEMA recommends 25 REM maximum single dose for emergency response. • Do not exceed 2 mrem/hr and 100 mrem total dose unless life saving benefit warrants the FEMA-recommended 25 REM exposure.
Oxygen	19.5 % or less (Deficient) 23.5 % or higher (Enriched)	Same as responder	• For both action levels, consider appropriate ventilation measures in order to achieve normal concentrations. • If ventilation is ineffective, continue to use SCBA or supplied air respirators. • If enriched: Presence of combustibles will create significant fire hazards. Take appropriate safety measures.
Flammability	Enclosed or confined area: 10% of the LEL Open outside area: 20% of the LEL Note: If inversion conditions exist at or near ground level, use 10% LEL	Members of the public should be maintained outside of any detectable concentrations.	• Personnel should not operate within these action levels. Outdoor leak control operations may occur if all ignition sources have been controlled and continuous perimeter air monitoring is conducted. • If in an enclosed or confined area, consider ventilation by appropriate means. Consider controlling the source of the release or suppressing the vapors from liquids with AFFF/ATC foam. • Control ignition sources.
Toxicity	10% of the NIOSH-established IDLH Maintain exposures below the TWA through the use of engineering, administrative, and PPE control measures.	Time Weighted Average General public with pre-existing medical conditions may need to be maintained at lower concentrations.	• Ensure all personnel are in appropriate PPE to ensure exposures are maintained below the appropriate Time Weighted Average. • 10% of the IDLH shall be considered an indicator that an IDLH environment does exist and therefore, appropriate IDLH measures shall be taken.
PID/FID General Sensing (unknown environments)	5 ppm above background 10 ppm above background		• At 5 ppm above background, mandatory use of at least Level B PPE • At 10 ppm above background, consider use of engineering controls and/or Level A PPE

Field Testing

After initial screening and monitoring has been completed and entry conditions are determined, site characterization can continue. The entry team should perform rapid field testing of the water suspected of contamination to obtain baseline water quality information. Recommended core field testing consists of monitoring for radiation, cyanide, chlorine residual, pH, conductivity, and dissolved oxygen content of the suspect water.

Rapid field testing of water suspected contamination narrows the types of unknown contaminates and facilitates targeted laboratory analyses. There is no single field testing kit that is effective for all radiological, chemical or biological contaminants. Commercially available field tests should be used only as a guide. A negative result may mean no contaminant is present or it may mean the test was not sensitive enough to detect the contaminant. False positive readings are also a possibility, so the manufacturer's guidance should be followed closely. Equipment and instruments for rapid field testing are described below. Additional information can be found in the US EPA Response Protocol Toolbox Module 3.[16] Information on field testing technologies is also available from the EPA's National Homeland Security Research Center (NHSRC), through its Technology Testing and Evaluation Program (TTEP). TTEP rigorously tests technologies for detection, monitoring, treatment, decontamination, computer modeling, and other tools for protecting water infrastructure and decontaminating structures and the environment. For more information on TTEP, visit the NHSRC website at www.epa.gov/nhsrc/tte.htm.

Table 2 [17]
Core and Expanded Field Test Kits

CORE FIELD TEST KIT			
Target Parameter	**Class**	**Methodology**	**Comments**
Radioactivity (alpha, beta, and gamma)	Primarily a Safety Screen	G-M probe and meter	May be expanded to water testing with a special probe.
Cyanide	Water Testing	Colorimetric or ion selective electrode	Tests water for cyanide ion, but not combined forms.
Chlorine residual	Water Testing	Colorimetric	Absence of residual may indicate a problem.
PH/conductivity	Water Testing	Ion selective electrode	Abnormal pH or conductivity may indicate a problem.
Dissolved Oxygen (DO)	Water Testing	DO meter (membrane/potassium chloride/electrodes)	Indicates amount of dissolved oxygen in the water

[16] US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents* Module 3: Site Characterization and Sampling Guide – pp. 27-30. December 2003.
[17] Table is adapted from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents* Module 3: Site Characterization and Sampling Guide – pg. 28. December 2003.

EXPANDED FIELD TEST KIT			
Target Parameter	**Class**	**Methodology**	**Comments**
General hazards	Safety Screen	HazCat Kit (explosives, oxidants, etc.)	Should be performed by trained HazMat responder.
Volatile chemicals	Safety Screen	Sniffer-type devices	Detects chemicals in air.
Chemical weapons (VX, sarin, etc.)	Both	Enzymatic / colorimetric	Many kits may also detect certain pesticides.
Water quality parameters	Water Testing	Variable (e.g., ion probes, colorimetric)	Kits available for a variety of common parameters.
Pesticides (OP and carbamates)	Water Testing	Immunoassays	Quick and simple to use.
VOCs and SVOCs	Water Testing	Portable GC/MS	Expensive, but expands field capability for chemicals.
Biotoxins (ricin, botulinum, etc.)	Water Testing	Immunoassays	Quick and simple to use.
Pathogens (tularemia, anthrax, plague, etc.	Water Testing	Immunoassays and PCR	Preconcentration will increase sensitivity.
Toxicity	Water Testing	Inhibition of biological activity.	Need to establish a baseline.

Baseline measures on water quality should be readily available to incident managers using parameters routinely monitored by the utility. This is true for raw and finished water. The following list of routinely monitored water quality parameters illustrates factors that may be considered when establishing a baseline: [18]

- pH of distributed water is determined by pH of finished water at the entry point to the distribution system. In well-buffered waters, pH will typically remain fairly constant throughout a distribution system if the water is in equilibrium with the pipe material; however, it may vary if there are corrosion problems.
- Conductivity of distributed water is determined by conductivity of finished water at the entry point to the distribution system. It will typically remain fairly constant throughout a distribution system if the water is in equilibrium with the pipe material; however, it may vary if there are corrosion problems.
- Chlorine/chloramine residual levels vary as a function of temperature, pH, degree of nitrification, pipe wall demand (i.e., from biofilm or corrosion), and distribution system residence time (i.e., water age). The initial residual is established at the plant by the disinfectant dose and oxidant demand of the water. Oxidant demand will vary as a function of water quality, and typically experiences seasonal fluctuations. The use of disinfectant booster stations in the distribution system must also be considered when evaluating baseline residual data.
- Total organic carbon (TOC) levels in the distribution system will remain relatively constant with respect to finished water TOC. However, use of strong oxidants, such as ozone, can increase the biodegradable fraction of TOC, potentially resulting in greater variability in TOC levels in the distribution system.

[18] List is adapted from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents* Module 3: Site Characterization and Sampling Guide – pg. 32. December 2003.

- UV absorbance is typically used as a surrogate for TOC, but is more indicative of the aromatic fraction of TOC. UV absorbance will experience variations similar to TOC, and UV absorbance is also impacted by oxidants and disinfectants used in water treatment.

If laboratory data is available, even historical data, it should also be examined to develop baseline conditions. However it should be noted that few contaminants of concern are monitored frequently enough to provide sufficient data to develop a comprehensive baseline. Typically, contaminants would only be monitored if required for drinking water standards compliance or if unregulated contaminants are known to occur in the finished water and are of significant importance to the utility.

Additional raw water quality parameters such as temperature, turbidity, suspended solids (total), ammonia (total), nitrogen (total), nitrate + nitrite (total), and phosphorus (total and soluble reactive) may indicate water quality issues or provide assurance of integrity.

7.2 Sample Collection, Handling and Preservation

General Drinking Water Incident Sample Collection Guidance

"Clean Hands/Dirty Hands" Procedure[19]
This method follows the outline of EPA number 1669, 'Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels' (1996). This method is commonly used for low-level trace analytes such as mercury, but the method can be employed for any operation that wishes to minimize contamination.

When a sampling team consists of two or more persons, each has specific steps for the collection and handling of samples. One member of the team is designated 'clean hands' and handles the sample bottle, from collection method to the bottling of the sample. 'Dirty hands' handles the coolers, prepares the sampling device, operates any machinery or equipment, and any other steps that do not involve the sample media itself. Regardless, a clean pair of gloves should be used for each sample collected.

Sample Location General Guidance
For a contamination incident at a WTP or distribution system, the following sample locations should be considered:

- Raw water – collect a sample of water prior to treatment.
- Bottom of filter/clearwell – collect a sample immediately following treatment.

[19] This procedure is referenced in Kentucky Department for Environmental Protection *Standard Operating Procedure – Sample Control and Management* – July 9, 2009. Pg.11. Section 8.3. (Revision No.3.0) derived from US EPA *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* - 1996.

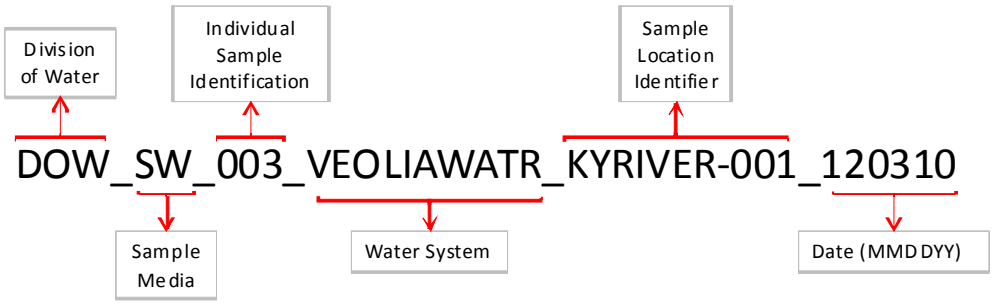
- First connection in Distribution System – collect a sample just inside Distribution System.
- Points north/south/east/west in Distribution System (can be driven by customer complaints).
- First tap inside any purchase system(s) – ensure that contamination has not entered purchase system(s).

Additional sample location general guidance for surface water, potable water and ground water sampling is presented in the following subsections.

Sample Nomenclature[20]

As the number of samples increase, opportunity for errors also increases. A clear, detailed methodology for nomenclature of samples affords the opportunity to decrease the risk of errors. This does not preclude the necessity of a detailed sample location map for use in conjunction with the analytical results, but can speed decision making if analytical results are indicative of when and where the samples were taken. A pre-scripted method for naming samples especially pays dividends when reviewing analytical results to make informed decisions about restoring drinking water service. The Kentucky DEP Environmental Services Branch (ESB) laboratory can report out forty (40) characters[21] in a single sample name, a proposed method for sample nomenclature utilizing these characters is as follows:

Figure 6
Sample Nomenclature



[20] Additional DEP Requirements for the full labeling of samples is contained in Kentucky Department for Environmental Protection *Standard Operating Procedure – Sample Control and Management* – July 9, 2009 (Revision No.3.0) pg. 8 Section 8.1 and in US EPA *Sampling Guidance for Unknown Contaminants in Drinking Water*. EPA-817-R-08-003. November 3, 2008. pg. 25. Section 6.0.

[21] At any given time, DEP has standing contracts with other laboratories that should be consulted prior to establishing incident specific nomenclature including a specified number of characters.

DOW: The first three characters, for a drinking water incident, should be "DOW" for the Division of Water *[3 characters]*

Sample Media: These two characters represent the media that the sample was taken from, choices are as follows *[2 characters]*:

SW – Surface Water	***SO*** – Soil
GW – Ground Water	***SD*** – Sediment
DW – Drinking Water	***AQ*** – Air Quality
WW – Waste Water	

Individual Sample Identification: sequential number from 001 to 999 *[3 characters]*

NOTE: these first three elements (*DOW*, *Sample Media* and *Individual Sample Identification*) could be the ONLY elements written on the actual sample label, the remaining elements of the full sample nomenclature could then be included on the chain of custody.

Water System: designator for the particular water system impacted, PWSID number could be used here. *[10 characters]*

Sample Location Identifier: unique designator to indicate where the sample was physically collected. For multiple sample locations on a single surface water body or river, consider numerical designators as part of this identifier. For confluence samples, consider including abbreviated versions of both surface water bodies. *[11 characters]*

Date: identified in MMDDYY format (two numerals for month, two numerals for day and two numerals for year) *[6 characters]*

NOTE: the underscore (_) between each of the sample nomenclature elements is an attempt to aid with readability of the sample name when reported out by the lab and is considered when counting the total number of characters allowable (40 total characters).

Quality Assurance/Quality Control (QA/QC) Samples
Field duplicates, field split samples, Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples, if required, should be specified, including frequency of collection, prior to commencement of sampling activities. Additionally, the need for blanks (field, trip, equipment, temperature, etc.) should be specified in advance. Increased QA/QC protocols performed during sampling and analysis typically yields more defensible data, lesser efforts at QA/QC are typically satisfactory for initial characterization efforts.

Surface Water[22]

[22] Excerpted from US EPA *Operating Procedure – Surface Water Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-201-R1. November 1, 2007.

Surface water samples will typically be collected either by directly filling the container from the surface water body being sampled or by decanting the water from a collection device such as a stainless steel scoop or other device. During sample collection, if transferring the sample from a collection device, make sure that the device does not come in contact with the sample containers. All samples requiring preservation must be preserved as soon as practically possible, ideally immediately at the time of sample collection.

A control or "background" sample should be collected from a location not affected by contamination. In moving bodies of water, this translates to collecting a sample upstream from the area known to be impacted. For impounded waters, it may be difficult to obtain the control sample from an area that has not been impacted. It may be appropriate to collect the control sample from a similar impoundment located nearby.

Potable Water[23]

The following are examples of common utility sampling locations. Disconnect any hoses, filters or aerators attached to existing sample locations because these elements can add, or remove in the case of aerators, contaminants. Efforts should be taken to reduce flow during sample collection to minimize sample agitation. Additionally, potable water samples must be collected, stored and transported in a separate, clean container (eg. cooler) apart from any other sampled media.

Sampling from Accessible Water Taps: Remove aerator, if present; aeration would remove VOCs from the sample. Maintain a steady flow of water until water temperature is constant, then hold sample container under the discharge at an angle so that the sample flows down the inside wall of sample container. This also minimizes aeration. Fill the container(s) to the fill line (if present) or to the top of the container lip.

Sampling from Fire Hydrants: Remove small cap from low-pressure side of the hydrant, adjust flow down to a manageable level for sample collection, and collect the sample as if from a tap.

Sampling from Water Towers: Allow water to run for at least 20 to 30 minutes to clear plumbing leading to the sample port before sampling. If there is no sampling port, then a pump should be used. Lower the pump into the water reservoir to depth(s) prescribed by the routine sampling plan or by the person in charge of the investigation.

Sampling from Underground Tanks or Reservoirs: If there is a sampling port, allow water to run for at least 20 to 30 minutes, then collect sample. If no sampling port exists, use a decontaminated submersible pump and set the pump flow to about 500 mL/min, then collect the water samples for analysis.

[23] Taken from US EPA *Sampling Guidance for Unknown Contaminants in Drinking Water*. EPA-817-R-08-003. November 3, 2008. pg. 30. Section 7.3. and US EPA *Operating Procedure – Potable Water Supply Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-305-R1.pg. 9. Section 2.3. November 1, 2007.

Ground Water[24]
Collecting ground water samples typically involve sampling from a well. Purging is the process of removing stagnant water from a well, immediately prior to sampling, causing its replacement by ground water from the adjacent formation that is representative of actual aquifer conditions. If the ground water well is the potentially contaminated source water of concern, consideration should be given to sampling prior to purging the well, especially if intentional contamination is suspected, as well as the more traditional sampling after purging approximately three (3) well volumes of water.

A permanent well with an in-place pump should be treated like a well without a pump. One limitation is that in most cases the in-place pump is hard mounted, that is, the pump is suspended in the well at a pre-selected depth and cannot be moved up or down during purging and sampling. In these cases, well volumes are removed, parameters are measured and the well is sampled from the pump discharge, after volume removal and parameter conditions have been met. If these pumps run continuously, opening a valve and allowing it to flush for a few minutes should be sufficient. If the pumps run infrequently, use best judgment to allow enough time to flush standing water from the piping.[25]

Soil[26]
Soil sampling could be considered in the site investigation, especially if material is released on the soil in the vicinity of a potable water source well. Manual methods of collection include grab sampling directly from the surface or using a hand auger to sample into the subsurface. Equipment utilized to collect samples should be decontaminated or discarded between samples, consider the use of equipment blanks to verify decontamination. In the event shovels or heavy equipment are utilized to access the subsurface, prior to sampling any soil surface that has been smeared should be scraped by hand to minimize the effects of contaminant migration by material from other levels.

Sediment[27]
Collection of sediment samples may also be considered. A variety of devices can be used to collect sediment (scoops, spoons, dredges, augers, coring devices, etc.). Ultimately, collection methodology largely depends on sample location, access by the sampler and consistency of the sediment.

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[24] Adapted from US EPA *Operating Procedure – Groundwater Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-301-R1. November 1, 2007.
[25] Information in this paragraph adapted from US EPA *Operating Procedure – Potable Water Supply Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-305-R1. pp.13-14. Section 4.2. November 1, 2007.
[26] Information in this paragraph adapted from US EPA *Operating Procedure – Soil Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-300-R1. November 1, 2007.
[27] Information in this paragraph adapted from US EPA *Operating Procedure – Sediment Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-200-R2. September 8, 2010.

Benthic Organisms and Biota[28]
Collection or assessment of benthic organisms and biota may also be considered. Field biologists should be involved in determination of the need for and methodology by which the sampling or assessment is conducted.

Action Item: General Sample Collection Guidance

The following checklist indicates minimum requirements for this activity. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident. Tasks may be delegated to staff as appropriate.

Prior to commencement of sampling activities, communicate the following to sampling team(s):

- ❒ Review health and safety concerns, check equipment and supplies, validate communications operability
- ❒ Document all field notes in a bound logbook, including a log of all photographs taken
- ❒ Review sample nomenclature, ideally pre-print sample labels and chain(s) of custody with as much information as possible
- ❒ Take care not to contaminate samples
  - Sample from "cleanest" to most contaminated locations when possible
  - Place Potable Water samples in a clean cooler or one designated "Drinking Water ONLY"
  - Ensure that potential additional contaminants are not kept in the same vicinity as samples
  - Follow "clean hands/dirty hands" procedures, ideally with a sampling team of two or more
- ❒ Review sampling protocols and methodologies as necessary
- ❒ Prepare chain of custody for all samples.
- ❒ Maintain custody of samples at all times, secure in an area with access to only designated personnel.
- ❒ Document critical information for each sample
- ❒ Use appropriate security measures as samples may be considered evidence
- ❒ Follow the laboratory's specific instructions for collection, packaging, and shipping samples.

Collecting Samples for Suspected Radiological Contamination[29]

Action Item: Sample Collection and Storage for Suspected Radiological Contamination

[28] References for this section include US EPA *Operating Procedure – Benthic Macroinvertebrate Sorting and Taxonomic Identification*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-509-R1. November 1, 2007, and United States Environmental Protection Agency (USEPA). 1999. *Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*. Second Edition. EPA 841-B-99-002. Office of Water, Washington, DC.
[29] References for this section include *Manual for the Certification of Laboratories Analyzing Drinking Water – Criteria and Procedures Quality Assurance* – Fifth Edition – EPA 815-R-05-004. January 2004. US Environmental Protection Agency – Office of Water, et.al. and US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents*. December 2003.

The following checklist indicates minimum requirements for this activity. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident. Tasks may be delegated to staff as appropriate.

Initiate sample collection for radiological analysis:

- ❒ If radiological materials are suspected, consult a health physicist prior to conducting radiological sampling. The following represents general guidance more than sampling protocol because a team specialized in the collection of radiological-impacted materials will be needed.
  - Note: most hazardous material teams do not have this specialty of the appropriate sampling equipment.
  - Note: Because most radionuclides of interest emit alpha or beta radiation, their levels in drinking water could be assessed by measurement of the total alpha and beta activities.
- ❒ Sample volume, containers, preservatives and holding times are specified in Attachment A (USEPA *Manual for the Certification of Drinking Water Laboratories*)
- ❒ For alpha and beta activity, generally a one litre sample of water representative of the source should be collected in a glass bottle. A small quantity of acid (HCl) should be added as a preservative to bring sample pH to less than 2, except for Iodine-131 and Tritium which do not require preservative. The sample should be transported to the analytical laboratory as soon as possible after collection, Iodine-131 has the shortest holding time at eight (8) days.
- ❒ A detailed list of numerous methods for radionuclide analysis is provided in USEPA *Manual for the Certification of Laboratories Analyzing Drinking Water – Criteria and Procedures Quality Assurance* – Fifth Edition – EPA 815-R-05-004 (January 2004) which should be consulted for specific radiological analytes.
- ❒ Document critical information for each sample
- ❒ Copy information captured on the sample labels into field logbook to serve as a sample inventory.
- ❒ Track and document sample custody using a chain of custody form.
- ❒ Use appropriate security measures as samples may be considered evidence
  - Keep samples under the control of designated personnel at all times.
  - When samples are not in the possession of designated personnel, place samples in a secure area where only designated personnel have access
  - Initiate chain of custody immediately after sample collection.
  - If necessary, collect duplicate samples for law enforcement.
  - If necessary, take photographs of the samples at the site of collection as another form of sample documentation.
- ❒ Follow the laboratory's specific instructions for collection, packaging, and shipping samples potentially containing radionuclide contaminants. Reference the Kentucky Drinking Water Certified Laboratory List in Appendix E.

Collecting Samples for Suspected Chemical Contamination[30]

After field testing of the water, water samples may be collected for laboratory analysis. If the threat is credible, samples should be sent immediately to an approved laboratory for analysis. If the threat is not credible, samples should be stored in a safe place for a specific period of time in case it later becomes necessary to analyze them. Be cognizant that sample holding times for radiological, biological and chemical contaminants vary widely and should be conducted in accordance with law enforcement guidelines when evidence preservation is required. EPA and USGS have developed sampling guidance

[30] Material adapted from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents*. December 2003.

for other purposes that are relevant to emergency water sampling. Some useful links to additional sampling guidance include:

- A series of standard operating procedures published by EPA's Environmental Response Team http://www.ertresponse.com/Response_Resrcs/index.htm.
- A series of field sampling and measurement procedures, and quality control documents used by field investigators of the two Region IV Science and Ecosystem Support Division (SESD) Field Branches Quality System and Technical Procedures: http://www.epa.gov/region4/sesd/fbqstp/.
- USGS field procedures for water sampling at http://water.usgs.gov/owq/Fieldprocedures.html.

These guidelines are applicable to the collection of investigation samples from within the distribution system including storage tanks, pressurized pipes, and other distribution system elements. In most cases, finished water samples will be collected from a tap connected to the distribution system element. However, it may be necessary to collect samples from a large body of water, such as a finished water reservoir. Sampling from such large bodies of water, whether finished or source water, requires different sampling techniques than those used to sample from distribution systems. Guidance developed for the collection of samples from surface water sources, such as the EPA Environmental Response Team's standard operation procedure #2013, may also be applicable to sampling from large finished water reservoirs (http://www.ertresponse.com/sops/2013-r10.pdf).

It is important to follow any special laboratory requirements regarding sample collection and transport since this may affect the quality of analytical results. Specifically, some procedures or laboratories require analysis of special quality control samples including field duplicates, field blanks, trip blanks, and field matrix spikes. There may also be specific chain of custody, notification, and shipping requirements.

It is advisable to collect backup samples in case there is a problem with the set delivered to the laboratory, or if there is a need for additional samples for confirmation or analysis by another entity (e.g., a specialty laboratory or law enforcement). Backup samples should be properly stored, secured, and tracked such that the integrity of the samples is maintained. While collection of individual backup samples may be appropriate in some cases, it may be logistically simpler to collect a large volume sample in a 10-liter container as a backup.

Action Item: Sample Collection for Suspected Chemical Contamination

The following checklist indicates minimum requirements for this activity. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident. Tasks may be delegated to staff as appropriate.

Initiate sample collection for chemical analysis:

❒ Review the site characterization plan to ensure that all samples are collected.

- ❒ Sample volume, containers, preservatives and holding times are specified in Appendix C (for DEP ESB lab) and Attachment A (USEPA *Manual for the Certification of Drinking Water Laboratories*)
- ❒ Properly label each sample container using a waterproof marker with the following information:
  - Analysis
  - Preservative (if any)
  - Dechlorinating agent (if any)
  - Sample location
  - Sample identification
  - Sample collection date and time
  - Sampler's initials
  - Additional information requested on the sample label should be provided as well.
- ❒ Flush sample taps for a time sufficient to displace the water in connecting lines in order to obtain a representative sample from treatment/distribution system element of interest.
- ❒ Keep the flow rate from the sample tap sufficiently low in order to avoid splashing and aerosolizing water droplets. Divert water to a drain if possible.
  - If the water flushed from the tap might pose a hazard to the discharge area, it may need to be collected for decontamination.
- ❒ Document critical information for each sample
- ❒ Copy information captured on the sample labels into field logbook to serve as a sample inventory.
- ❒ Track and document sample custody using a chain of custody form.
- ❒ Use appropriate security measures as samples may be considered evidence
  - Keep samples under the control of designated personnel at all times.
  - When samples are not in the possession of designated personnel, secure samples in a secure area only accessible by designated personnel.
  - Initiate chain of custody immediately after sample collection.
  - If necessary, collect duplicate samples for law enforcement.
  - If necessary, take photographs of the samples at the site of collection as another form of sample documentation.
- ❒ If the decision is made to analyze the samples immediately, the laboratory should be contacted as soon as possible so they can prepare for arrival of the samples. Reference the Kentucky Drinking Water Certified Laboratory List in Appendix E.
- ❒ If the decision is made to hold samples rather than send them to the laboratory for immediate analysis, the following precautions should be taken:
  - Chill samples but protected from freezing.
  - Hold samples until the threat evaluation has been completed and the decision has been made to either analyze the samples or close the investigation.
  - Monitor the shortest holding time for a particular analysis as it will dictate the maximum time that samples should be held prior to analysis.

Note: Holding times for preserved samples are contained in their respective analytical methods, but are typically 7-28 days for properly preserved samples. The respective analytical method should be consulted for authoritative details about holding samples. If it is necessary to store unpreserved samples, the stability of the target analyte in water should be considered when determining how long an unpreserved sample might be stored.

Collecting Samples for Suspected Biological Contamination

If the microbiological contaminant has been tentatively identified and has an established analytical technique suitable for water, then samples should be collected in accordance with that technique. However, established and validated sample collection and analytical techniques for

microbial contaminants in water are limited to a few pathogenic microorganisms; principally enteric bacteria, viruses and protozoa, and a few other organisms with known waterborne transmission. All samples for suspected biological contaminants should be collected using aseptic sampling procedures (clean hands, disposable gloves for each sample, etc.). The following is a brief overview:

- **Bacteria**: collect a four-liter grab sample for membrane filtration and culture of several different types of bacteria through use of selective media.
- **Virus**: filter between 100 and 1,200 liters of water through a positively charged filter (ICR Microbial Laboratory Manual, EPA/600/R-95/178, April 1996, http://www.epa.gov/nerlcwww/). The processed filters can be shipped to the laboratory or viruses adsorbed to the filter can be eluted in the field and shipped as a one-liter *retentate* (or concentrate) to a laboratory for further processing by conventional procedures.
- **Protozoa**: collect a 10-liter grab sample for shipment to a laboratory where it is filtered to concentrate the protozoa for subsequent processing and analysis (Method 1623: *Cryptosporidium* and *Giardia* in Water by Filtration by IMS/FA, EPA-821-R-99-006, April 1999, http://www.epa.gov/nerlcwww/). Another alternative is to perform the filtration in the field, similar to the approach for virus.

Many microbiological methods also specify the addition of a dechlorinating agent to maintain the organisms viability so that they can be cultured. The established method for the target microbiological contaminant should be consulted to determine the appropriate dechlorination and preservation techniques.

If the microbial contaminant is unknown, sample collection is performed through the use of ultrafiltration, which is a membrane filtration process that retains particles, including microorganisms, larger than the molecular weight cut-off (MWCO) of the membrane. The solution containing the concentrated particles and pathogens is called the retentate, while the water that passes through the ultrafiltration membrane is called the *filtrate*. Ultrafiltration can concentrate viruses, bacteria, spores, and parasites if the MWCO is sufficiently small. Thus, the method is suitable for sampling water with an unknown microbiological contaminant. Refer to specific laboratory collection instructions for additional details.

Action Item: Sample Collection for Suspected Microbiological Contamination

The following checklist indicates minimum requirements for this activity. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident. Tasks may be delegated to staff as appropriate.

Initiate sample collection for biological analysis:

- ❒ Avoid splashing or aerosolizing water droplets during sample collection or field concentration.
- ❒ Do not rinse or overfill the sample containers. This is especially important if the sample container contains a preservative or dechlorinating agent.
- ❒ Handle sample aliquot collected for culture analysis in a manner such that viability of the microorganisms is maintained.
- ❒ If necessary, add any preservatives and/or dechlorinating agents. Note: Preservatives and/or dechlorinating agents may be added to the sample containers during sample kit preparation, which can significantly decrease the complexity and time required for sample collection.

- ❒ If necessary, conduct ultrafiltration.
- ❒ Wipe the outside of the sealed containers with an aseptic wipe or a mild bleach solution.
- ❒ Document critical information for each sample
- ❒ Copy information captured on the sample labels into field logbook to serve as a sample inventory.
- ❒ Track and document sample custody using a chain of custody form.
- ❒ Use appropriate security measures as samples may be considered evidence
  - Keep samples under the control of designated personnel at all times.
  - When samples are not in the possession of designated personnel, secure samples in a secure area only accessible by designated personnel.
  - Initiate chain of custody immediately after sample collection.
  - If necessary, collect duplicate samples for law enforcement.
  - If necessary, take photographs of the samples at the site of collection as another form of sample documentation.
- ❒ Follow the laboratories' specific instructions for collection, packaging, and shipping samples potentially containing infectious biological contaminants. Reference the Kentucky Drinking Water Certified Laboratory List in Appendix E. Approved analytical methods are provided in Attachment A (USEPA *Manual for the Certification of Drinking Water Laboratories*)

Collecting Samples for Suspected Petroleum Contamination

If the petroleum contaminant has been tentatively identified and has an established analytical technique suitable for water, then samples should be collected in accordance with that technique. The following is a brief overview:

- **Gasoline**: collect three (3) forty milliliter (ml) VOA vial samples preserved with ice and hydrochloric (HCl) acid (pH less than 2.0) for shipment to a laboratory and specify analysis for Benzene, Toluene, Ethylbenzene and Xylene (BTEX) only (holding time 14 days). One field blank is required. Add 25 milligrams (mg) ascorbic acid is chlorinated per vial, pH must be less than 2.0 using hydrochloric (HCl) acid.
- **Diesel**: collect 1000 milliliter (ml) grab sample in amber glass container preserved with ice for shipment to a laboratory for Diesel Range Organics (DRO) analysis (holding time 7 days).
- **Crude Oil**: collect 1000 milliliter (ml) grab sample(s) in glass container(s) preserved with ice for shipment to a laboratory for Acid/Base/Neutral (ABN) analysis (holding time 7 day extraction/40 day analysis). Add 40-50 milligrams (mg) of sodium sulfite, pH must be less than 2.0 using hydrochloric (HCl) acid for chlorinated drinking waters.
- **Waste Oil**: collect 500 milliliter (ml) grab sample(s) in plastic or glass container(s) preserved with Nitric (HNO3) acid for shipment to a laboratory for Metals analysis (holding time 6 months).
- **Unknown Petroleum Contaminant**:

  (1) collect three (3) forty milliliter (ml) VOA vial samples preserved with ice and hydrochloric (HCl) acid (pH less than 2.0) for Volatile Organics (VOC) analysis (holding time 14 days). One field blank is required. Add 25 milligrams (mg) ascorbic acid is chlorinated per vial, pH must be less than 2.0 using hydrochloric (HCl) acid.

  (2) collect 1000 milliliter (ml) grab sample(s) in glass container(s) preserved with ice for shipment to a laboratory for Acid/Base/Neutral (ABN) analysis (holding time 7 day

extraction/40 day analysis). Add 40-50 milligrams (mg) of sodium sulfite, pH must be less than 2.0 using hydrochloric (HCl) acid for chlorinated drinking waters.

(3) collect 500 milliliter (ml) grab sample(s) in glass container(s) preserved with Nitric (HNO3) acid for shipment to a laboratory for Metals analysis (holding time 6 months).

Action Item: Sample Collection for Suspected Petroleum Contamination

The following checklist indicates minimum requirements for this activity. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident. Tasks may be delegated to staff as appropriate.

Initiate sample collection for petroleum analysis:

- ❒ Review the site characterization plan to ensure that all samples are collected.
- ❒ Sample volume, containers, preservatives and holding times are specified in Appendix C (for DEP ESB lab) and Attachment A (USEPA *Manual for the Certification of Drinking Water Laboratories*)
- ❒ Properly label each sample container using a waterproof marker with the following information:
  - Analysis
  - Preservative (if any)
  - Dechlorinating agent (if any)
  - Sample location
  - Sample identification
  - Sample collection date and time
  - Sampler's initials
  - Additional information requested on the sample label should be provided as well.
- ❒ Flush sample taps for a time sufficient to displace the water in connecting lines in order to obtain a representative sample from treatment/distribution system element of interest.
- ❒ Keep the flow rate from the sample tap sufficiently low in order to avoid splashing and aerosolizing water droplets. Divert water to a drain if possible.
  - If the water flushed from the tap might pose a hazard to the discharge area, it may need to be collected for decontamination.
- ❒ Document critical information for each sample
- ❒ Copy information captured on the sample labels into field logbook to serve as a sample inventory.
- ❒ Track and document sample custody using a chain of custody form.
- ❒ Use appropriate security measures as samples may be considered evidence
  - Keep samples under the control of designated personnel at all times.
  - When samples are not in the possession of designated personnel, secure samples in a secure area only accessible by designated personnel.
  - Initiate chain of custody immediately after sample collection.
  - If necessary, collect duplicate samples for law enforcement.
  - If necessary, take photographs of the samples at the site of collection as another form of sample documentation.
- ❒ If the decision is made to analyze the samples immediately, the laboratory should be contacted as soon as possible so they can prepare for arrival of the samples. Reference the Kentucky Drinking Water Certified Laboratory List in Appendix E.
- ❒ If the decision is made to hold samples rather than send them to the laboratory for immediate analysis, the following precautions should be taken:
  - Chill samples but protected from freezing.
  - Hold samples until the threat evaluation has been completed and the decision has been made to either analyze the samples or close the investigation.

- Monitor the shortest holding time for a particular analysis as it will dictate the maximum time that samples should be held prior to analysis.

Note: Holding times for preserved samples are contained in their respective analytical methods, but are typically 7-28 days for properly preserved samples. The respective analytical method should be consulted for authoritative details about holding samples. If it is necessary to store unpreserved samples, the stability of the target analyte in water should be considered when determining how long an unpreserved sample might be stored.

7.3 Sample Analysis

Laboratory Analysis[31]

The purpose of this section is a framework for developing an approach for the analysis of water samples that may contain an unknown contaminant from chemical, biological, or radiological substances. The framework is flexible and will allow the approach to be crafted based on the requirements of the specific situation. The framework is also designed to promote the effective and defensible performance of laboratory analysis. The sampling team should work with the laboratory to choose the analyses to be done, and determine if the lab can do the analyses based on data quality objectives (e.g., accuracy, precision, range) and limitations. This guide also presents model approaches and procedures for analysis of water samples suspected of contamination with a known or unknown substance. Importantly, all sampling activities should also be conducted in accordance with OSHA 29 CFR 1910.120. Additional information can be found in the *Manual for the Certification of Laboratories Analyzing Drinking Water – Criteria and Procedures Quality Assurance* – Fifth Edition – EPA 815-R-05-004 dated January 2004 and USEPA *Planning for and Responding to Drinking Water Contamination Threats and Incidents, Response Protocol Toolbox*, Module 4: Analytical Guide dated December 12, 2003.

In addition to laboratories within water utilities, standard and specialized chemistry laboratories within Federal Government, the Commonwealth of Kentucky, as well as commercial laboratories, may support analysis of water samples. Laboratory resources may also be available from the academic and industrial sectors. The list of certified drinking water laboratories is included in Appendix E. The following types of labs may be needed during an incident.

Radiological Labs: Radiological labs analyze and identify radioactive substances and contaminants such as radioactive isotopes (also known as radioisotopes), radionuclides, radiochemical compounds and radiological weapons. The EPA, Department of Energy (DOE), states and some commercial firms have labs that can analyze radioactive materials. The Federal Radiological Monitoring and Assessment Center (FRMAC), maintained by DOE, can provide information on analyzing radioactive materials.

Biological Labs: The Laboratory Response Network (LRN) was specifically developed to address bioterrorism threats. The LRN was set up by the CDC, the Association of Public Health Laboratories and the FBI. LRN labs include certain

[31] This section adapted from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents*. December 2003 and *Manual for the Certification of Laboratories Analyzing Drinking Water – Criteria and Procedures Quality Assurance* – Fifth Edition – EPA 815-R-05-004. January 2004. US Environmental Protection Agency – Office of Water, et.al.

city, county, state and federal public health labs. Some labs that are part of the LRN can perform analyses of pathogens, some biotoxins and a "Select List" of particularly dangerous pathogens. During the planning stage, a utility should partner with such labs in order to jointly plan for threat or incident response; this should make it easier to quickly access lab services during an actual incident. In addition, Environmental Microbiology Labs test for microbiological pathogens such as disease-causing bacteria, certain protozoans, viruses, fungi and other microorganisms. An environmental microbiology lab, state water quality lab, hospital lab, medical lab, public health lab or a lab that belongs to the LRN will probably be able to analyze pathogens in water samples. However, not all of these labs may be able to analyze contaminants resulting from bioterrorism, depending on what the contaminant is.

Environmental Chemistry Labs: This group includes many EPA, state and commercial labs that test water samples to see if they meet federal and state drinking water standards under the Safe Drinking Water Act, Clean Water Act or other relevant environmental laws. Under these regulations, government-certified labs should use certain analytical methods that have been standardized and approved for use.

Specialty Labs: Specialty labs include both chemical weapons labs and biotoxin labs. Chemical weapons, defined by the Chemical Weapons Convention (CWC), can only be analyzed by labs that have the appropriate capability and legal authority. Nationwide, there are only a few of these labs, and analyses should usually be arranged by the proper authorities, such as the FBI or certain other federal agencies. Few laboratories currently exist which can perform chemical weapons analyses. Biotoxins, produced by animals or plants, can be analyzed by certain government or university labs. Some commercial environmental chemistry labs may also be able to perform certain biotoxin analyses.

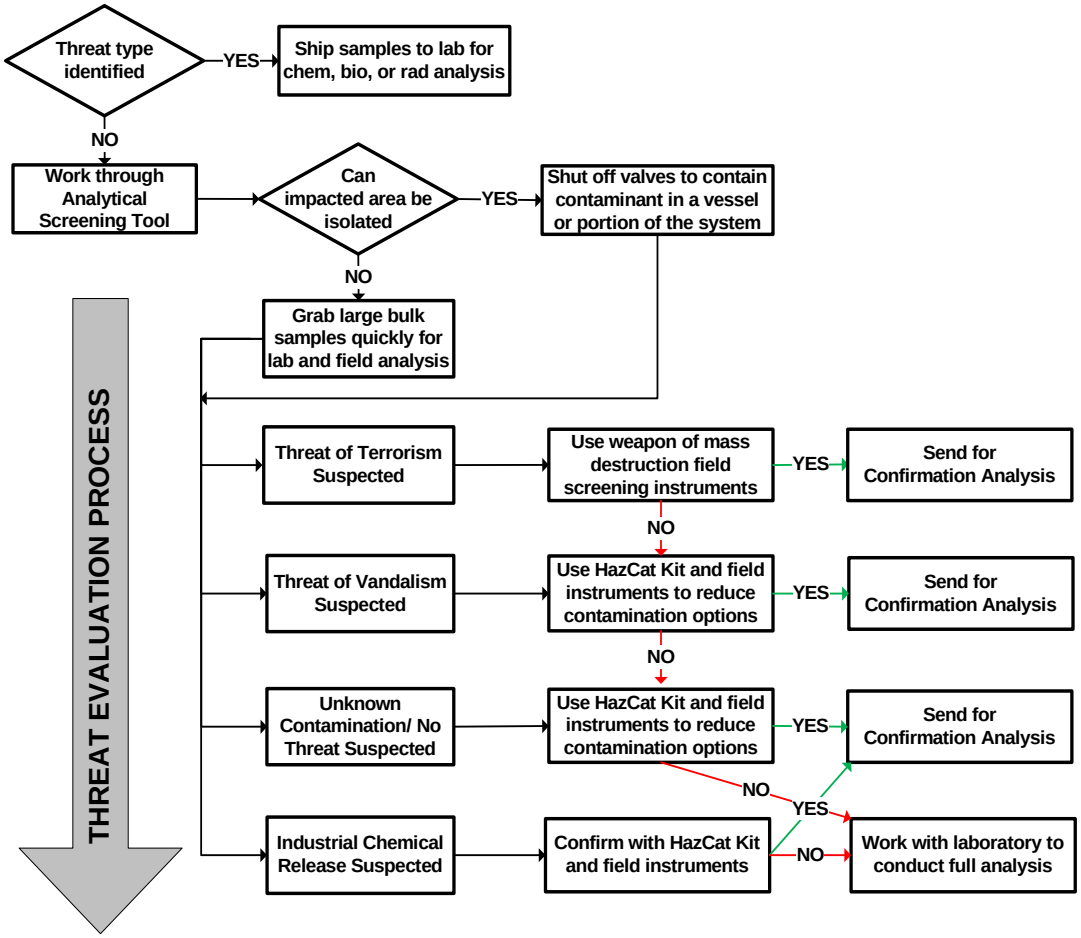
Prior to collecting and subsequently shipping samples to government, university, or commercial laboratories, the Sampling Team should call the preferred laboratory to confirm the lab can conduct the required analysis within the agreed upon analytical data turn around times (ideally, a Quality Assurance Program Plan (QAPP) will already be in place with certified labs). The Sampling Team should also confirm the types of sample collection containers, preservatives, sampling volumes, and shipping instructions.

In addition to the laboratories referenced on the tear sheet, the EPA's Compendium of Environmental Testing Laboratories is a database of laboratories that describes each lab analytical capacities and capabilities. The database is designed to assist EPA and other users identify qualified laboratories that analyze chemical, biological, and radiological agents. The website is located www.epa.gov/compendium (requires a simple registration to access) or contact the EPA Region IV EPA laboratory at 706-355-8500.

Approaches to Analytical Screening for Contaminants

A number of organizations including laboratories may be needed in the development of an analytical approach in response to a contamination threat. During the response to a contamination threat, the laboratory will need to establish clear lines of communication with incident managers, the affected utility, sampling teams, and any other stakeholders, potentially through a laboratory coordinator. This collective group of decision-making officials should evaluate available information and work together to develop an analytical approach that is appropriate for the circumstances and the specific threat.

Figure 7[32]
Analytic Screening Decision Tree



[32] *Analytical Screening Decision Tree* diagram adapted from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents*. December 2003.

1) Determine if there is sufficient information to make a tentative identification of the contaminant as radiological, chemical, and/or biological. If yes, proceed to the appropriate analysis. If no, the sample should be treated as an unknown. The recommended analytical approach for unknowns is described below.

Radiological

2) Proceed with radiological testing.
3) Determine if the preliminary confirmatory analysis used for the tentatively identified contaminant is consistent with other available information, tests, and readings.
4) If gross alpha, beta, or gamma radiation is detected, send the sample to a qualified laboratory the specific radionuclides analysis.
5) Determine the need for additional screening for radiological contamination if results are inconsistent with other tests/readings.

Chemical

6) Determine if there is sufficient information to make a tentative classification of the contaminant within a chemical family
    a. If it is determined to be a particular chemical class or specific contaminant, proceed to the corresponding chemical in Table 4 for analysis options.
    b. If the information is not sufficient to make a determination between chemical contaminants, then the sample may be treated as a chemical unknown. The recommended analytical approach for an unknown is described below.
7) Determine if initial analytical results are consistent with other available information, tests, and readings.
8) Determine needs for additional screening for chemical contamination if results are inconsistent with other tests/readings.

Biological

9) Determine if there is sufficient information to make a tentative classification of the contaminant within a biological family.
10) If it is determined to be a particular biological class or specific organism, proceed to the corresponding item in Table 6 for analysis options.
11) If the information is not sufficient to make a determination between chemical and biological contaminants, the sample may be treated as a biological unknown.
12) Determine if the preliminary confirmatory analysis used for the tentatively identified contaminant is consistent with other available information, tests, and readings.
13) Determine the need for additional screening for chemical, biological, or radiological contamination if results are inconsistent with other tests/readings

Approaches to Analytical Screening for Unknown Contaminants

14) Analyze available information to guide sampling plan development. The following sources should be considered:
    a. Available public health information
    b. Tentatively positive results from field screening/testing
    c. Physical evidence at the site
    d. Location-specific contamination threats

e. Background concentrations
f. Threat credibility
g. Consequences of failing to properly identify an unknown contaminant (or not confirming the absence of harmful contaminants)

15) Proceed with an analytical approach for unknowns based on contaminant classes derived from a prioritization of chemicals and pathogens of public health concern.

In the case of unknowns, the problem of confirming the presence/absence of a contaminant or identifying specific contaminant presents a significant challenge. Unfortunately, there is no one screening process that can detect all known contaminants. Difficulty arises from the large number of potential contaminants and the impracticality of screening for all contaminants. The following is an excerpt from Planning for and Responding to Drinking Water Contamination Threats and Incidents Response Protocol Toolbox, Modules 5, 6, and 8. The following assumptions and principles were used in the development of these approaches:

1) Selection of target analytes was based on an assessment of contaminants likely to pose a threat to public health if introduced into the drinking water supply.
2) Existing laboratory infrastructure and analytical methodologies were utilized when possible.
3) Both chemical and microbiological procedures are tiered, with a progression through field safety screening and rapid field testing to laboratory testing to confirmatory analysis.
4) Samples analyzed in a laboratory that cannot be confirmed by the laboratory performing the test are referred to laboratories that can perform a confirmatory analysis. This upward referral system is formalized for microbiological analysis, through the Laboratory Response Network, while it is not as well defined for chemical analysis.
5) The entire approach relies on the systematic elimination of potential contaminants, both to ensure the safety of sampling and laboratory personnel, and to aid in identification of the unknown contaminant.

Table 3[33]
Summary of Types of Chemical Contaminants, their Analytical Group, and the Class of Contaminants Determined by the Analysis

Chemical types	Analytical Group	Example Contaminants*
Organic	Volatiles	Acetone, acrylonitrile, chloroform, methyl *t*-butyl ether, tetrachloroethene, toluene,
	Semivolatiles	Organophosphates (e.g., malathion, mevinphos, dichlorvos, etc.), cyanazine, chlorinated insecticides, chlordane, pentachlorophenol

[33] Table taken from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents*. Module 4 (pg. 51). December 2003.

	Non-volatiles	Sodium trifluroacetates, surfactants
	Carbamate compounds	Aldicarb, carbofuran, oxamyl
	Quaternary nitrogen compounds	Diquat, paraquat
	Pharmaceuticals	Nicotine, illicit drugs
Inorganic	Trace metals	Mercury, lead, cobalt
	Nonmetals	Arsenic salts
	Organometallics	Organomercury compounds
Cyanides	Cyanides	Cyanide salts, cyanogen chloride
Radionuclides	Radiologicals	Cesium-137, Cobalt-60, Strontium-92
CW Agents	Schedule 1 only**	(e.g., VX, sarin, nitrogen and sulfur mustards, Lewsites)

* Not every contaminant in a particular analytical group is listed in this column.
**See USEPA RPTB Module 4 Section 2.1.4 for a discussion of Schedule 1 agents.

Table 4[34]
Suggested Analytical Techniques for Performing the Basic Chemical Screen, broken out by the classes given in Table 3.

Chemical (general class)	Analytical Technique	EPA Method[1,5]	Analyte List[4]
Volatiles (organic)	Purge-and-trap PID/ELCD Purge-and-trap GC/MS	502.2, 8021B 524.2, 8260B	A
Semivolatiles (organic, includes many pesticides)	Solid-phase extraction GC/MS	525.2, 8270D/3535A	B
Carbamate pesticides (organic)	HPLC – fluorescence detection	531.1, 531.2	C
Quaternary nitrogen compounds (organic)	HPLC – UV	549.2	D
Trace metals (inorganic)	ICP-AES, ICP-MS, graphite furnace AA	200.7, 200.8,[2] 200.9	E
Total mercury (inorganic, includes organomercury compounds)	Cold vapor AA	245.1, 245.2 with persulfate	F
Cyanides	Wet chemistry	335.2, 335.3, 335.4	G
Radionuclides	Gross alpha, gross beta, Gross gamma	900, or technique preferred by lab[3]	H

Notes:

1. Method titles are listed in USEPA RPTB Module 4 Table 4-19 (Section 10, page 108)

2. Method 200.8 may be applied in the time-saving "direct analysis" mode that does not require digestion, if the NTU of the water sample is <1. Note that the NTU of the water may be quickly determined in-house and/or may be available in the site characterization report supplied with the sample. The use of the scanning mode in Method 200.8 is also suggested.

3. Many radionuclide laboratories have developed in-house methods for rapid screening of radionuclides. These may be similar to EPA 900-Series methods, which were developed for the measurement of very low, environmental levels of radioactivity in drinking water but may require several days to obtain a result. See Section 6.4.8 for further discussion. Analytical confirmation may be required via EPA Method or other defensible methods.

4. Standard may contain these. See US EPA RPTB Module 4 Table 4-20 (Section 10, pp. 109-111).

[34] Table taken from US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents*. Module 4 (pg. 59). December 2003.

5. The standardized methods listed in this table do not include some analytes of concern such as the biotoxins, chemical warfare agents and pharmaceuticals.

Unknown Microbial Screening

Microbiological screening is similar to screening for chemical contaminants or biotoxins, except that it targets pathogenic microorganisms. It involves four steps:

Rapid field testing. The sample is tested in the field to see if the pathogen is present. Keep in mind that rapid field testing equipment for pathogens may be limited.
Sample concentration and recovery in the field. Large volumes of suspect water are collected and the sample is concentrated down to a smaller volume to improve the chances of finding a pathogen;
Testing at a Sentinel Laboratory, which is a laboratory certified for analysis of certain pathogens;
Testing at a Reference Laboratory, if necessary, to compare the pathogen to known pathogens kept in "reference collections" (much as reference books are kept in a library).

Two broad classes of pathogens may be encountered in a contaminated water sample: (1) traditional waterborne pathogens and (2) exotic and select agents that may be suitable for a water route of transmission. The following table lists some of these pathogens. This section is intended as a guide for selecting analytical approaches for samples suspected of containing known and unknown microbial contaminants.

Table 5[35]
General Classes of Pathogens, Specific Organisms, and Select Agent Status

Pathogen general class	Organism	Select Agent[1]
Bacteria (non-spore forming)	*Brucella* spp.	Yes
	Burkholderia pseudomallerei	Yes
	Campylobacter spp.	
	E. coli 0157:H7	
	Francisella tularensis	Yes
	Salmonella spp.	
	Shigella spp.	
	Vibrio cholerae	
	Yersinia pestis	Yes
Bacteria (spore forming)	*Bacillus anthracis*	Yes
	Clostridium botulinum A	Yes
Bacteria (Rickettsia)	*Coxiella burnetti*	Yes
Protozoa	*Cryptosporidium parvum*	
	Entamoeba histolytica	
	Giardia intestinalis	
	Toxoplasma gondii	

[35] Table taken from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents*. Module 4 (pg. 87). December 2003.

Viruses	Enteroviruses Hepatitis A Hepatitis E Noroviruses Rotavirus Variola VEE VHF	 Yes Yes Yes

Note:
Select Agents are biological contaminants, including some pathogens and biotoxins that are regulated by US Department of Health and Human Services. Only certain laboratories, registered with the CDC in accordance with the Select Agent Act, are permitted to confirm the presence of, and maintain cultures of, select agents. Refer to http://www.cdc.gov/od/sap/docs/salist.pdf for a complete list.

Table 6[36]
Known Waterborne Pathogens with Established Techniques for Sample Collection and Analysis

Pathogen (general class)	Organism	Analytical Technique	Method[1]
Bacteria	*Campylobacter spp.* E. coli 0157:H7 *Salmonella spp.* *Shigella spp.* *Vibrio cholerae*	Culture in selective media	SM 9260 G SM 9260 F SM 9260 B SM 9260 E SM 9260 H
Protozoa	*Cryptosporidium parvum* *Giardia intestinalis*	IMS/IFA[2]	EPA 1622/23 EPA 1623
Viruses	Enteroviruses Hepatitis A	Mammalian cell culture	EPA/600/4-84/013 EPA ICR manual

Notes:
1. SM refers to Standard Methods for the Examination of Water and Wastewater (Clesceri *et. a.l.*, 1999). The EPA methods may be found at http://www.epa.gov/nerlcwww/
2. Immunomagnetic separation (IMS) and immunofluorescence assay (FA) microscopy.

7.4 Data and Records Management

Report format for laboratory analytical data should be pre-arranged. If possible, data should be reported in an electronic format that lends itself to being readily transferred into databases and geospatial software. The emphasis should be on rapidly and efficiently providing data to stakeholders in a visual format that allows for informed decision making. Records, including field logbooks, photographs, analytical data and other work products developed during a drinking water incident, should be maintained in accordance with DEP policy.

[36] Table taken from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents*. Module 4 (pg. 90). December 2003.

7.5 Quality Assurance and Quality Control[37]

Because of the diversity of potential field testing and sampling activities during site characterization, there may be no specific quality assurance (QA) activities which apply to all sampling procedures. However, the following general QA principles would apply in most cases and are consistent with the QA guidelines published by EPA's Environmental Response Team (http://www.ertresponse.com/sops/2013-r10.pdf):

- All data should be documented in field logbooks.
- All instrumentation should be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities should occur prior to site characterization and documented.
- Any relevant QA principles and plans specific to the particular water utility or responding organization should be observed.

One consideration with respect to QA/QC for analytical methods used during the evaluation of suspected water contamination incidents is the objective of the analysis. For instance, one goal may be to qualitatively confirm the presence of a particular contaminant. Another goal would be to quantitatively determine the concentration of a contaminant. Selecting the objectives of a particular analysis is part of planning for a site-specific response to a contamination threat. In many cases, the threat evaluation process (Figure 7) will drive the purpose of the analysis toward quantifying chemicals at concentrations from milligrams per liter to low micrograms per liter of chemicals, and pathogens at their infective doses. However, depending on the specific plan, other goals may be applicable.

[37] Adapted from the US EPA Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents*. Module 3 (pg. 34) and Module 4 (pg. 35). December 2003.

Section 8 References

The references for this standard operating guideline, also captured in footnotes throughout the text, are included in this section for the user's convenience:

1) "Kentucky Public Water System Statistics" compiled by Julie Roney in November 2010.

2) Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2).

3) Kentucky Department for Environmental Protection *Standard Operating Procedures – The Collection of Surface Water Samples from Flowing Systems during Emergency Response Conditions* – April 15, 2011 (Revision No.1).

4) Response Protocol Toolbox (RPTB): *Planning for and Responding to Drinking Water Contamination Threats and Incidents.* six modules – EPA-817-D-03-007, et.al. December 2003. US Environmental Protection Agency – Office of Ground Water and Drinking Water, et.al.

5) US EPA *Sampling Guidance for Unknown Contaminants in Drinking Water*. EPA-817-R-08-003. November 3, 2008.

6) US EPA *Operating Procedure – Potable Water Supply Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-305-R1.pg. 9. Section 2.3. November 1, 2007.

7) US EPA *Operating Procedure – Surface Water Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-201-R1. November 1, 2007.

8) US EPA *Operating Procedure – Groundwater Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-301-R1. November 1, 2007.

9) US EPA *Operating Procedure – Soil Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-300-R1. November 1, 2007.

10) US EPA *Operating Procedure – Sediment Sampling*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-200-R2. September 8, 2010.

11) US EPA *Operating Procedure – Benthic Macroinvertebrate Sorting and Taxonomic Identification*. Science and Ecosystem Support Division (SESD) procedure number SESDPROC-509-R1. November 1, 2007.

12) United States Environmental Protection Agency (USEPA). 1999. *Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers: Periphyton, Benthic*

Macroinvertebrates, and Fish. Second Edition. EPA 841-B-99-002. Office of Water, Washington, DC.

13) *Manual for the Certification of Laboratories Analyzing Drinking Water – Criteria and Procedures Quality Assurance* – Fifth Edition – EPA 815-R-05-004. January 2004. US Environmental Protection Agency – Office of Water, et.al.

Section 9 Appendices

Appendix A Kentucky HAZMAT Team List

(One page)

This listing was current at the time this document was published.

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Appendix B DEP Worksite Hazard Assessment

(Two pages)

The DEP Worksite Hazard Assessment is located in Kentucky Department for Environmental Protection *Employee Safety and Health Program – Standard Operating Procedures* – January 2011 (Version 2) pages 23-24.

DEP WORKSITE HAZARD ASSESSMENT

PART A Site Name/AI:	Incident #:
Description of Activities	
PART B **Check the hazard(s) located at the site being assessed sufficient to require Personal Protection Equipment (PPE).**	
I. HEAD LIKELY INJURY/HAZARD 1. ☐ Struck By 2. ☐ Struck Against 3. ☐ Electrical 4. ☐ Temperature 5. ☐ Other _____	**I. 29 CFR 1910.135 HEAD PPE** 1. Hard hat 2. NO GO – Maintain distance 3. Hard hat with winter liner or sweat band, cooling device as required 4. Call supervisor
II. EYES/FACE LIKELY INJURY/HAZARD 1. ☐ Airborne 2. ☐ Chemical 3. ☐ Flash/Light/UV 4. ☐ Other _____	**II. 29 CFR 1910.133 EYES/FACE PPE** 1. Safety goggles with side shields, goggles or full face shield as for hazard 2. Review MSDS and determine appropriate eyewear also beware respiratory hazard 3. Non-vented goggles or full face shield filter or tinted lens. Sunscreen for sun exposure **4.** Call supervisor
III. RESPIRATORY LIKELY INJURY/HAZARD 1. ☐ Oxygen Deficiency 2. ☐ Airborne Particles 3. ☐ Dusts 4. ☐ Fumes 5. ☐ Mists 6. ☐ Airborne Contaminants 7. ☐ Gases 8. ☐ Vapors 9. ☐ Combinations 10. ☐ Temperature 11. ☐ Other _____	**III. 29 CFR 1910.134 RESPIRATORY PPE** 1. NO GO 2. NO GO unless in DEP Respiratory Protection Program (RPP) 3. Same as #2 4. Same as #2 5. Same as #2 6. Same as #2 7. Same as #2 8. Same as #2 9. Same as #2 10. Cold temps-cover mouth/nose, Hot temps-SCBA or supplied air (tempered) 11. Call supervisor **NOTE: If in the RPP follow proper respirator selection protocols and procedures for any item checked above**.
IV. HAND/ARM LIKELY INJURY/HAZARD 1. ☐ Cut/Abrasion/Puncture/Gash 2. ☐ Electrical 3. ☐ Chemical 4. ☐ Biological 5. ☐ Temperature 6. ☐ Sunburn 7. ☐ Body Fluids 8. ☐ Cumulative 9. ☐ Strain 10. ☐ Other_____	**IV. 29 CFR 1910.138 HAND/ARM PPE** 1. Gloves-canvas, leather, mesh, Kevlar 2. NO GO – Maintain distance 3. Review MSDS and determine appropriate gloves/sleeves or coveralls 4. Clothing/gloves/coveralls/barrier cream repellant 5. Gloves/clothing 6. Wear long sleeves, gloves or sunscreen 7. Latex/nitrile gloves (review Bloodborne Pathogen Plan - BBP) 8. Gloves/restraints 9. Adequate tools/assistance from others 10. Call supervisor

V. FOOT/LEG LIKELY INJURY/HAZARD 1. ☐ Cut/Abrasion/Puncture/Gash 2. ☐ Electrical 3. ☐ Chemical 4. ☐ Biological 5. ☐ Temperature 6. ☐ Struck By/Against 7. ☐ Strain 8. ☐ Other_____	**V. 29 CFR 1910.136 FOOT/LEG PPE** 1. Approved safety shoe/proper clothing 2. NO GO – Maintain distance 3. Review MSDS and determine proper PPE 4. Coverall/barrier cream/repellant 5. Insulated footwear/clothing adequate for hazard 6. Safety shoes/adequate clothing proper techniques/assistance 7. Adequate tools/ assistance from others 8. Call supervisor
VI. TORSO/WHOLE BODY LIKELY INJURY/HAZARD 1. ☐ Cut/Abrasion/Puncture/Gash 2. ☐ Electrical 3. ☐ Chemical 4. ☐ Biological 5. ☐ Temperature 6. ☐ Struck By/Against 7. ☐ Body Fluids 8. ☐ Strain 9. ☐ Cumulative 10. ☐ Slip/Trip/Fall 11. ☐ Same Level 12. ☐ Different Level 13. ☐ Entrapment 14. ☐ Immersion/Submersion/Water 15. ☐ Permit Required Confined Sp. 16. ☐ Other_____	**VI. 29 CFR 1910. MISC. STANDARDS-TORSO/WHOLE BODY** 1. Adequate clothing 2. NO GO – Maintain distance 3. Review MSDS and determine proper PPE 4. Proper clothing/barrier cream/repellant 5. Cold-insulated jacket/coat, heat-appropriate clothing, work/rest intervals 6. Protective clothing, warning devices, guards 7. Protective apron/coveralls review BBP Plan 8. Proper work habit, assistance, appropriate tools 9. Body mechanics, proper tools, workstations 10. Proper footwear, harness/tether/lifeline, assistance 11. Same as # 10 12. Same as # 10 13. NO GO - Do not enter 14. Personal flotation device, tether/lifeline 15. NO GO 16. Call supervisor
VII. AUDITORY **NOISE LEVEL** 1. ☐ Ambient Level above 85 dBa 2. ☐ Impact Level above 85 dBa 3. ☐ Other _____ **NOTE: Noise level rule of thumb: If you are within 2-3 feet of someone and you have to yell to communicate you are above 85 dba**.	**VII. 29 CFR 1910.95 HEARING PROTECTION** 1. Appropriate NRR ear plugs or muffs 2. Appropriate NRR ear plugs or muffs 3. Call supervisor

PART C

GO: ☐ NO GO: ☐

COMMENTS:

PART D

CERTIFICATION

I certify this WORKSITE HAZARD ASSESSMENT was conducted, reviewed and/or updated. Appropriate Personal Protective Equipment was utilized per hazards noted or anticipated.

_____ _____

Signature Date

Appendix C Environmental Services Branch Sampling Guidelines

(Four pages)

DEP Environmental Services Branch (ESB) provides the following Sampling Guidelines as DEP 9000 Appendix L – Revision #5 – November 30, 2010

ENVIRONMENTAL SERVICES BRANCH SAMPLING GUIDELINES

502-564-6120 FAX 502-564-8930

Revised March 2011

MATRIX: WATER

Parameter	Minimum Volume Required	Container *	Preservative	Holding Times
Acidity	100 mL	plastic or glass	ice	14 days
Acid/Base/Neutral (see Note 7)	1000 mL	glass only	ice	7 day extraction/40 day analysis
Alkalinity	100 mL	plastic or glass	ice	14 days
Ammonia	100 mL	plastic or glass	H_2SO_4, ice	28 days
BOD-Do not collect on Monday/Tuesday	500 mL	plastic or glass	ice	48 hours
Bromide	100 mL	plastic or glass	ice	28 days
Caffeine	1000 mL	glass only	ice, HCl pH < 2	7 days extraction/28 days analysis
Carbamates (see Note 1)	125 mL	glass only	ice;4.0 mL Monochloroacetic acid buffer pH<3	28 days
Chloride	100 mL	plastic or glass	ice	28 days
Color	100 mL	plastic or glass	ice	48 hours
Conductivity	100 mL	plastic or glass	ice	28 days
Cyanide (Amenable) (see Note 2)	500 mL	plastic or glass	NaOH, ice	14 days
Cyanide (Total)	500 mL	plastic or glass	NaOH, ice	14 days
Diquat/Paraquat (see Note 1)	500 mL	amber plastic	ice, H_2SO_4 pH<2	7 days extraction/14 days analysis
Diesel Range Organics (DROs)	1000 mL	glass only	ice only or ice, HCl or H2SO4 pH<2	7 days
EDB & DBCP (see Note 4)	40 mL	3 VOA vials	3 mg sodium thiosulfate per vial, ice	14 days
Flashpoint	500 mL	glass only	none	none defined
Fluoride	100 mL	plastic or glass	ice	28 days
Glycols	1000 mL	glass only	ice	7 days extraction/40 days analysis
Glyphosate (see Note 1)	1000 mL	glass only	ice	If frozen, 18 months analysis
Hardness	100 mL	plastic or glass	HNO_3, ice	28 days

Haloacetic Acid	80 mL	4 VOA vials	Ammonium chloride, ice	14 days extraction/14 days analysis
Parameter	**Minimum Volume Required**	**Container**	**Preservative**	**Holding Times**
Herbicides, chlorophenoxy (see Note 7)	1000 mL	glass only	ice, HCl pH < 2	7 days extraction/14 days analysis
Hexavalent Chromium (see Note 3)	1000 mL	plastic or glass	ice	24 hours
Ignitability	4 oz	glass only	none	none defined
MBAS (see Note 3)	250 mL	plastic or glass	ice	48 hours
Low-level Mercury	250 mL	glass only	HCl	28 days
Mercury	500 mL	plastic or glass	HNO_3	28 days
Metals	500 mL	plastic or glass	HNO_3	6 months
Metals, Dissolved	500 mL	plastic or glass	HNO_3	6 months
Nitrate	100 mL	plastic or glass	ice	48 hours
Nitrate-Nitrite	100 mL	plastic or glass	H_2SO_4, Ice	28 days
Nitrite	100 mL	plastic or glass	ice	48 hours
Nitrogen/Phosphorus Pesticides (see Note 1)	1000 mL	glass only	ice	7 days extraction/40 days analysis
Oil and Grease	1000 mL	glass only	ice, HCl or H_2SO_4 pH<2	28 days
Ortho-phosphate	50 mL, filter on	plastic only	ice	48 hours
PAHs	1000 mL	glass only	ice	7 day extraction/40 day analysis
PCBs (see Note 1)	1000 mL	glass only	ice	7 days extraction/40 days analysis
Pesticides/PCBs (see Note 1)	1000 mL	glass only	ice	7 days extraction/40 days analysis
pH	100 mL	plastic or glass	ice	analyze immediately
Residual Chlorine	100 mL	plastic or glass	none	analyze immediately
Semi-Volatiles	1000 mL	glass only	ice	7 day extraction/40 day analysis
Sulfate	100 mL	plastic or glass	ice	28 days
Sulfide (See Note 8)	100 mL	call for container	call for preservative	7 days
Sulfonyl Urea Herbicides (see Note 1)	1000 mL	glass only	ice	7 days extraction/40 days analysis
Trihalomethane (THM)	40 mL	3 VOA vials	3 mg sodium thiosulfate per vial, ice	14 days

Total Dissolved Phosphorus	50 mL, filter on	plastic or glass	H_2SO_4, ice	28 days
Parameter	**Minimum Volume Required**	**Container**	**Preservative**	**Holding Times**
Total Dissolved Solids	200 mL	plastic or glass	ice	7 days
Total Kjeldahl Nitrogen	100 mL	plastic or glass	H_2SO_4, ice	28 days
Total Organic Carbon (non-drinking water)	50 mL	plastic or glass	H_2SO_4, ice	28 days
Total Organic Carbon (drinking water)	50 mL	glass only	H_2SO_4, ice	28 days
Total Phenols	500 mL	glass only	H_2SO_4, ice	28 days
Total Phosphorus	50 mL	plastic or glass	H_2SO_4, ice	28 days
Total Settleable Solids	1000 mL	plastic or glass	ice	48 hours
Total Solids	200 mL	plastic or glass	ice	7 days
Total Suspended Solids	200 mL	plastic or glass	ice	7 days
Total Volatile Solids	200 mL	plastic or glass	ice	7 days
Total Volatile Suspended Solids	200 mL	plastic or glass	ice	7 days
Turbidity	100 mL	plastic or glass	ice	48 hours
Volatile Organics (see Notes 4 & 5)	40 mL	3 VOA vials	ice, HCl pH<2	14 days

* glass refers to amber glass bottles

Note 1: Add 80 mg sodium thiosulfate if chlorinated.

Note 2: Add 0.6 g ascorbic acid if chlorinated.

Note 3: Contact laboratory 24 hours prior to collection of this sample.

Note 4: Field blank (only one) required.

Note 5: Add 25 mg ascorbic acid if chlorinated per vial, pH must be less than 2.0 using HCL.

Note 6: Add 65 mg ammoniuim chloride per vial.

Note 7: Add 40-50 mg sodium sulfite, ph must be less than 2.0 using HCL for chlorinated drinking waters.

Note 8: Add 4 drops 2 Normal zinc acetate per 100 mL, pH must be greater than 9.0 using 6 Normal sodium hydroxide.

MATRIX: SEDIMENT, SOIL, OR CHEMICAL WASTE

Parameter	Minimum Volume Required	Container	Preservative	Holding Times
Metals	100 g	glass only	ice	6 months
Pesticides/PCBs	100 g	glass only	ice	14 days extraction/40 days analysis
TCLP Metals	500 g	glass only	ice	6 months extraction/6 months analysis
TCLP Semi-volatiles	250 g	glass only	ice	14 & 7 day extractions/40 days analysis
TCLP Volatiles	250 g	glass only	ice	14 days extraction/14 days analysis
Oil & Grease	100 g	glass only	ice	28 days
Flashpoint	500 mL	glass only	ice	none
Acid/Base/Neutral	100 g	glass only	ice	14 days extraction/40 days analysis
Volatile Organics	100 g	glass only	ice	14 days

MATRIX: FISH TISSUE

Parameter	Volume Required	Container	Preservative	Holding Times
Metals	50 g	glass	frozen	None defined
% Lipids	50 g	glass	frozen	None defined
Pesticides/PCBs	50 g	glass	frozen	None defined

MATRIX: AIR

Parameter	Container	Holding Times
Carbonyls	Cartridge	14 days extraction/30 days analysis
Metals	PM10-PM2.5 Filters	6 Months
Volatiles	SUMMA canister	28 Days

Appendix D Chain of Custody Record - Energy and Environment Cabinet

(Three Pages)

The Energy and Environment Cabinet (EEC) provides the following Chain of Custody Record as DEP 5005 (5146GP) – February 28, 2011

CHAIN OF CUSTODY RECORD
ENERGY AND ENVIRONMENT CABINET

Program/DOW: ☐ 106 ☐ NPS ☐ SDWA ☐ Stream Survey ☐ Groundwater ☐ Wild Rivers ☐ Tox. Test ☐ Ref. Reach ☐ Lakes ☐ Pretreatment ☐ BMP ☐ ERT

Program/DWM: ☐ RCRA ☐ UST ☐ TSCA ☐ Solid Waste ☐ Fed. CERCLA ☐ St. CERCLA

Program/AQ: ☐ Air Toxics/Canister # _____ ☐ Air Quality

Fund Source/MARS # _____ Site # _____ Other Program _____ Incident #/AI # _____ Incident

SITE LOCATION: _____ FACILITY NO.: _____ COUNTY: _____

FIELD ID #	DATE TIME	DESCRIPTION OF SITE	MATRIX	NUMBER OF CONTAINERS	PRESER-VATION	ANALYSIS REQUESTED	pH	LAB USE ONLY
	Date: ___/___/___ Time: ☐ am ___:___ ☐ pm	AKGWA #: _____ - _____	☐ Liquid ☐ Solid ☐ Chemical ☐ Grab ☐ Composite ☐ Other	___ Glass 1000 ml ___ Plastic 1000 ml ___ VOA 40 ml ___ Glass 140 ml ___ 280 ml ___Other:	☐ Ice ☐ H_2SO_4 ☐ NaOH ☐ HNO_3 ☐ HCI ☐ Other	☐ **ABN** ☐ **VOC** ☐ **NH_3** ☐ **TO14** ☐ **TOC** ☐ **TSS** ☐ **CI** ☐ **HERB** ☐ **TKN** ☐ **BOD** ☐ **CN** ☐ **T. METALS** ☐ **O&G** ☐ **PAH** ☐ **FP** ☐ **PEST/PCB** ☐ **TDS** ☐ **ALK** ☐ **TCLP** ☐ **N/P PEST** ☐ **BTEX** ☐ **ORTHO/P** ☐ **OTHER:** _____		Sample # Report #
	Date: ___/___/___ Time: ☐ am ___:___ ☐ pm	AKGWA #: _____ - _____	☐ Liquid ☐ Solid ☐ Chemical ☐ Grab ☐ Composite ☐ Other	___ Glass 1000 ml ___ Plastic 1000 ml ___ VOA 40 ml ___ Glass 140 ml ___ 280 ml ___Other:	☐ Ice ☐ H_2SO_4 ☐ NaOH ☐ HNO_3 ☐ HCI ☐ Other	☐ **ABN** ☐ **VOC** ☐ **NH_3** ☐ **TO14** ☐ **TOC** ☐ **TSS** ☐ **CI** ☐ **HERB** ☐ **TKN** ☐ **BOD** ☐ **CN** ☐ **T. METALS** ☐ **O&G** ☐ **PAH** ☐ **FP** ☐ **PEST/PCB** ☐ **TDS** ☐ **ALK** ☐ **TCLP** ☐ **N/P PEST** ☐ **BTEX** ☐ **ORTHO/P** ☐ **OTHER:** _____		Sample # Report #
	Date: ___/___/___ Time: ☐ am ___:___ ☐ pm	AKGWA #: _____ - _____	☐ Liquid ☐ Solid ☐ Chemical ☐ Grab ☐ Composite ☐ Other	___ Glass 1000 ml ___ Plastic 1000 ml ___ VOA 40 ml ___ Glass 140 ml ___ 280 ml ___Other:	☐ Ice ☐ H_2SO_4 ☐ NaOH ☐ HNO_3 ☐ HCI ☐ Other	☐ **ABN** ☐ **VOC** ☐ **NH_3** ☐ **TO14** ☐ **TOC** ☐ **TSS** ☐ **CI** ☐ **HERB** ☐ **TKN** ☐ **BOD** ☐ **CN** ☐ **T. METALS** ☐ **O&G** ☐ **PAH** ☐ **FP** ☐ **PEST/PCB** ☐ **TDS** ☐ **ALK** ☐ **TCLP** ☐ **N/P PEST** ☐ **BTEX** ☐ **ORTHO/P** ☐ **OTHER:** _____		Sample # Report #

Metals: ☐ As ☐ Ba ☐ Cd ☐ Cr ☐ Pb ☐ Hg ☐ Se ☐ Ag ☐ Cu ☐ Fe ☐ Mn ☐ Zn ☐ Other _____

Inspector(s):

Relinquished by:	Date	Received by:
Representing:	Time	Representing:
Relinquished by:	Date	Received by:
Representing:	Time	Representing:

STANDARD TESTS

Symbol	Test
☐ Acid	Acidity
☐ Alk	Alkalinity
☐ Br	Bromide
☐ COD	Chemical Oxygen Demand
☐ CI	Chloride
☐ Color	Color (ADMI)
☐ Cond	Conductivity
☐ CN-t	Cyanide, total
☐ CN-a	Cyanide, amenable
☐ Hard	Hardness
☐ ICAS	IC Anion Scan
☐ O&G	Oil and Grease
☐ Phenol	Phenol (4AAP)
☐ pH	pH
☐ TS	Total Solids
☐ TSS	Total Suspended Solids
☐ TDS	Total Dissolved Solids
☐ TVS	Total Volatile Solids
☐ TVSS	Total Volatile Suspended Solids
☐ SO_4	Sulfate
☐ H_2S	Hydrogen Sulfide
☐ TOC	Total Organic Carbon
☐ Turb	Turbidity
☐ F	Fluoride

HAZARDOUS WASTE

Symbol	Test
☐ Corr	Corrosivity
☐ CN-r	Cyanide, reactive
☐ H_2S-R	Sulfide, reactive
☐ FP	Flashpoint
☐ Ignit	Ignitability
☐ TCLP	TCLP (Metals only)

MINERALS

☐ Na	Sodium
☐ K	Potassium
☐ Ca	Calcium
☐ Mg	Magnesium

METALS

Symbol	Test
☐ ICPS	Metal Scan
☐ Al	Aluminum
☐ E-Al	Aluminum, extractable
☐ Sb	Antimony
☐ As	Arsenic
☐ Ba	Barium
☐ Be	Beryllium
☐ Cd	Cadmium
☐ Cr	Chromium
☐ Hex Cr	Hexavalent Chromium
☐ Co	Cobalt
☐ Cu	Copper
☐ Fe	Iron
☐ Pb	Lead
☐ Hg	Mercury
☐ Ni	Nickel
☐ SiO_2	Silica
☐ Sr	Stronium
☐ V	Vanadium
☐ Mn	Manganese
☐ Mo	Molybdenum
☐ Se	Selenium
☐ Ag	Silver
☐ Sn	Tin
☐ Zn	Zinc

NUTRIENTS

☐ NH_3	Ammonia
☐ TKN	Total Kjeldahl Nitrogen
☐ NO_3	Nitrate
☐ o-P	Phosphorus, ortho
☐ T-P	Phosphorus, total
☐ TDP	Phosphorus, total dissolved

AIR QUALITY

☐	API Gravity
☐	Ash
☐	Microscopic
☐ BTU	Gross Heat of Combustion
☐ TO14	Volatile Organics
☐ N	%Nitrogen
☐ S	%Sulfur
☐ H_2O	%Water
☐ NO_4	Oxides of Nitrogen
☐ SO_2	Sulfur Dioxide

ORGANICS

Symbol	Test
☐	EDB & DBCP
☐ Pest	Pesticides
☐	N/P Pesticides
☐ Herb	Herbicides
☐ PCB	Polychlorinated Biphenyls
☐ MBAS	Methylene Blue Active Substances
☐	Carbamates
☐ PAH	Polynuclear Aromatic Hydrocarbon
☐ VOC	Volatile Organic Chemicals
☐ A/B/N	Acid/Base/Neutral
☐	%Lipids
☐	Endothall
☐	Clyphosate
☐	Paraquat/Diquat

CONTINUATION PAGE ____ of ____

SITE LOCATION: _____ FACILITY NO.: _____ COUNTY: _____

FIELD ID #	DATE TIME	DESCRIPTION OF SITE	MATRIX	NUMBER OF CONTAINERS	PRESER-VATION	ANALYSIS REQUESTED	pH	LAB USE ONLY
	Date: ___/___/___ Time: ☐ am ____:____ ☐ pm	AKGWA #: _____ - _____	☐ Liquid ☐ Solid ☐ Chemical ☐ Grab ☐ Composite ☐ Other	___ Glass 1000 ml ___ Plastic 1000 ml ___ VOA 40 ml ___ Glass 140 ml ___ 280 ml ___Other:	☐ Ice ☐ H_2SO_4 ☐ NaOH ☐ HNO_3 ☐ HCI ☐ Other	☐ **ABN** ☐ **VOC** ☐ **NH_3** ☐ **TO14** ☐ **TOC** ☐ **TSS** ☐ **CI** ☐ **HERB** ☐ **TKN** ☐ **BOD** ☐ **CN** ☐ **T. METALS** ☐ **O&G** ☐ **PAH** ☐ **FP** ☐ **PEST/PCB** ☐ **TDS** ☐ **ALK** ☐ **TCLP** ☐ **N/P PEST** ☐ **BTEX** ☐ **ORTHO/P** ☐ **OTHER:** _____		Sample # Report #
	Date: ___/___/___ Time: ☐ am ____:____ ☐ pm	AKGWA #: _____ - _____	☐ Liquid ☐ Solid ☐ Chemical ☐ Grab ☐ Composite ☐ Other	___ Glass 1000 ml ___ Plastic 1000 ml ___ VOA 40 ml ___ Glass 140 ml ___ 280 ml ___Other:	☐ Ice ☐ H_2SO_4 ☐ NaOH ☐ HNO_3 ☐ HCI ☐ Other	☐ **ABN** ☐ **VOC** ☐ **NH_3** ☐ **TO14** ☐ **TOC** ☐ **TSS** ☐ **CI** ☐ **HERB** ☐ **TKN** ☐ **BOD** ☐ **CN** ☐ **T. METALS** ☐ **O&G** ☐ **PAH** ☐ **FP** ☐ **PEST/PCB** ☐ **TDS** ☐ **ALK** ☐ **TCLP** ☐ **N/P PEST** ☐ **BTEX** ☐ **ORTHO/P** ☐ **OTHER:** _____		Sample # Report #
	Date: ___/___/___ Time: ☐ am ____:____ ☐ pm	AKGWA #: _____ - _____	☐ Liquid ☐ Solid ☐ Chemical ☐ Grab ☐ Composite ☐ Other	___ Glass 1000 ml ___ Plastic 1000 ml ___ VOA 40 ml ___ Glass 140 ml ___ 280 ml ___Other:	☐ Ice ☐ H_2SO_4 ☐ NaOH ☐ HNO_3 ☐ HCI ☐ Other	☐ **ABN** ☐ **VOC** ☐ **NH_3** ☐ **TO14** ☐ **TOC** ☐ **TSS** ☐ **CI** ☐ **HERB** ☐ **TKN** ☐ **BOD** ☐ **CN** ☐ **T. METALS** ☐ **O&G** ☐ **PAH** ☐ **FP** ☐ **PEST/PCB** ☐ **TDS** ☐ **ALK** ☐ **TCLP** ☐ **N/P PEST** ☐ **BTEX** ☐ **ORTHO/P** ☐ **OTHER:** _____		Sample # Report #
	Date: / / Time: ☐ am ____:____ ☐ pm	AKGWA #: _____	☐ Liquid ☐ Solid ☐ Chemical ☐ Grab ☐ Composite ☐ Other	___ Glass 1000 ml ___ Plastic 1000 ml ___ VOA 40 ml ___ Glass 140 ml ___ 280 ml ___ Other:	☐ Ice ☐ H2SO4 ☐ NaOH ☐ HNO3 ☐ HCI ☐ Other	☐ **ABN** ☐ **VOC** ☐ **NH3** ☐ **TO14** ☐ **TOC** ☐ **TSS** ☐ **CI** ☐ **HERB** ☐ **TKN** ☐ **BOD** ☐ **CN** ☐ **T. METALS** ☐ **O&G** ☐ **PAH** ☐ **FP** ☐ **PEST/PCB TDS** ☐ ☐ **ALK** ☐ **TCLP** ☐ **N/P PEST BTEX** ☐ ☐ **ORTHO/P** ☐ **OTHER:**		Sample # Report #

Appendix E Kentucky Drinking Water Certified Laboratory List

(Two pages)

This list is maintained by the Kentucky Division of Water Drinking Water Branch and includes the State Primacy Laboratories (capable of analyzing all drinking water contaminants specified in 40 CFR) in bold type at the top of the first page and the Kentucky Certified Drinking Water Laboratories (certified by Kentucky to perform drinking water sample analysis for compliance purposes).

Kentucky Drinking Water Certified Laboratory List - 2011

LabID	Micro	Chem	Rads	LabName	LabAddress	LabCity	LabState	LabZipCode	LabPhone	LabFax
00036	**Yes**			**Morehead State University Microbiology Laboratory**	**150 University Blvd., Box 804**	**Morehead**	**KY**	**40351**	**(606) 783-2961**	**(606) 783-5045**
00041		**Yes**		**Environmental Services Branch / Central Lab**	**100 Sower Blvd., Suite 104**	**Frankfort**	**KY**	**40601**	**(502) 564-6120**	**(502) 564-8930**
00095		**Yes**		**Bureau Veritas North America, Inc.**	**3380 Chastain Meadows Parkway**	**Kennesaw**	**GA**	**30144**	**(770) 590-6706**	**(770) 499-7511**
90125		**Yes**	**Yes**	**TestAmerica - St. Louis**	**13715 Rider Trail North**	**Earth City**	**MO**	**63045**	**(314) 298-8566**	**(314) 298-8757**
90116	**Yes**	**Yes**		**Environmental Laboratories, Inc.**	**635 Green Road; P.O. Box 968**	**Madison**	**IN**	**47250**	**(812) 273-6699**	**(812) 273-5788**
00001	Yes	Yes		Louisville Water Company	550 South Third Street	Louisville	KY	40202	(502) 569-3600	(502) 569-0813
00003	Yes	Yes		Northern Kentucky Water District	700 Alexandria Pike	Ft. Thomas	KY	41075	(859) 441-0482	(859) 441-1863
00008	Yes			Hopkinsville Water Environment Authority	1000 Metcalfe Lane	Hopkinsville	KY	42240	(270) 887-4232	(270) 887-4151
00011	Yes			Kentucky American Water	2300 Richmond Road	Lexington	KY	40502	(859) 335-3670	(859) 335-3370
00013	Yes			Ashland Drinking Water Microbiology Laboratory	4040 Winchester Avenue	Ashland	KY	41101	(606) 327-2058	(606) 327-2070
00016	Yes	Yes		Paducah Water	P.O. Box 2377; 1800 North 8th Street	Paducah	KY	42002	(270) 442-2746	(270) 443-8933
00017	Yes			Frankfort Plant Board	P.O. Box 308; 200 Coffee Tree Road	Frankfort	KY	40601	(502) 352-4340	(502) 227-4130
00019	Yes			City Utilities Commission	1515 Cumberland Falls Highway	Corbin	KY	40701	(606) 528-5975	(606) 528-4848
00021	Yes			Henderson Water Utility	510 N. Water St.	Henderson	KY	42420	(270) 869-6591	(270) 826-2428
00024	Yes			Somerset Water Service	5400 S. Hwy 27; P.O. Box 989	Somerset	KY	42502	(606) 561-4626	(606) 561-6208
00030	Yes	Yes		McCoy & McCoy Laboratories Inc.	825 Industrial Road	Madisonville	KY	42431	(270) 821-7375	(270) 825-9200
00031	Yes			McCoy & McCoy Laboratories Inc.	1800 S. Kentucky Ave.	Paducah	KY	42001	(270) 444-6547	(270) 444-6572
00033	Yes	Yes		KY Division of Laboratory Services	100 Sower Blvd.; Suite 204	Frankfort	KY	40601	(502) 564-4446	(502) 564-7019
00034	Yes	Yes		Fort Knox Water Laboratory	DPW, Bldg 1205 Water Street	Fort Knox	KY	40121	(502) 624-5252	(502) 624-5251
00035	Yes	Yes		WATERS Laboratory	1906 College Heights Blvd. #61066	Bowling Green	KY	42101	(270) 745-5287	(270) 745-3102
00037	Yes			BGMU WTP Lab	16 Chestnut St.; P.O. Box 10300	Bowling Green	KY	42101	(270) 782-1200	(270) 782-4307
00039	Yes			Owensboro Municipal Utilities	4067 US HWY 60 E	Owensboro	KY	42303	(270) 926-3200	(270) 926-7433
00040	Yes			Microbac Laboratories, Inc.	2520 Regency Rd	Lexington	KY	40503	(859) 276-3506	(859) 278-5665
00044	Yes	Yes		Beckmar Environmental Lab	3251 Ruckriegel Pkwy.	Louisville	KY	40299	(502) 266-6533	(502) 266-6446
00050	Yes	Yes		McCoy & McCoy Laboratories, Inc	173 Island Creek Road	Pikeville	KY	41501	(606) 432-3104	(606) 432-3171
00053	Yes			Cardinal Laboratories, Inc.	104 North Street	Wilder	KY	41071	(859) 341-9989	(859) 341-5081
00060	Yes			Fouser Environmental Services at LWC	210 Lindsey Wilson Street	Columbia	KY	42728	(859) 753-4101	(270) 384-7303
00061	Yes	Yes		Fouser Environmental Services	165 Camden Avenue	Versailles	KY	40383	(859) 873-6211	(859) 873-3715
00062	Yes			City of Paris Microbiology Laboratory	525 High Street	Paris	KY	40361	(859) 987-2118	(859) 987-2123
00063	Yes			SMR Labs	200 N. 1st Street	Central City	KY	42330	(270) 754-9928	(270) 754-1288
00066	Yes			McCoy & McCoy Laboratories, Inc.	2456 Fortune Drive; Suite 160	Lexington	KY	40509	(859) 299-7775	(859) 299-7785
00074	Yes	Yes		Microbac Laboratories, Inc.	3323 Gilmore Industrial Blvd	Louisville	KY	40213	(502) 962-6400	(502) 962-6411
00076		Yes		McCall & Spero Environmental, Inc.	1831 Williamson Ct	Louisville	KY	40223	(502) 244-7135	(502) 244-7136
00078	Yes	Yes		Moss McGraw Environmental Laboratory, Inc.	503 A 5th Street; P.O. Box 915	Henderson	KY	42420	(270) 830-7075	(270) 830-7348
00079	Yes			Glasgow Water Company Micro Lab	1321 Narrows Road	Glasgow	KY	42141	(270) 646-2042	(270) 646-2042
00080	Yes	Yes		Appalachian States Analytical, LLC	P.O. Box 520	Shelbiana	KY	41562	(606) 437-5616	(606) 437-0615
00083	Yes			White Mills Laboratory	P.O. Box 10; Hwy 84 & Cave Rd.	White Mills	KY	42788	(270) 862-3213	(270) 862-3768
00084	Yes			Georgetown Water Laboratory	214 West Main Street; P.O. Box 640	Georgetown	KY	40324	(502) 863-7819	(502) 863-9284
00085	Yes			Richmond Water Lab	216 Bend Road; P.O. Box 700	WACO	KY	40385	(859) 369-5389	(859) 369-0091
00087	Yes	Yes		Logan \ Todd Regional Water	248 Tower St.; P.O. Box 400	Guthrie	KY	42234	(270) 483-6990	(270) 483-6691
00088	Yes			CH2M Hill PWS Ft. Campbell	1746 1st Street & KY Avenue; P.O. Box 595	Ft. Campbell	KY	42223	(931) 431-2036	(931) 431-0952

Kentucky Drinking Water Certified Laboratory List - 2011

LabID	Micro	Chem	Rads	LabName	LabAddress	LabCity	LabState	LabZipCode	LabPhone	LabFax
00089	Yes			Microbac Laboratories, Inc.	5309 Reidland Road	Paducah	KY	42003	(270) 898-3637	(270) 898-3666
00090	Yes			Western KY Regional Lab	169 2nd Street; P.O. Box 40	Hardin	KY	42048	(270) 437-4800	(270) 437-4805
00091	Yes			Barbourville Utility Commission Laboratory	202 Daniel Boone Drive	Barbourville	KY	40906	(606) 546-3189	(606) 545-4206
00093	Yes			Kentucky American Water - Plant C	16035 Hwy 127 South	Owenton	KY	40359	(859) 335-3670	(859) 335-3370
00094	Yes			REI Consultants Inc.; Mid-Ohio Valley Service Center	101 17th Street	Ashland	KY	41101	(606) 393-5027	(606) 393-5027
00201	Yes			Lawrenceburg Microbiology Lab	1536 Tyrone Road	Lawrenceburg	KY	40342	(502) 839-4011	(502) 839-9891
00249	Yes			Wood Creek Water Lab	984 Filter Plant Road	East Bernstadt	KY	40729	(606) 843-2458	(606) 878-9425
00255	Yes			McCreary County Water Lab.	158 Tom Robert Road; P.O. Box 488	Whitley City	KY	42653	(606) 376-2540	(606) 376-5507
90005		Yes		American Water	1115 South Illinios Street	Belleville	IL	62220	(618) 222-4060	(618) 235-6349
90010		Yes		Environmental Science Corp.	12065 Lebanon Road; P.O. Box 938	Mt. Juliet	TN	37122	(615) 758-5858	(615) 758-5859
90012		Yes		Lionville Laboratory	264 Welsh Pool Rd.	Exton	PA	19341	(610) 280-3000	(610) 280-3041
90018		Yes		ALLOWAY	1776 Marion Waldo Road	Marion	OH	43302	(740) 389-5991	(740) 389-1481
90023		Yes		TestAmerica - Chicago	2417 Bond Street	University Park	IL	60484	(708) 534-5200	(708) 534-5211
90026		Yes		National Testing Laboratories, Ltd.	556 South Mansfield St	Ypsilanti	MI	48197	(734) 483-8333	(734) 483-0340
90029		Yes		TestAmerica Buffalo	10 Hazelwood Drive	Amherst	NY	14228	(716) 691-2600	(716) 691-7991
90033			Yes	KNL Laboratory Services, Inc	2742 N. Florida Avenue	Tampa	FL	33602	(813) 229-2879	(813) 229-0002
90038		Yes		TestAmerica Nashville	2960 Foster Creighton Drive	Nashville	TN	37204	(615) 726-0177	(615) 726-3404
90039		Yes		REI Consultants, Inc.	225 Airport Industrial Rd; PO BOX 286	Beaver	WV	25813	(304) 255-2500	(304) 255-2572
90047		Yes		Environmental Testing and Consulting	2790 Whitten Road	Memphis	TN	38133	(901) 213-2400	(901) 213-2440
90048		Yes		Heritage Environmental Services	7901 W Morris St.	Indianapolis	IN	46231	(317) 390-3182	(317) 243-4384
90050		Yes		Pace Analytical Services - Florida	8 E. Tower Circle	Ormond Beach	FL	32174	(386) 672-5668	(386) 673-4001
90056		Yes	Yes	Underwriters Laboratories, Inc.	110 S. Hill Street	South Bend	IN	46617	(574) 233-4777	(574) 233-8207
90073		Yes		Broward Testing Laboratory LTD	4416 NE 11th Avenue	Ft. Lauderdale	FL	33334	(954) 776-7238	(954) 776-0689
90074		Yes		Maxxam Analytics	6740 Campobello Rd.	Mississauga	ON	L5N 2L8	(905) 817-5700	(905) 817-5777
90084		Yes		TestAmerica Savannah	5102 LaRoche Avenue	Savannah	GA	31404	(912) 354-7858	(912) 352-0165
90088		Yes		Lancaster Laboratories, Inc.	2425 New Holland Pike	Lancaster	PA	17601	(717) 656-2300	(717) 656-2681
90101		Yes		TestAmerica Knoxville	5815 Middlebrook Pike	Knoxville	TN	37921	(865) 291-3000	(865) 584-4315
90107		Yes	Yes	MWH Laboratories; A Division of MWH Americas, Inc.	750 Royal Oaks Drive; Suite 100	Monrovia	CA	91016	(626) 386-1100	(626) 386-1139
90115	Yes	Yes		Greater Cincinnati Water Works	5651 Kellogg Avenue	Cincinnati	OH	45230	(513) 624-5600	(513) 624-5670
90120		Yes		SGS North America, Inc.	5500 Business Drive	Wilmington	NC	28405	(910) 350-1903	(910) 350-1557
90124		Yes		Hampton - Clarke / Veritech	175 Rte. 46 West; Unit D	Fairfield	NJ	07004	(973) 244-9770	(973) 244-9787
90129		Yes	Yes	GEL Laboratories, LLC	2040 Savage Road	Charleston	SC	29407	(843) 556-8171	(843) 766-1178
90131		Yes		Accutest Laboratories	2235 US Route 130 S.	Dayton	NJ	08810	(732) 329-0200	(732) 329-3499
90132		Yes		Pace Analytical Services, Inc. - Columbus	1233 Dublin Rd	Columbus	OH	43215	(614) 486-5421	(614) 487-5478
90133			Yes	Pace Analytical Services, Inc. -Pittsburgh	1638 Roseytown Road	Greensburg	PA	15601	(724) 850-5600	(724) 850-5601
90137			Yes	ALS Laboratory Group	225 Commerce Drive	Fort Collins	CO	80524	(970) 490-1511	(970) 490-1522
90139		Yes	Yes	Benchmark Analytics, Inc.	4777 Saucon Creek Road	Center Valley	PA	18034	(610) 974-8100	(610) 974-8104
90142		Yes		Anatek Labs, Inc.	1282 Alturas Dr.	Moscow	ID	83843	(208) 883-2839	(208) 882-9246
90143		Yes		Microbac Laboratories Inc.	209 Senate Avenue; Suite 105W	Camp Hill	PA	17011	(717) 763-0582	(717) 214-1269
90144		Yes		Analytics Corporation	10329 Stony Run Lane	Ashland	VA	23005	(804) 365-3000	(804) 365-3002

Section 10 Attachments

Attachment A Drinking Water Parameters for Analysis

(Ten pages)

Attachment A documents are taken from the *Manual for the Certification of Laboratories Analyzing Drinking Water – Criteria and Procedures Quality Assurance* – Fifth Edition – EPA 815-R-05-004. January 2004. US Environmental Protection Agency – Office of Water, et.al.

Included are the following:

	PAGES
Radionuclide Contaminants	
Table VI-1 *Methods for Radionuclide Analysis CFR 141.25*	VI-14 to -15
Table VI-2 *Sample Handling, Preservation, and Instrumentation*	VI-16
Chemical Contaminants	
Table IV-6 *Sample Containers, Preservation and Holding Times For Regulated Parameters*	IV-23 to -26
Microbiological Contaminants	
List of Approved Analytical Methods	V-11 to -13

Table VI-1 Methods for Radionuclide Analysis CFR 141.25

Contaminant	Methodology	Reference (method or page number)									
		EPA[1]	EPA[2]	EPA[3]	EPA[4]	EPA[5]	SM[5]	ASTM[6]	USGS[7]	DOE[8]	Other
Naturally occurring											
Gross alpha[11] and beta	Evaporation	900.0	p 1	00-01	p 1		302, 7110 B	. . . . .	R-1120-76	. . . . .	
Gross alpha[11]	Co-precipitation	. . . . .	. . . . .	00-02	. . . . .		7110 C	. . . . .	. . . . .	. . . . .	
Radium 226	Radon emanation, Radiochemical	903.1 903.0	p 16 p 13	Ra-04 Ra-03	p 19		7500-Ra C 304, 305, 7500-Ra B	D 3454-97 D 2460-97	R-1141-76 R-1140-76	Ra-04	N.Y.[9]
Radium 228	Radiochemical	904.0	p 24	Ra-05	p 19		304, 7500-Ra D	. . . . .	R-1142-76	. . . . .	N.Y.[9] N. J.[10]
Uranium[12]	Radiochemical Fluorometric Alpha spectrometry Laser Phosphorimetry ICP-MS	908.0 908.1 . . . . 200.8[13]	. . . .	. . . . 00-07	. . . . p 33		7500-U B 7500-U C (17th Ed.) 7500-U C (18th, 19th, or 20th Ed.) 3125	. . . . . . D 2907-97 D 3972-97 D 5174-97 D5673-03	. . . . . . R-1180-76 R-1181-76 R-1182-76	. . . . . . U-04 U-02	
Man-made											
Radioactive cesium	Radiochemical Gamma ray spectrometry	901.0 901.1	p 4	. . . .	. . . . . . p 92		7500-Cs B 7120	D-2459-72 D 3649-91	R-1111-76 R-1110-76	. . . . . . 4.5.2.3	
Radioactive iodine	Radiochemical Gamma ray spectrometry	902.0 901.1	p 6 p 9	. . . .	. . . . . . p 92		7500-I B 7500-I C, 7500-I D 7120 (19th Ed.)	D 3649-91 D 4785-93	. . . .	. . . . . . 4.5.2.3	
Radioactive Strontium 89, 90	Radiochemical	905.0	p 29	Sr-04	p. 65		303, 7500-Sr B	. . . . .	R-1160-76	Sr-01 Sr-02	
Tritium	Liquid scintillation	906.0	p 34	H-02	p. 87		306, 7500-3H B	D 4107-91	R-1171-76	. . . . .	
Gamma emitters	Gamma ray Spectrometry	901.1 902.0 901.0	. . . . .	. . . . .	p 92		7120 7500-Cs B 7500-I B	D 3649-91 D 4785-93	R-1110-76	GA-01-R	

The procedures shall be performed in accordance with the documents listed below. The incorporation by reference of the following documents was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies of the documents may be obtained from the sources listed below. Information regarding obtaining these documents can be obtained from the Safe Drinking Water Hotline at 800-426-4791. Documents may be inspected at EPA's Drinking Water Docket, 401 M Street, SW., Washington, DC 20460 (Telephone: 202-260-3027); or at the Office of Federal Register, 800 North Capitol Street, NW., Suite 700, Washington, DC.

1. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", EPA 600/4-80-032 , August 1980. Available at U.S. Department of Commerce, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161 (Telephone 800-553-6847) , PB 80-224744.
2. "Interim Radiochemical Methodology for Drinking Water", EPA 600/4-75-008(revised), March 1976. Available at NTIS, ibid. PB 253258.
3. "Radiochemistry Procedures Manual", EPA 520/5-84-006, December 1987. Available at NTIS, ibid. PB 84-215581.
4. "Radiochemical Analytical Procedures for Analysis of Environmental Samples", March 1979. Available at NTIS, ibid. EMSL LV 053917.
5. "Standard Methods for the Examination of Water and Wastewater", 13th, 17th, 18th, 19th Editions, or 20th edition. 1971, 1989, 1992, 1995, 1998. Available at American Public Health Association, 1015 Fifteenth Street N.W., Washington, D.C. 20005. Methods 302, 303, 304, 305, and 306 are only in the 13th edition. Methods 7110B, 7110C, 7500-Ra B, 7500Ra C, 7500-Ra D, 7500-U B, 7500-Cs B, 7500-I B, 7500-I C, 7500-I D, 7500-Sr B, 7500-3H B are in the 17th, 18th, 19th and 20th editions. Method 7500-U C Fluorometric Uranium is only in the 17th edition, and 7500-U C Alpha spectrometry is only in the 18th 19th and 20th editions. Method 7120 is only in the 19th and 20th editions.
6. Annual Book of ASTM Standards, Vol. 11.02, 1999. Available at American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428.
7. "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments", Chapter A5 in Book 5 of Techniques of Water-Resources Investigations of the United States Geological Survey, 1977. Available at U.S. Geological Survey (USGS) Information Services, Box 25286, Federal Center, Denver, CO 80225-0425.
8. "EML Procedures Manual", 28th (1997) or 27th (1990) Edition, Volume I and II. Available at the Environmental Measurements Laboratory, U.S. Department of Energy (DOE), 376 Hudson Street, New York, NY 10014-3621.
9. "Determination of Ra-226 and Ra-228 (Ra-02)", January 1980, Revised June 1982. Available at Radiological Sciences Institute Center for Laboratories and Research, New York State Department of Health, Empire State Plaza, Albany, NY 12201.
10. "Determination of Radium 228 in Drinking Water", August 1980. Available at State of New Jersey, Department of Environmental Protection, Division of Environmental Quality, Bureau of Radiation and Inorganic Analytical Services, 9 Ewing Street, Trenton, NJ 08625.
11. Natural uranium and thorium-230 are approved as gross alpha calibration standards for gross alpha with co-precipitation and evaporation methods; americium-241 is approved with co-precipitation methods.
12. If uranium (U) is determined by mass, a 0.67 pCi/μg of uranium conversion factor must be used. This conservative factor is based on the 1:1 activity ratio of U-234 to U-238 that is characteristic of naturally occurring uranium.
13. "Methods for the Determination of Metals in Environmental Samples - Supplement I," EPA-600/R-94-111, May 1994. Available at NTIS, PB 94-184942.

Table VI-2: Sample Handling, Preservation, and Instrumentation

Parameter	Preservative[1]	Container[2]	Maximum Holding Time[3]	Instrumentation[4]
Gross Alpha	Conc. HCl or HNO_3 to pH <2[5]	P or G	6 mo	A, B, or G
Gross beta	Conc. HCl or HNO_3 to pH <2[5]	P or G	6 mo	A or G
Strontium-89	Conc. HCl or HNO_3 to pH <2[5]	P or G	6 mo	A or G
Strontium-90	Conc. HCl or HNO_3 to pH <2[5]	P or G	6 mo	A or G
Radium-226	Conc. HCl or[5] HNO_3 to pH <2	P or G	6 mo	A, B, D or G
Radium-228	Conc. HCl or HNO_3 to pH <2[5]	P or G	6 mo	A or G
Cesium-134	Conc. HCl to pH <2[5]	P or G	6 mo	A, C or G
Iodine-131	None	P or G	8 da	A, C or G
Tritium	None	G	6 mo	E
Uranium	Conc. HCl or HNO_3 to pH <2[5]	P or G	6 mo	A, B, F, H
Photon emitters	Conc. HCl or HNO_3 to pH <2[5]	P or G	6 mo	C

[1]It is recommended that the preservative be added to the sample at the time of collection unless suspended solids activity is to be measured. If the sample has to be shipped to a laboratory or storage area unpreserved, acidification of the sample (in its original container) may be delayed for a period not to exceed 5 days. A minimum of 16 hours must elapse between acidification and analysis.
[2]P = Plastic, hard or soft; G = Glass, hard or soft.
[3]Holding time is defined as the period from time of sampling to time of analysis. In all cases, samples should be analyzed as soon after collection as possible. If a composite sample is prepared, a holding time cannot exceed 12 months.
[4]A = Low background proportional system; B = Alpha and beta scintillation system; C = Gamma spectrometer [Ge(Hp) or Ge(Li)]; D = Scintillation cell system; E = Liquid scintillation system (section C.2.a); F = Fluorometer (section C.1.1); G = Low background alpha and beta counting system other than gas-flow proportional; H=Alpha spectrometry system.
[5]If HCl is used to acidify samples which are to be analyzed for gross alpha or gross beta activities, the acid salts must be converted to nitrate salts before transfer of the samples to planchets.

Table IV-6 Sample Containers, Preservation and Holding Times for Regulated Parameters

Parameter/ Method	Preservative	Sample Holding Time	Extract Holding Time and Storage Conditions	Suggested Sample Size	Type of Container
Metals (except Hg)	HNO_3 pH<2	6 months		1 L	Plastic or Glass
Mercury	HNO_3 pH<2	28 days		100 mL	Plastic or Glass
Alkalinity	Cool, 4C	14 days		100 mL	Plastic or Glass
Asbestos	Cool, 4C	48 hours		1 L	Plastic or Glass
Chloride	none	28 days		100 mL	Plastic or Glass
Residual Disinfectant	none	immediately		200 mL	Plastic or Glass
Color	Cool, 4C	48 hours		100 mL	Plastic or Glass
Conductivity	Cool, 4C	28 days		100 mL	Plastic or Glass
Cyanide	Cool, 4C, Ascorbic acid (if chlorinated), NaOH pH>12	14 days		1 L	Plastic or Glass
Fluoride	none	1 month		100 mL	Plastic or Glass
Foaming Agents	Cool, 4C	48 hours			
Nitrate (chlorinated)	Cool, 4C non-acidified	14 days		100 mL	Plastic or Glass
Nitrate (non chlorinated)	Cool, 4C, non-acidified	48 hours		100 mL	Plastic or Glass
Nitrite	Cool, 4C	48 hours		100 mL	Plastic or Glass
Nitrate+ Nitrite	H2SO4 pH<2	28 days		100 mL	Plastic or Glass
Odor	Cool, 4C	24 hours		200 mL	Glass
pH	none	immediately		25 mL	Plastic or Glass
o-Phosphate	Cool, 4C	48 hours		100mL	Plastic or Glass

Parameter/ Method	Preservative	Sample Holding Time	Extract Holding Time and Storage Conditions	Suggested Sample Size	Type of Container
Silica	Cool, 4C	28 days		100 mL	Plastic
Solids (TDS)	Cool, 4C	7 days		100 mL	Plastic or Glass
Sulfate	Cool, 4C	28 days		100 mL	Plastic or Glass
Temperature	none	immediately		1 L	Plastic or Glass
Turbidity	Cool, 4C	48 hours		100 mL	Plastic or Glass
502.2	Sodium Thiosulfate or Ascorbic Acid, 4C, HCl pH<2	14 days		40-120 mL	Glass with PTFE Lined Septum
504.1	Sodium Thiosulfate Cool, 4C,	14 days	4C, 24 hours	40 mL	Glass with PTFE Lined Septum
505	Sodium Thiosulfate Cool, 4C	14 days (7 days for Heptachlor)	4C, 24 hours	40 mL	Glass with PTFE Lined Septum
506	Sodium Thiosulfate Cool, 4C, Dark	14 days	4C, dark 14 days	1 L	Amber Glass with PTFE Lined Cap
507	Sodium Thiosulfate Cool, 4C, Dark	14 days(see method for exceptions)	4C, dark 14 days	1 L	Amber Glass with PTFE Lined Cap
508	Sodium Thiosulfate Cool, 4C, Dark	7 days (see method for exceptions)	4C, dark 14 days	1 L	Glass with PTFE Lined Cap
508A	Cool, 4C	14 days	30 days	1 L	Amber Glass with PTFE Lined Cap
508.1	Sodium Sulfite HCl pH<2 Cool, 4C	14 days (see method for exceptions)	30 days	1 L	Glass with PTFE Lined Cap
515.1	Sodium Thiosulfate Cool, 4C, Dark	14 days	4C, dark 28 days	1 L	Amber Glass with PTFE Lined Cap

Parameter/ Method	Preservative	Sample Holding Time	Extract Holding Time and Storage Conditions	Suggested Sample Size	Type of Container
515.2	Sodium Thiosulfate or Sodium Sulfite HCl pH<2 Cool, 4C, Dark	14 days	≤4C, dark 14 days	1 L	Amber Glass with PTFE Lined Cap
515.3	Sodium Thiosulfate Cool, 4C, Dark	14 days	≤4C, dark 14 days	50 mL	Amber Glass with PTFE Lined Cap
515.4	Sodium Sulfite, dark, cool ≤10C fro first 48 hr. ≤6C thereafter	14 days	≤0C 21 days	40 mL	Amber glass with PTFE lined septum
524.2	Ascorbic Acid or Sodium Thiosulfate HCl pH<2, Cool 4C	14 days		40-120 mL	Glass with PTFE Lined Septum
525.2	Sodium Sulfite, Dark, Cool, 4C, HCl pH<2	14 days (see method for exceptions)	≤4C 30 days	1 L	Amber Glass with PTFE Lined Cap
531.1, 6610	Sodium Thiosulfate, Monochloroacetic acid, pH<3, Cool, 4C	Cool 4C 28 days		60 mL	Glass with PTFE Lined Septum
531.2	Sodium Thiosulfate, Potassium Dihydrogen Citrate buffer to pH 4, dark, ≤10C for first 48 hr, ≤6C thereafter	28 days		40 mL	Glass with PTFE Lined Septum
547	Sodium Thiosulfate Cool, 4C	14 days(18 mo.frozen)		60 mL	Glass with PTFE Lined Septum

Parameter/ Method	Preservative	Sample Holding Time	Extract Holding Time and Storage Conditions	Suggested Sample Size	Type of Container
548.1	Sodium Thiosulfate (HCl pH 1.5-2 if high biological activity) Cool, 4C, Dark	7 days	≤4C 14 days	≥ 250 mL	Amber Glass with PTFE Lined Septum
549.2	Sodium Thiosulfate, (H_2SO_4 pH<2 if biologically active) Cool, 4C, Dark	7 days	21 days	≥ 250mL	High Density Amber Plastic or Silanized Amber Glass
550, 550.1	Sodium Thiosulfate Cool, 4C, HCl pH<2	7 days	4C, Dark 550, 30 days 550.1, 40 days	1 L	Amber Glass with PTFE Lined Cap
551.1	Sodium Sulfite, Ammonium Chloride, pH 4.5-5.0 with phosphate buffer Cool, 4C	14 days		≥ 40 mL	Glass with PTFE Lined Septum
552.1	Ammonium chloride Cool, 4C, Dark	28 days	≤4C, dark 48 hours	250 mL	Amber Glass with PTFE Lined Cap
552.2	Ammonium chloride Cool, 4C, Dark	14 days	≤4C, dark 7 days ≤-10C 14 days	50mL	Amber Glass with PTFE Lined Cap
555	Sodium Sulfite HCl, pH≤2 Dark, Cool 4C	14 days		≥ 100 mL	Glass with PTFE Lined cap
1613	Sodium Thiosulfate Cool, 0-4C, Dark		Recommend 40 days	1 L	Amber Glass with PTFE Lined Cap

QC **5.1.7** Laboratories are encouraged to perform parallel testing between a newly approved test and another EPA-approved procedure for enumerating total coliforms for at least several months and/or over several seasons to assess the effectiveness of the new test for the wide variety of water types submitted for analysis. During this testing, spiking the samples occasionally with sewage or a pure culture may be necessary to ensure that some of the tests are positive.

5.1.8 A list of approved analytical methods (or proposed methods, where noted), applicable regulations, and section identifiers for each method is provided in the Table below.

Approved Methods	Part	Media	Method Citation[1]	TCR[2] (Detect)	SWTR[2] (Count)	GWR[2] (Detect)
Total Coliforms						
Fermentation broth method	5.2.2	LTB⇒BGLB Broth	SM 9221B,C	X	X	
	5.2.3	P-A Broth ⇒ BGLB Broth	SM 9221D	X		
Enzyme substrate method	5.3.2	Colilert®, Colilert-18®	SM 9223	X	X	
	5.3.2	Colisure®	SM 9223	X		
	5.3.2	Readycult® or Fluorocult LMX®		X		
	5.3.2	E*Colite®		X		
	5.3.2	Colitag®		X		
Membrane filter method	5.4.2	M-Endo or LES-Endo ⇒ LTB, BGLB Broth	SM 9222B,C	X	X	
	5.4.2	MI Medium	SM 9222	X	X	
	5.4.2	m-ColiBlue 24®		X		
	5.4.2	Chromocult®		X		
	5.4.2	Coliscan®		X	X	
Fecal Coliforms						
Fermentation broth method	5.2.4	LTB or P/A broth ⇒ EC broth	(SM 9221B,D) SM 9221E	X	X	
	5.2.4	A-1 broth	SM 9221E		X	
Membrane filter method	5.2.4	M-Endo medium ⇒ EC broth	(SM 9222B) SM 9221E	X	X	
	5.4.2	mFC	SM 9222D		X	

Approved Methods	Part	Media	Method Citation[1]	TCR[2] (Detect)	SWTR[2] (Count)	GWR[2] (Detect)
Escherichia coli						
Enzyme substrate method	5.3.2	Colilert® or Colilert-18®	SM 9223	X		X
	5.3.2	Colisure®	SM 9223	X		X
	5.3.2	E*Colite®		X		X
	5.3.2	Readycult® or Fluorocult LMX®		X		
	5.3.3	LTB, P/A broth, M-Endo ⇒ EC-MUG	(SM 9221B,D; SM 9222B) SM 9221F	X		X
	5.3.2	Colitag®		X		
Membrane filter method	5.4.2	MI Medium	SM 9222	X		X
	5.4.2	m-ColiBlue24®		X		X
	5.4.2	Chromocult®		X		
	5.4.2	Coliscan®		X		
	5.4.3	M-Endo or LES Endo ⇒ NA-MUG	(SM 9222B) → SM 9222G	X		X
Enterococci[3]						
Enzyme substrate method	5.3.4	Enterolert	ASTM D6503-99			X
Fermentation broth method	5.2.5	Azide Dextrose ⇒ BEA/BHI	SM 9230B			X
Membrane filter method	5.4.4	mE ⇒EIA m-Enterococcus	SM 9230C			X
	5.4.4	mEI	EPA 1600			X
Heterotrophic Bacteria						
Pour plate method	5.5	Plate count agar	SM 9215B		X	
Multiple enzyme substrate	5.5	SimPlate®			X	
Pour plate, spread plate, or membrane filter methods	5.5	R2A		X[4]		

Approved Methods	Part	Media	Method Citation[1]	TCR[2] (Detect)	SWTR[2] (Count)	GWR[2] (Detect)
Male-Specific and Somatic Coliphage[3]						
Agar plate method	5.6.2	Two-Step Enrichment	EPA 1601			X
	5.6.3	Single Agar Layer	EPA 1602			X

[1] SM = *Standard Methods for the Examination of Water and Wastewater*, 18th, 19th or 20th edition.
[2] TCR=Total Coliform Rule (40 CFR 141.21 (f)), SWTR=Surface Water Treatment Rule (40 CFR 141.74 (a)). For convenience, analytical methods approved for the TCR and SWTR are reproduced in Appendix G.
[3] GWR = Based on proposed Groundwater Rule (65 FR 30194, dated 5/10/2000). Until the GWR is promulgated, laboratories will not be certified for enterococci or coliphage methods.
[4] For possible use if system operates under a variance to the TCR.

5.2 Fermentation broth methods

5.2.1 General

5.2.1.1 The water level of the water bath should be above the upper level of the medium in the culture tubes.

5.2.1.2 A Dri-bath incubator is acceptable if the specified temperature requirement can be maintained in all tube locations used.

5.2.2 Multiple Tube Fermentation Technique (for detecting total coliforms in drinking water and enumerating total coliforms in source water)

5.2.2.1 For drinking water samples: Various testing configurations can be used (CFR141.21(f)(3), see Appendix G), as long as a total sample volume of 100 mL is examined for each test.

5.2.2.2 For source water samples: Laboratories must use at least 3 series of 5 tubes each with appropriate sample dilutions of source water (e.g., 0.1 mL, 0.01 mL, 0.001 mL).

5.2.2.3 Media

5.2.2.3.1 Lauryl tryptose broth (LTB) (also known as lauryl sulfate broth) must be used in the presumptive test and 2% brilliant green lactose bile broth (BGLBB) in the confirmed test. Lactose broth (LB) may be used in lieu of LTB (40 CFR 141.21(f)(3)) if the laboratory conducts at least 25 parallel tests between this medium and LTB using the waters normally tested and this comparison demonstrates that the false-positive rate and false-negative rate for total coliforms, using LB, is less than 10%. This comparison should be documented and the records retained. The final pH must be 6.8±0.2 for LTB, and 7.2±0.2 for 2% BGLBB.

5.2.2.3.2 The test medium concentration must be adjusted to compensate for the sample volume so that the resulting medium after sample addition is single strength. Optionally, if a single 100-mL sample volume is used, the inverted vial should be replaced with an acid indicator (bromcresol purple) to prevent problems associated with gas bubbles in large inverted tubes. The media must be autoclaved at 121°C for 12-15 minutes.

5.2.2.3.3 Sterile medium in tubes must be examined to ensure that the inverted vials, if used, are free of air bubbles and are at least one-half to two-thirds covered after the water sample is added.

5.2.2.4 After the medium is inoculated, it must be incubated at 35°±0.5°C for 24±2 hours. If no gas or acid is detected, it must be incubated for another 24 hours (total incubation time 48±3 hours).

Attachment B Maximum Contaminant Levels (MCLs)

(Four pages)

Attachment B information was extracted from the USEPA website "*Drinking Water Contaminants*" located at: http://water.epa.gov/drink/contaminants/index.cfm

Maximum Contaminant Levels for Drinking Water Contaminants

Microorganisms		
Contaminant	**MCLG[1] (mg/L)[2]**	**MCL or TT[1] (mg/L)[2]**
Cryptosporidium	zero	TT [3]
Giardia lamblia	zero	TT[3]
Heterotrophic plate count	n/a	TT[3]
Legionella	zero	TT[3]
Total Coliforms (including fecal coliform and *E. Coli*)	zero	5.0%[4]
Turbidity	n/a	TT[3]
Viruses (enteric)	zero	TT[3]
Disinfection Products		
Contaminant	**MCLG[1] (mg/L)[2]**	**MCL or TT[1] (mg/L)[2]**
Bromate	zero	0.010
Chlorite	0.8	1.0
Haloacetic acids (HAA5)	n/a[6]	0.060[7]
Total Trihalomethanes (TTHMs)	--> n/a[6]	--> 0.080[7]
Disinfectants		
Contaminant	**MCLG[1] (mg/L)[2]**	**MCL or TT[1] (mg/L)[2]**
Chloramines (as Cl_2)	MRDLG=4[1]	MRDL=4.0[1]
Chlorine (as Cl_2)	MRDLG=4[1]	MRDL=4.0[1]
Chlorine dioxide (as ClO_2)	MRDLG=0.8[1]	MRDL=0.8[1]
Inorganic Chemicals		
Contaminant	**MCLG[1] (mg/L)[2]**	**MCL or TT[1] (mg/L)[2]**
Antimony	0.006	0.006
Arsenic	0[7]	0.010 as of 01/23/06
Asbestos (fiber >10 micrometers)	7 million fibers per liter	7 MFL
Barium	2	2
Beryllium	0.004	0.004
Cadmium	0.005	0.005
Chromium (total)	0.1	0.1
Copper	1.3	TT[7]; Action Level=1.3
Cyanide (as free cyanide)	0.2	0.2
Fluoride	4.0	4.0
Lead	zero	TT[7]; Action Level=0.015
Mercury (inorganic)	0.002	0.002
Nitrate (measured as Nitrogen)	10	10
Nitrite (measured as Nitrogen)	1	1
Selenium	0.05	0.05
Thallium	0.0005	0.002
Organic Chemicals		
Contaminant	**MCLG[1] (mg/L)[2]**	**MCL or TT[1] (mg/L)[2]**
Acrylamide	zero	TT[8]
Alachlor	zero	0.002
Atrazine	0.003	0.003
Benzene	zero	0.005
Benzo(a)pyrene (PAHs)	zero	0.0002
Carbofuran	0.04	0.04
Carbon tetrachloride	zero	0.005
Chlordane	zero	0.002
Chlorobenzene	0.1	0.1
2,4-D	0.07	0.07

Dalapon	0.2	0.2
1,2-Dibromo-3-chloropropane (DBCP)	zero	0.0002
o-Dichlorobenzene	0.6	0.6
p-Dichlorobenzene	0.075	0.075
1,2-Dichloroethane	zero	0.005
1,1-Dichloroethylene	0.007	0.007
cis-1,2-Dichloroethylene	0.07	0.07
trans-1,2-Dichloroethylene	0.1	0.1
Dichloromethane	zero	0.005
1,2-Dichloropropane	zero	0.005
Di(2-ethylhexyl) adipate	0.4	0.4
Di(2-ethylhexyl) phthalate	zero	0.006
Dinoseb	0.007	0.007
Dioxin (2,3,7,8-TCDD)	zero	0.00000003
Diquat	0.02	0.02
Endothall	0.1	0.1
Endrin	0.002	0.002
Epichlorohydrin	zero	TT[8]
Ethylbenzene	0.7	0.7
Ethylene dibromide	zero	0.00005
Glyphosate	0.7	0.7
Heptachlor	zero	0.0004
Heptachlor epoxide	zero	0.0002
Hexachlorobenzene	zero	0.001
Hexachlorocyclopentadiene	0.05	0.05
Lindane	0.0002	0.0002
Methoxychlor	0.04	0.04
Oxamyl (Vydate)	0.2	0.2
Polychlorinated biphenyls (PCBs)	zero	0.0005
Pentachlorophenol	zero	0.001
Picloram	0.5	0.5
Simazine	0.004	0.004
Styrene	0.1	0.1
Tetrachloroethylene	zero	0.005
Toluene	1	1
Toxaphene	zero	0.003
2,4,5-TP (Silvex)	0.05	0.05
1,2,4-Trichlorobenzene	0.07	0.07
1,1,1-Trichloroethane	0.20	0.2
1,1,2-Trichloroethane	0.003	0.005
Trichloroethylene	zero	0.005
Vinyl chloride	zero	0.002
Xylenes (total)	10	10
Radionuclides		
Contaminant	**MCLG[1] (mg/L)[2]**	**MCL or TT[1] (mg/L)[2]**
Alpha particles	none[7] ---------- zero	15 picocuries per Liter (pCi/L)
Beta particles and photon emitters	none[7] ---------- zero	4 millirems per year
Radium 226 and Radium 228 (combined)	none[7] ---------- zero	5 pCi/L
Uranium	zero	30 ug/L as of 12/08/03

Source: http://water.epa.gov/drink/contaminants/index.cfm

Notes:

1. Definitions:

Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.

Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

Maximum Residual Disinfectant Level Goal (MRDLG) - The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

Treatment Technique (TT) - A required process intended to reduce the level of a contaminant in drinking water.

Maximum Residual Disinfectant Level (MRDL) - The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

2. Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million.

3. EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

Cryptosporidium: Unfiltered systems are required to include Cryptosporidium in • their existing watershed control provisions.

- Giardia lamblia: 99.9% removal/inactivation
- Viruses: 99.99% removal/inactivation
- Legionella: No limit, but EPA believes that if Giardia and viruses are removed/inactivated, according to the treatment techniques in the Surface Water Treatment Rule, Legionella will also be controlled.
- Turbidity: For systems that use conventional or direct filtration, at no time can turbidity (cloudiness of water) go higher than 1 nephelolometric turbidity unit NTU), and samples for turbidity must be less than or equal to 0.3 NTU in at least 95 percent of the samples in any month. Systems that use filtration other than the conventional or direct filtration must follow state limits, which must include turbidity at no time exceeding 5 NTU.
- HPC: No more than 500 bacterial colonies per milliliter.
- Long Term 1 Enhanced Surface Water Treatment: Surface water systems or (GWUDI) systems serving fewer than 10,000 people must comply with the applicable Long
- Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, Cryptosporidium removal requirements, updated watershed control requirements for unfiltered systems).
- Long Term 2 Enhanced Surface Water Treatment Rule This rule applies to all surface water systems or ground water systems under the direct influence of surface water. The rule targets additional Cryptosporidium treatment requirements for higher risk systems and includes provisions to reduce risks from uncovered finished water storage facilities and to ensure that the systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts.
- Filter Backwash Recycling; The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

4. No more than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or E. coli if two

consecutive TC-positive samples, and one is also positive for E.coli fecal coliforms, system has an acute MCL violation.

5. Fecal coliform and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Disease-causing microbes (pathogens) in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems.

6. Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- Trihalomethanes: bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L): chloroform (0.07mg/L).
- Haloacetic acids: dichloroacetic acid (zero); trichloroacetic acid (0.02 mg/L); monochloroacetic acid (0.07 mg/L). Bromoacetic acid and dibromoacetic acid are regulated with this group but have no MCLGs.

7. Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

8. Each water system must certify, in writing, to the state (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows:

- Acrylamide = 0.05% dosed at 1 mg/L (or equivalent)
- Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent)

Additional information can be garnered by calling the EPA's Safe Drinking Water Hotline: (800) 426-4791 or http://water.epa.gov/drink/contaminants/index.cfm.

Secondary Maximum Contaminant Level

National Secondary Drinking Water Regulations are non-enforceable guidelines regarding contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply.

Secondary Maximum Contaminant Levels

Contaminant	Secondary Maximum Contaminant Level
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/

Source: http://water.epa.gov/drink/contaminants/index.cfm