Hazen

Current Source Control, Operations, Maintenance, and Training for DPR

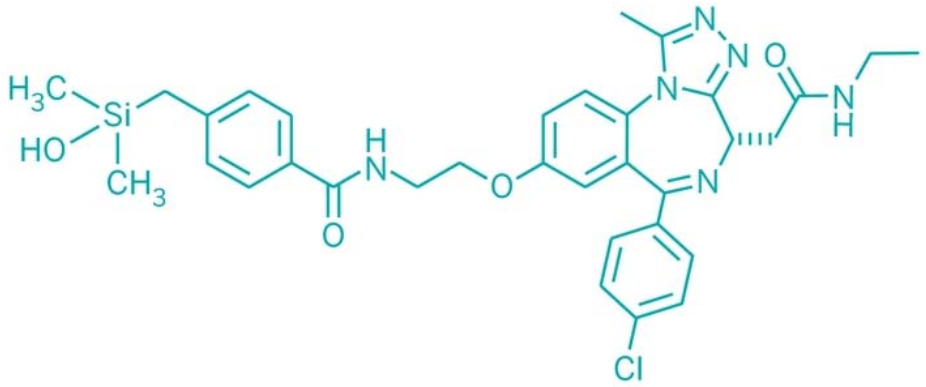
Ben Stanford, Ph.D.
Director of Applied Research and Corporate Reuse Practice Leader

Over 100,000,000 Registered Chemical Substances

On June 23, 2015, a compound to treat leukemia became the 100 millionth registered substance

75 million chemicals have been added in the past 10 years alone

http://cen.acs.org/articles/93/web/2015/06/Chemical-Abstracts-Service-Marks-Multiple.html



CAS Registry's 100 millionth substance

How Much Effort to Assess Toxicity and Treatment Per Compound?

It would take one person working 40 hours per week, 52 weeks per year, 385,000 years to evaluate this list at 8 hours per compound

At one hour per compound it would take 48,000 years

To do this in a reasonable time frame, you would need a staff of 4800 highly trained people working full time for 10 years

Future compounds are not even included in this assessment

High Volume Chemicals

What if we focus only on high volume chemicals like the MCHM responsible for the Charleston, WV spill and drinking water shutdown?

Hazen

Study: Chemical in W.Va. Spill More Toxic Than Thought

A chemical used to clean coal that leaked into the Elk River is even more potent than was stated.

Storage tanks are offloaded onto trucks in January in Charleston, W.Va., after the leak of a chemical known as MCHM into the Elk River.

By Alan Neuhauser | July 10, 2014 | 4:35 p.m. EDT + More

Data on High-Production Volume Chemicals Are Limited

MCHM does not appear on EPA's High Production Volume Information System

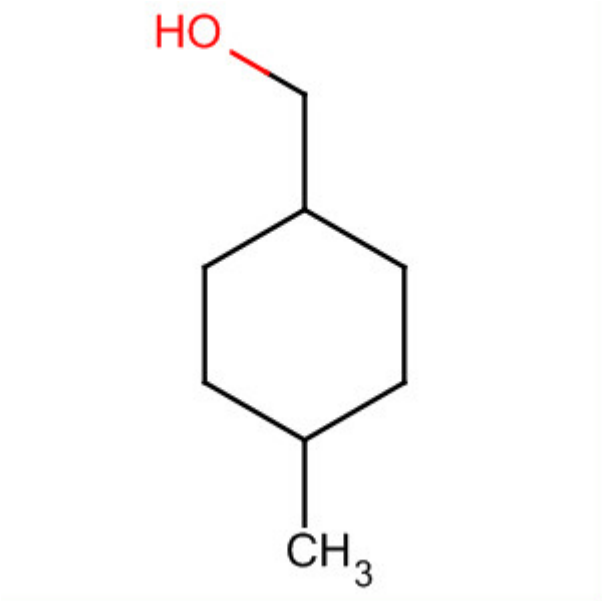
MCHM does not appear on EPA's high priority list for the Contaminant Candidate List Universe (7,000 compounds)

MCHM was in production before the Toxic Substances Control Act was enacted and is grandfathered (along with 62,000 additional compounds) from registry

MCHM does show up on the European Organization for Economic Cooperation and Development website in a list of 4638 high production chemicals (website updated in 2007)

MCHM is a Polar, Low Molecular Weight, Unreactive Chemical

MCHM would have had limited removal by RO or UV/AOP in a potable reuse system



Hazen

Significant Chemicals Impacting Drinking Water Systems

2015 Animas River Coal Ash Spill – EPA – Colorado

2014 Train Derailment and Crude Oil Spill, Lynchburg, VA

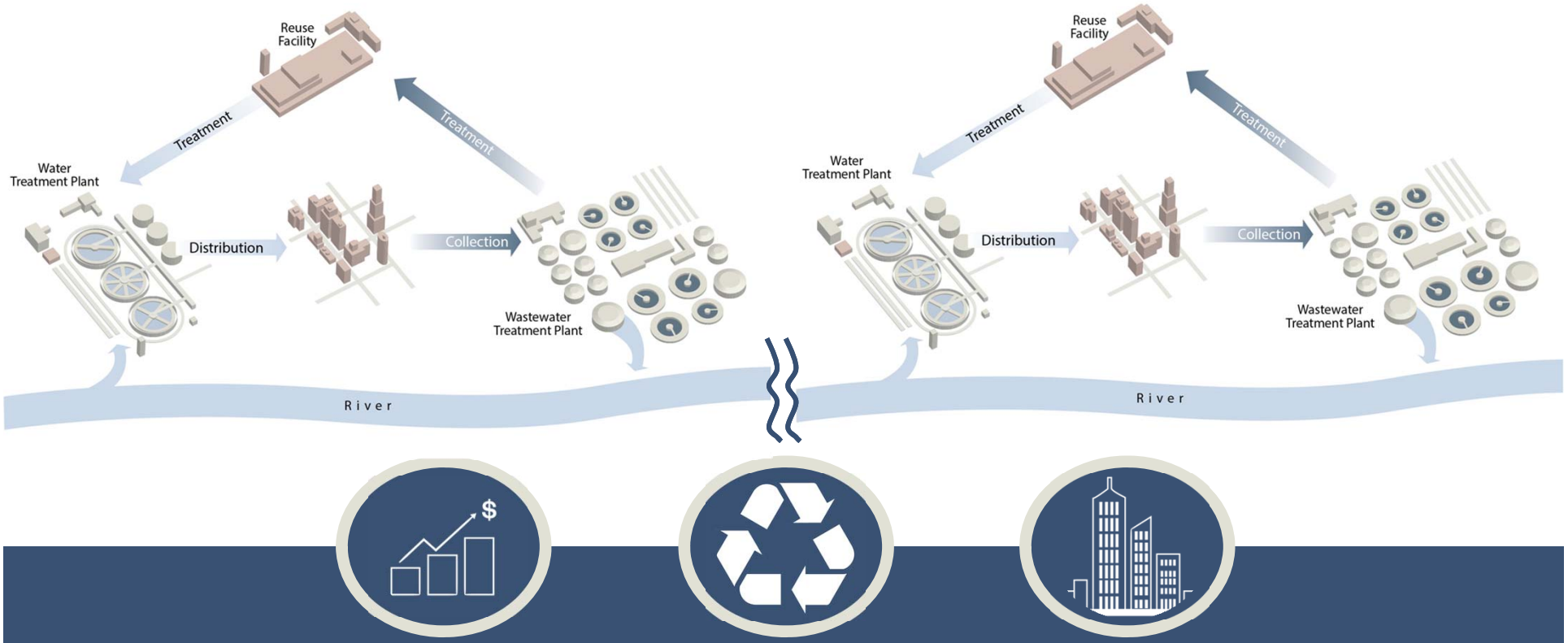
2014 Elk River MCHM Spill

2014 Dan River Coal Ash Spill, Eden, NC

2014 Toledo Cyanotoxins Event

2013 to Present, on-going 1,4- dioxane contamination of Cape Fear River, NC

We Cannot Let Fear of the Unknown Impede Progress



HACCP gives a framework to assess and manage risks

Tools for Assessing and Managing Risks in DPR

Source Control, Operations, Training

Building Confidence & Trust in DPR: WRRF-13-03 and 13-13

Can we trust the technology?

- Hazard Analysis and Critical Control Point (HACCP) methodology
- Reliability of critical control points (CCPs)
- Reliability of monitoring devices (Risk Priority Number approach)

Can we trust operations?

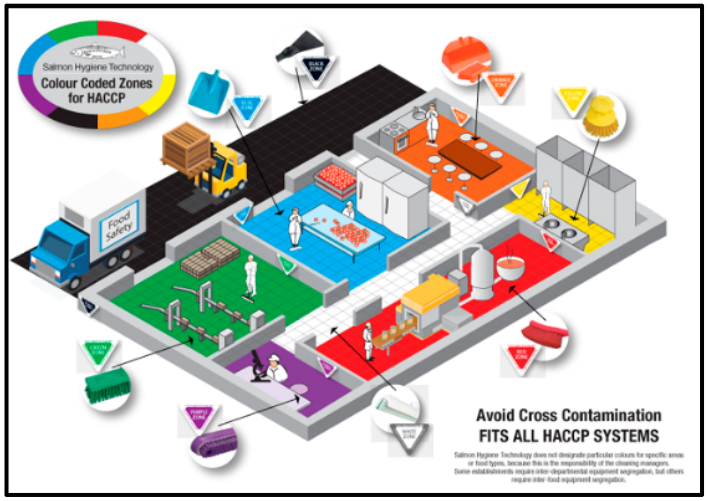
- Reliability and training of operations staff

Hazard Analysis and Critical Control Point (HACCP) History

Systematic preventative approach to Food Safety.

Focus on barriers – not end of pipe treatment

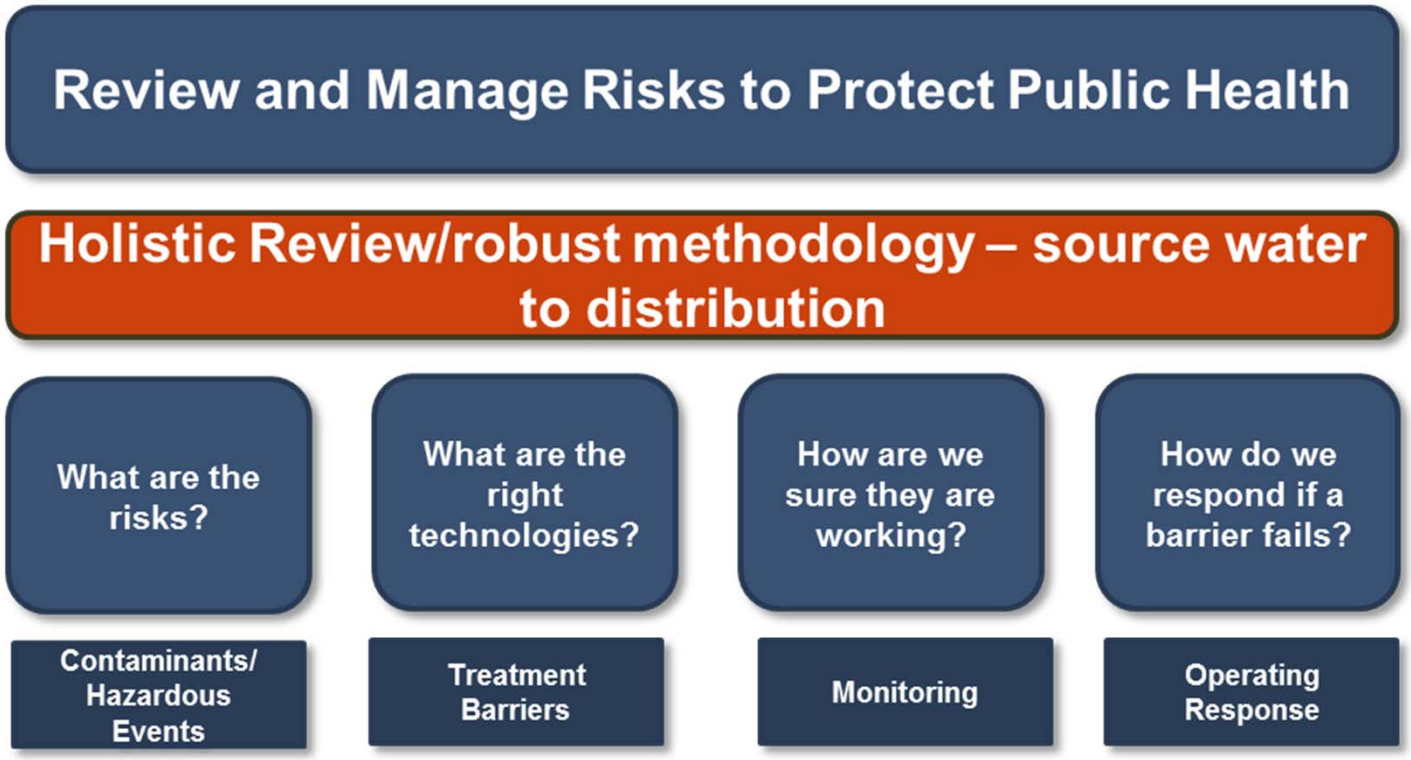
Conceived in 1960s by Pillsbury for NASA



Defined in ISO 22000 – Food Safety

WHO Uses "Water Safety Plan" to differentiate from food industry

What Does the CCP Approach Provide?

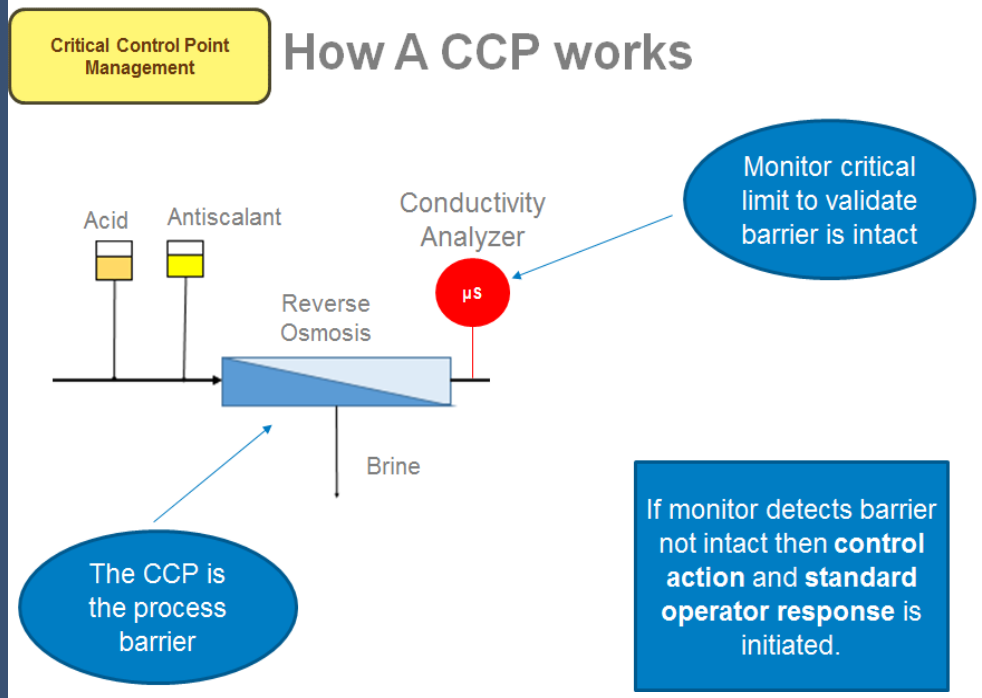


Focus is on health relevant contaminants.

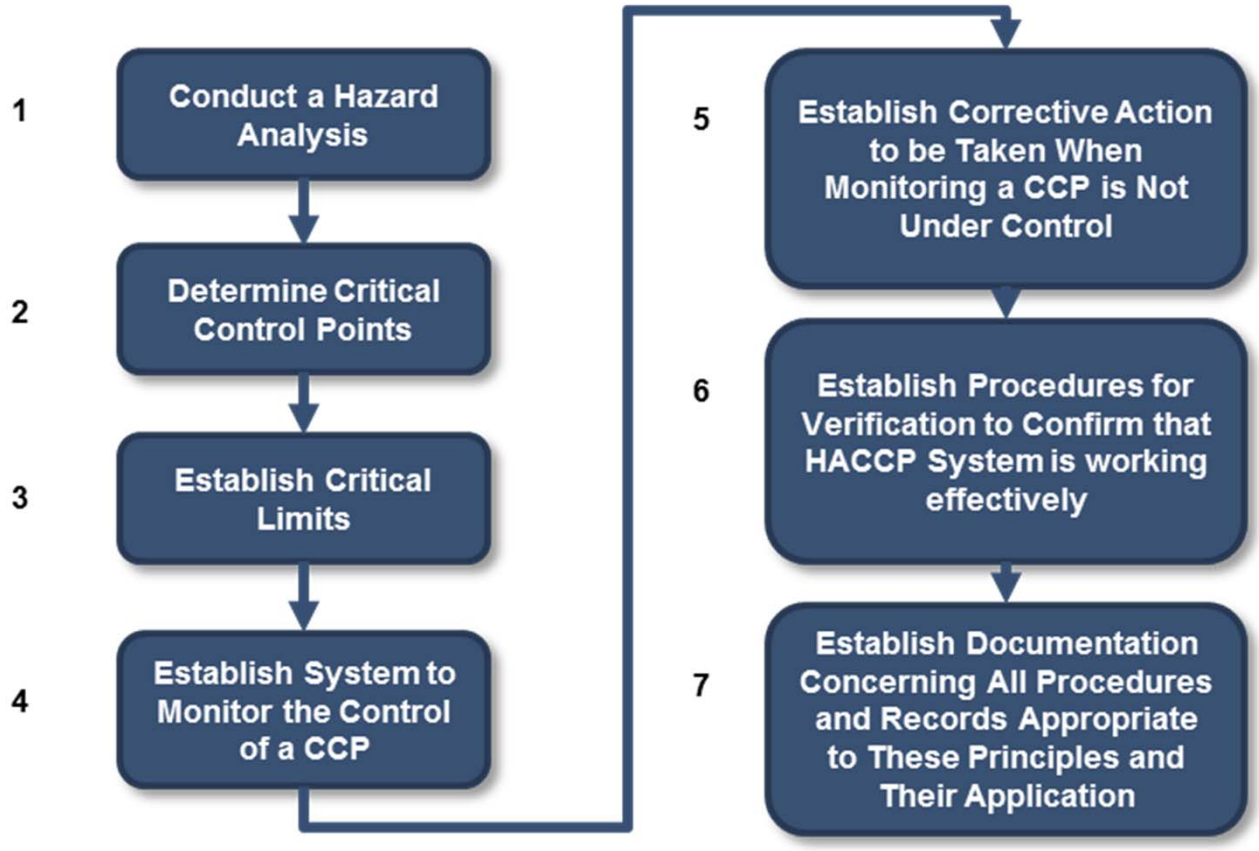
CCPs Defined

CCPs are points in the treatment process that are specifically designed to reduce, prevent, or eliminate a human health hazard and ***for which controls exist*** *to ensure the proper performance of that process.*

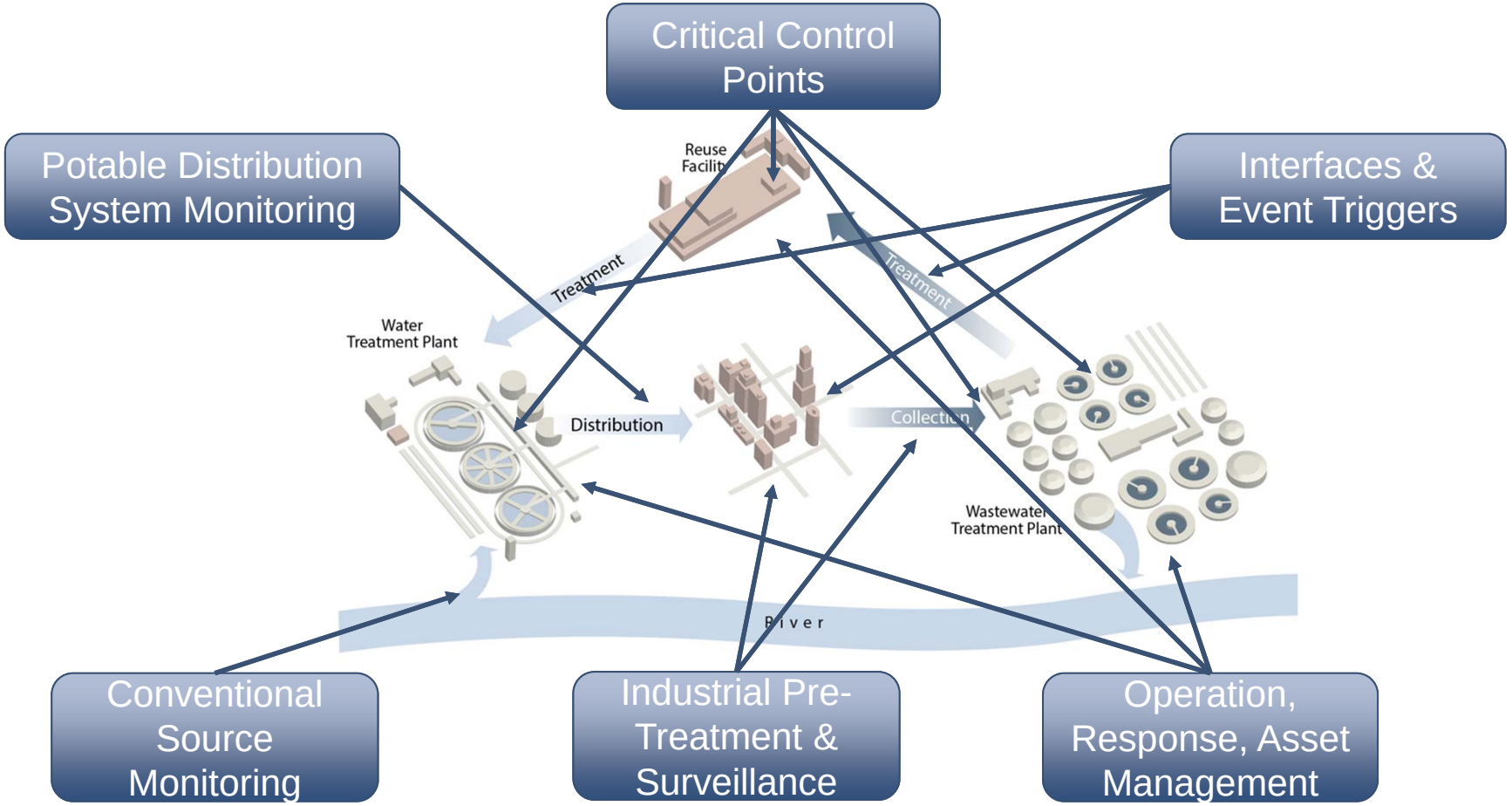
Hazen



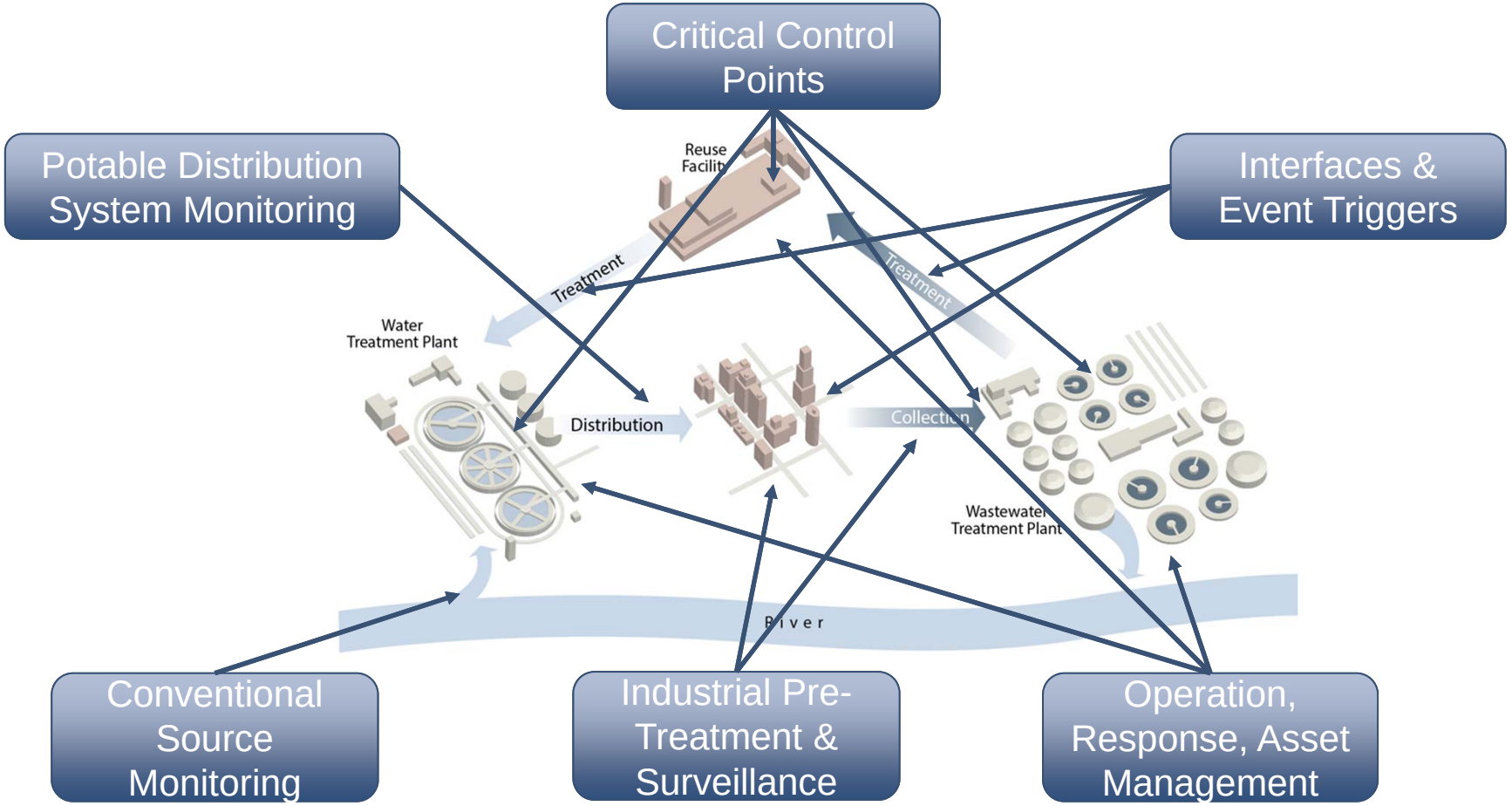
The 7 HACCP Principles



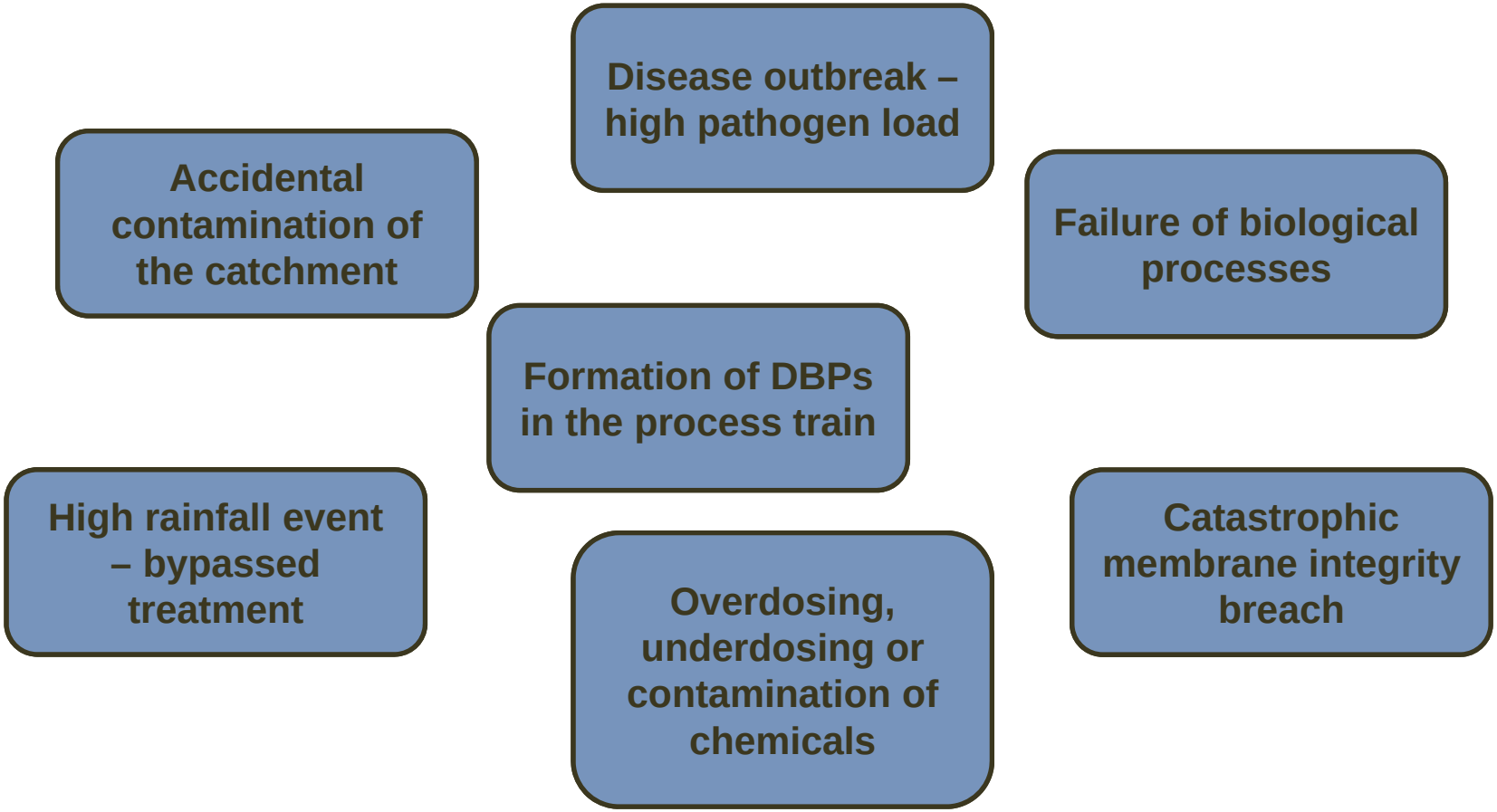
HACCP Applies To All Stages of Treatment from Collection to Distribution



HACCP Applies To All Stages of Treatment from Collection to Distribution

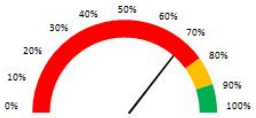


Identify Hazardous Events



Operations - Striking the Right Balance

OPERATING RISK



OPERATING COST

Public Health

Quality

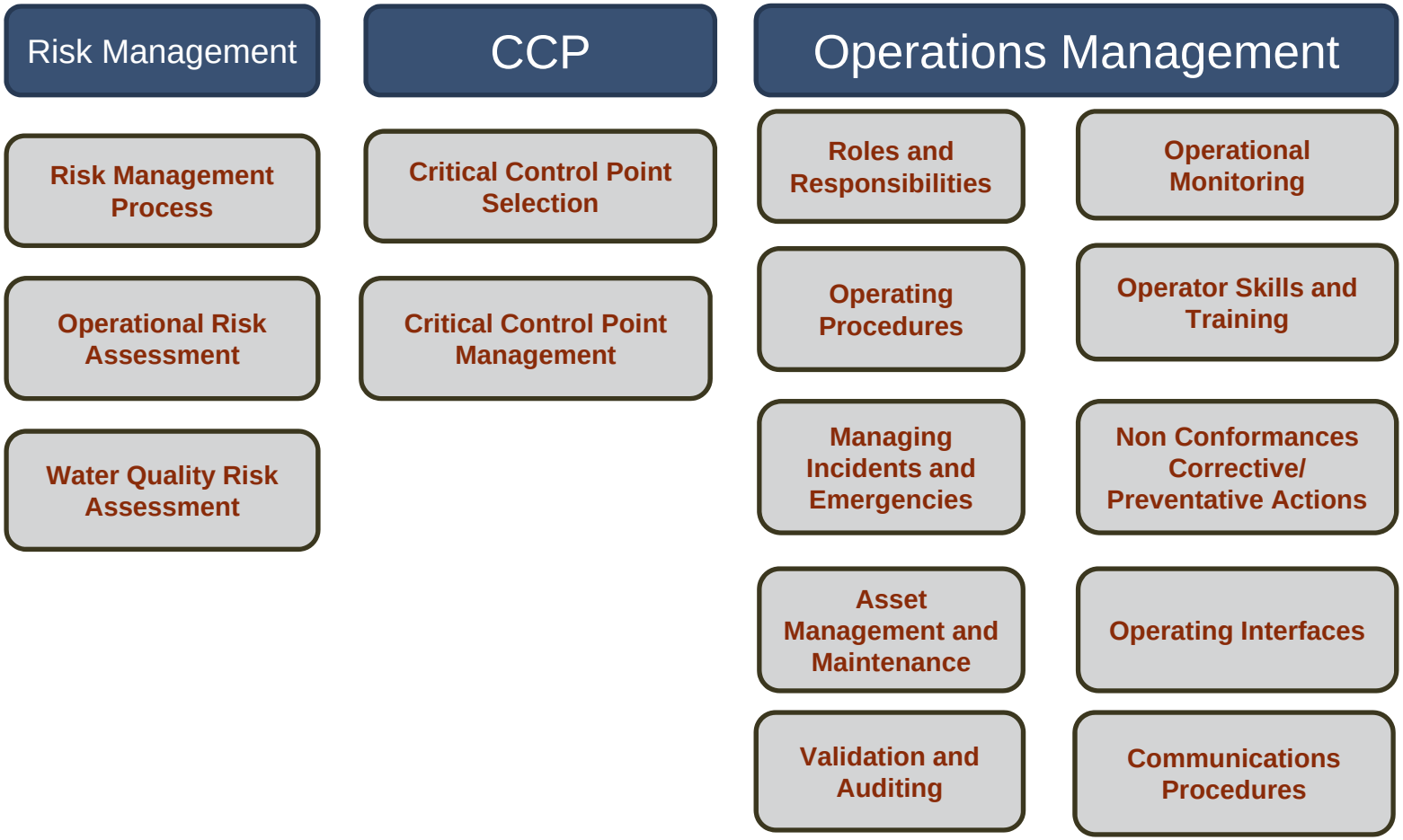
Production

Operator Effort

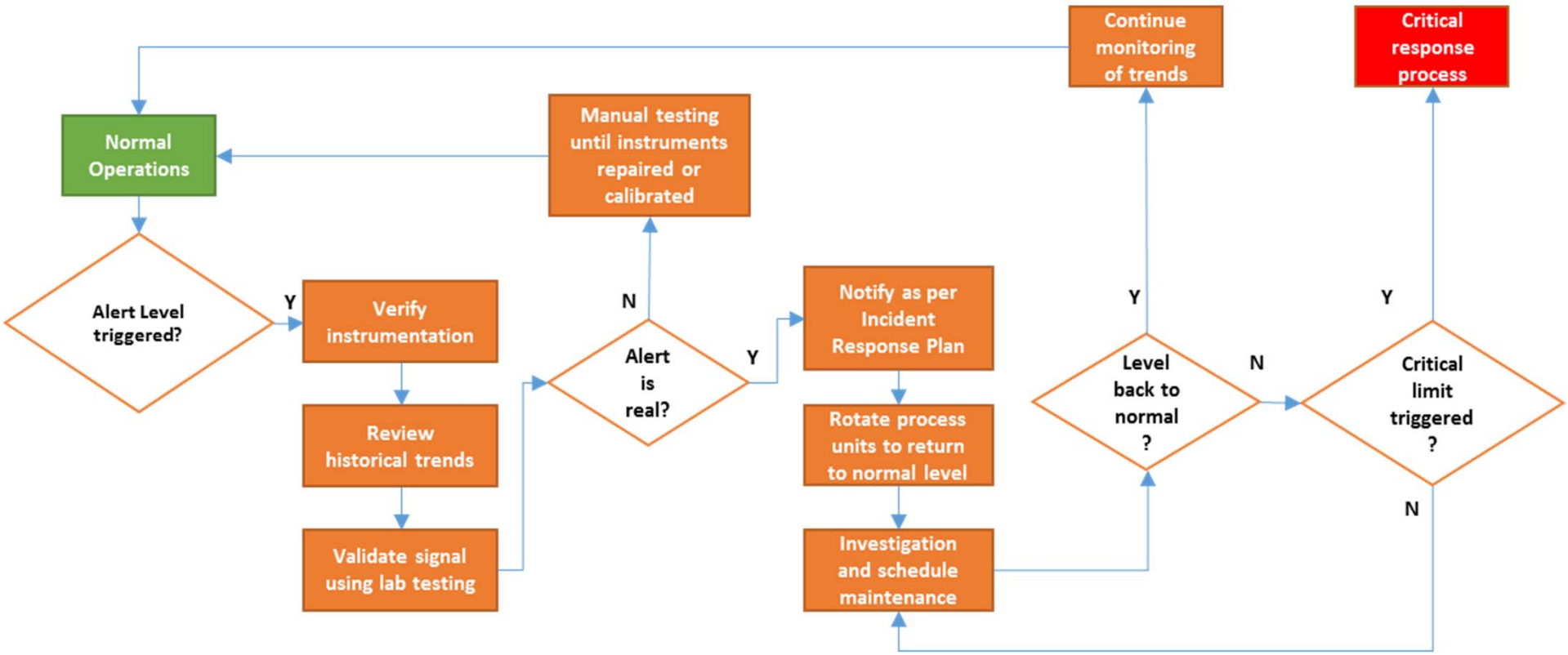
Chemicals and Energy

Asset Replacement

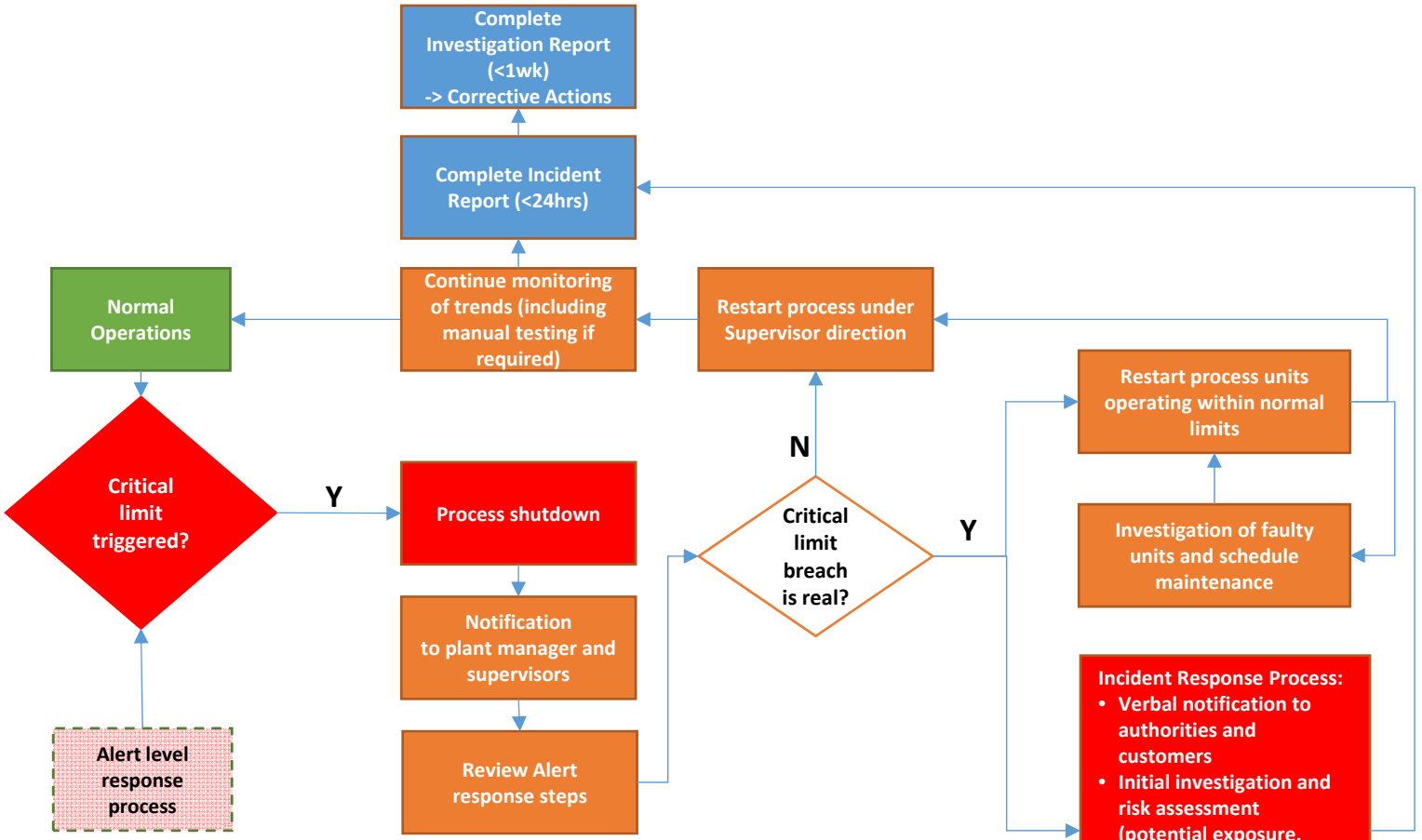
DPR Operations Management Plan



Clear Response Procedures to Aid Operations: Alerts



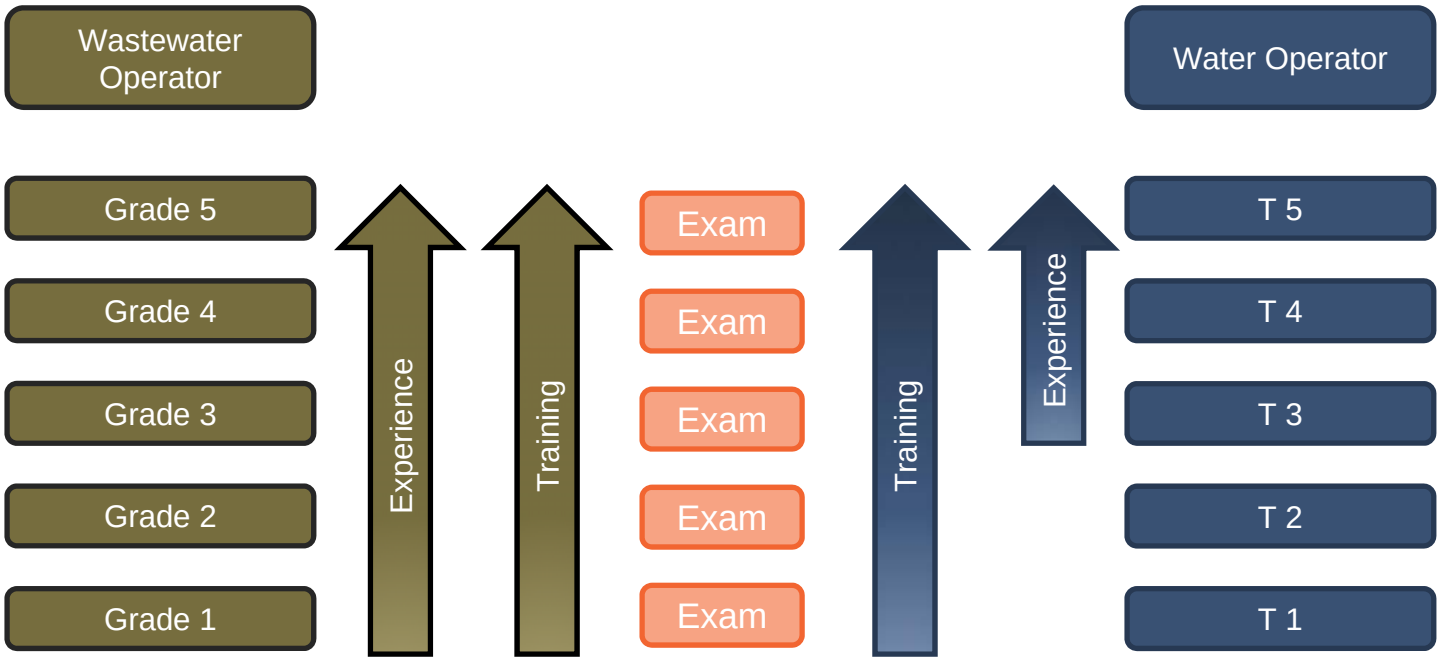
Clear Response Procedure to Aid Operations: Alarms



Certification – The Current CA Approach

Title 23 CCR, Division 3, Chapter 26

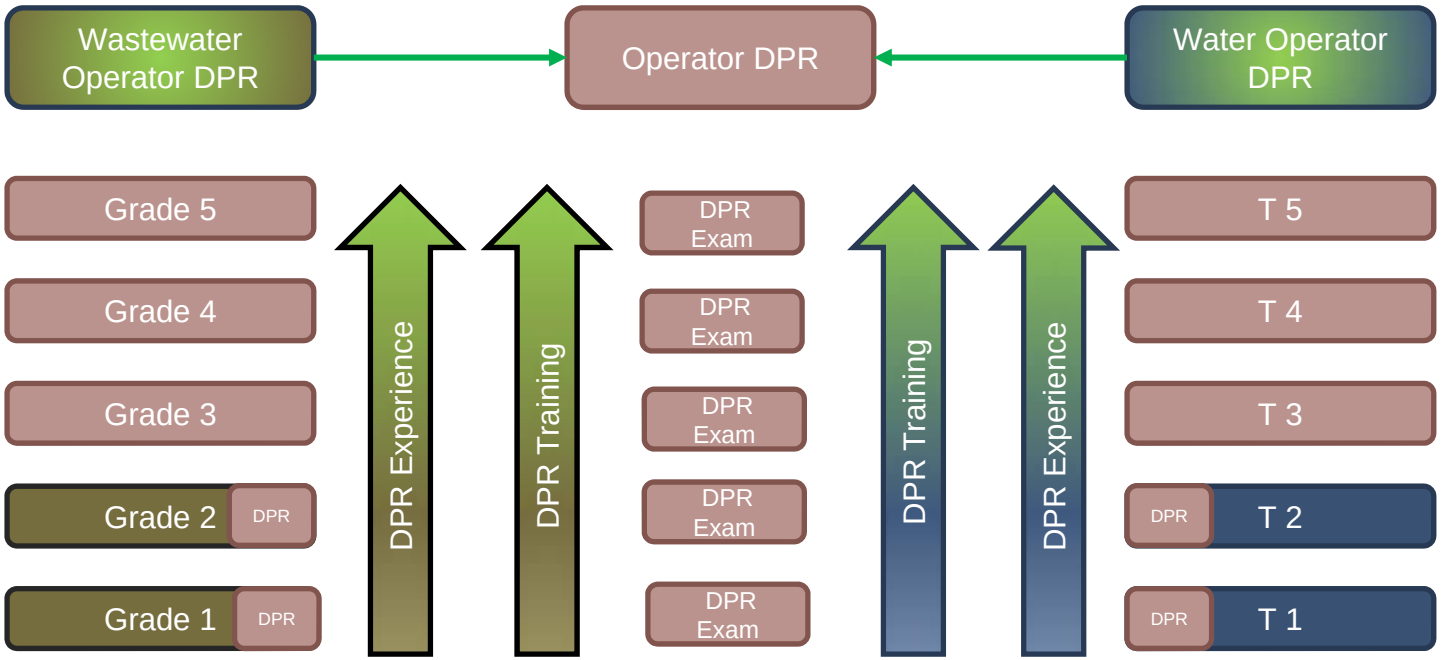
Title 22 CCR, Division 4, Chapter 13



A Potential Framework Integrating DPR

Leverage from existing pool of operators

Append to system – options for operators



What Key Technologies Should be Taught in Certification?

Should an agency operating only biological and membrane treatment processes require ozone and GAC technology training?

Should a non-membrane facility require knowledge of RO operations and response?

We might consider a tailored training approach that is directed by facility-specific needs such as:

(a) Source Water Risks

(b) Advanced Water Treatment Technology Use

Could we recommend a “menu” of training options?

Gaps and Strategies Moving Forward: Contaminants

CECs: From a chronic risk standpoint, single event excursions are not a major concern

HACCP framework informs assessment of acute and chronic risks, then provides a plan for managing risks

Within a DPR framework, we likely have more control (not less) than in conventional drinking water treatment

At the end of the day, the conventional supply may be a greater risk than DPR will ever be

Gaps and Strategies Moving Forward: Operations

Operations: Alerts, alarms, and subsequent response is only as good as the instrumentation informing the operators

Remember, “shutdown” does not mean loss of water supply

- Just because one process unit fails to meet limits doesn’t mean the entire bank of processes has failed (e.g., duty units, standby units, backup units)

Maintenance (asset management) is key; guidance how many spares to keep and how often to replace equipment is needed

Some training material exists for advance processes but not all

- Pedagogical methods may be as important as content itself
- Educators AND engineers need to work together on curriculum

Research Topics / Primer Questions

Verification: Do selected processes manage risks identified?

(Are the risks real and health-relevant?)

Validation: Do selected processes perform as expected?

Process Monitoring & Controls—do we have surrogate measures for process performance?

Questions?

bstanford@hazenandsawyer.com

Hazen