Category 3 Property Loss: Clearing Murky Waters
Case Study 1: Loss Description

- Homeowner awoke to water on Kitchen and surrounding floors
- Potable water filtration release
- Shut off within minutes/hours
- No pets, no external intrusion, no waste plumbing release
- Mitigation began on DOL
Case Study 1: Mitigation

- Structural drying, air movers and HEPA filtration initiated on DOL
- Some unsalvageable material removal
- Assignment of Loss Benefits (AOB)
- “The customer has been advised by us to obtain a professional indoor air quality testing firm to analyze the discoloration, fungi, mildew, mold observed in this area(s) of the structure.”
Case Study 1: Microbial Assessment

- State-licensed mold assessor
- “Water Intrusion Evaluation and Category of Loss Determination with Remediation Protocol”
- 3 bacterial swab samples, lab analysis reported coliform bacteria, no *E. coli*
- “Because of the presence of bacteria, this is defined as a Category 3 water loss.”
- Protocol: Remove all water-damaged materials 2 feet past damage
Case Study 1: Remediation

- Contractor interpreted the protocol as “remove everything”
- 19 days of structural drying, etc.
- Liberal biocide application and upcharges based on Category 3
- Remediation Invoice (no reconstruction): $67,459.00
Case Study 2: Loss Description

- Homeowner away 4 hours, returned to water on floors
- Release attributed to dishwasher water supply
- Mitigation and dry-out initiated on the DOL
- Small dog lived in the residence
- Obvious building envelope water intrusion
Case Study 2: Mitigation

- Water extraction, de-humidification, carpet pad removal
- Remediation/Restoration contractor, recommended an IAQ consultant
- “While… stabilizing the affected areas within the residence, the remediation contractor needed more information to accurately assure that all areas affected were addressed.”
Case Study 2: Microbial Assessment

- State-licensed mold assessor
- 3 spore trap fungal air samples
- 2 bacterial swab samples
- No independent determination of water source, assumed dishwasher water supply
- Lab analysis positive for coliform bacteria, negative for *E. coli*
- “Category 2 water loss”
- Declared “contaminated property”
Case Study 2: Remediation

- Remediation Contractor response: remove everything
  - All cabinets
  - All base trim
  - All floor coverings including ceramic tile
IICRC Water Release Categories

• Institute of Inspection Cleaning and Restoration Contractors (IICRC) – S500 Standard and Reference Guide for Professional Water Restoration
• Categories “refer to the range of contamination in water, considering both its originating source and its quality after it contacts materials present on the job site.”
• Contamination – the presence of undesired substances; the identity, location and quantity of which are not reflective of a normal indoor environment, and may produce adverse health effects…
Category 1 Water

- Originates from a sanitary water source; no substantial risk from dermal, ingestion or inhalation exposure
- Broken water supply, tub/sink overflow, appliance water supply malfunction, rainwater, toilet bowls and tanks
- May deteriorate: contact contents and materials, soils and contaminants, type and use of structure, general housekeeping
Category 2 Water

- Contains significant contamination; may cause discomfort or sickness if contacted or consumed
- Can contain unsafe levels of microorganisms or their nutrients, organic or inorganic matter
- Discharge/overflow from dishwashers or washing machines; toilet overflow (not beyond trap, no feces); hydrostatic seepage, aquariums and water beds
- May deteriorate for the same reasons cited in Category 1
Category 3 Water

- Grossly contaminated and can contain pathogenic, toxigenic or other harmful agents.
- Sewage; toilet backflow beyond trap; seawater and surface water intrusion; “other contaminated water” such as wind-driven rain
- Not just pathogens; organic matter, chemicals, heavy metals
Category 3 Contaminants

- Toxic substances, chemicals, pesticides
- Organic debris – soils, sediments, fecal runoff
- Biological contaminants/pathogens
  - Protozoans
  - Viruses
  - Bacteria
- Most of the pathogens cause gastrointestinal diseases (diarrhea), thus found in sewage
- IICRC discusses potential aerosolization, but primary concern is fecal oral transmission
IICRC Category Confusion

- Categorization is somewhat nebulous: water or site conditions?
- Can there ever be a Category 1 release?
- Each category may degrade to Category 3; interpretation is subjective
- Little or no consideration of specific contaminant risk
- Intent of categorization: guideline or prescriptive?
- “An environment can be contaminated as a result of pre-existing damage. The remediation procedures should not vary regardless of whether contaminants are the result of water intrusion or pre-existing damage.” Insurance providers are obligated to pre-loss conditions
Pathogenic Protozoans

- Single-celled, eukaryotic, heterotrophic organisms
- Aquatic environments or very wet soils
- Ingested or transmitted by a host vector
- *Giardia, Cryptosporidium, Cyclospora, Microsporidia, Isospora*, amoebas
- Highly susceptible to desiccation
Viruses

- Non-living sub-microscopic infectious structure composed of a nucleic acid and proteins
- Cannot reproduce independently in water; must have a host cell
- UV light, heat, some chemicals and pH extremes
- Numerous viral pathogens; gastroenteritis to respiratory, blood-borne and neurological diseases
- Hepatitis (A, B, C), norovirus, rotavirus, adenovirus, parvovirus, coxsackie virus, coronavirus
Bacteria

- 2 Biological Domains based on cell structure: Prokaryotes and Eukaryotes
- 6 Kingdoms of Life, 2 are the bacteria: Archaea and Eubacteria (Bacteria)
- Bacteria are simple single-celled organisms; anucleate, no organelles; reproduce by binary fission
- Small cells: Eukaryote cells may be 20x larger
- Require wet environments – $A_w \geq 0.95$
- Most successful organism, world-wide ubiquity
Coliform Bacteria

• Coliform bacteria - broad group of rod-shaped Gram-negative bacteria
  • Ferment lactose → lactic acid & CO₂
  • Non-sporulating; rarely (if ever) pathogenic, low health risk
  • Common in soil, vegetation and aquatic environments
  • Indicator of unsanitary conditions and general cleanliness
• Fecal Coliforms – universally abundant in the intestinal tracts of endothermic animals
  • Specifically of fecal origin
  • May indicate presence of other pathogens
Escherichia coli

- *E. coli* is one of many species of coliform and more specifically fecal coliform bacteria
- Of the several dozen strains of *E. coli*, most are non-virulent and commensal
- Virulent strains may produce a variety of diseases
- Very young children are most susceptible
- May indicate presence of other fecal-borne pathogens
Coliform Characterization

Coliform Bacteria

Fecal Coliforms

E. coli
Pathogenic Bacteria

- **Aeromonas spp.** – common aquatic pathogen; contaminated food or water
- **Campylobacter jejuni** – most prevalent diarrheal organism; contaminated food
- **Clostridium spp.** – “food poisoning” and diarrhea; some antibiotic resistant strains; tetanus and botulism
- **Escherichia coli** O157:H7 – severe diarrhea with enteric hemorrhaging, septicemia and kidney failure; possibly fatal
Pathogenic Bacteria

• *Helicobacter pylori* – gastrointestinal irritation and ulceration
• Mycobacteria – numerous strains with varying pathogenicity; lung infections and pneumonitis
• *Salmonella spp.* – “food poisoning” and diarrhea; common in poultry products, also other fresh foods; Typhoid fever; millions infected, thousands hospitalized, hundreds die
Pathogenic Bacteria

- *Shigella spp.* – worldwide dysentery cases in millions annually, fatal in hundreds of thousands; fecal oral direct transmission
- *Vibrio spp.* – causes cholera, wound infection (“flesh-eating”), septicemia; fish and shellfish, contaminated water
Pathogen Viability

• Protozoans must remain hydrated in an aqueous environment; desiccation within minutes to hours
• Virus viability varies widely
  • Favor in low temperatures
  • UV light degrades proteins and nucleic acids
  • pH 5 – 9 favorable; diminished viability outside this range
  • Ideal some remain days to months, others only minutes to hours
  • Dry surfaces: some minutes, others 10 – 14 days
• Bacteria survivability also highly variable
  • Prefer conditions similar to above; must have water
  • Most desiccate in hours to a few days
  • Ideal conditions may be weeks to months
Sewage Notes

- Raw sewage is approximately 99% water, and the majority of the organisms in sewage are not a risk to human health

- Source influences pathogenicity
  - Single-family vs. high density
  - Industrial, food processing
  - Hospitals pose greatest risk
Bacterial Sampling

- Tests for presence of bacteria in drinking water and food processing to satisfy EPA and health code requirements
- Revised Total Coliform Rule (RTCR) established maximum contaminant level (MCL); low threshold due to high likelihood of ingestion
- Modified techniques for sampling in occupied dwellings
- Sterile swabs usually stored in tube with Butterfield’s solution
- Defined sample area; typically 4” x 4”
- Field blanks recommended for control purposes
Laboratory Analysis

• Qualitative vs. quantitative analysis
• Quantitative methods provide actual or estimated counts
  • Serial dilutions from sample filter collection
  • Colony forming units (CFU) from cultures
  • Most probable number (MPN) from serial test tubes
Laboratory Analysis

- Presence/Absence tests (PA) only detect presence of bacteria, a qualitative assay
  - Test reagent inoculated with field sample
  - Reagent has nutrients to promote replication, amplify metabolites for detection
  - Color change, turbidity, gas liberation (+) coliform bacteria
  - Florescence (+) *E. coli*
- Lab controls: stock cultures used to demonstrate reagent efficacy
Interpreting Lab Results

- Individual PA tests do not quantify; only indicate presence of viable bacteria in the sampled location
- Must have a quantitative analysis to indicate degree of contamination
- Labs typically offer coliform/E. coli PA test without distinguishing fecal coliforms; least expensive test
- Coliform bacteria are commonplace
  - Origin may be indefinite
  - Indicator of general cleanliness, not sepsis
- *E. coli* strong indicator of human fecal contaminants, possible presence of other pathogens; some microbiologists propose testing for *Bacteroides* as a surrogate
Got Pets?

- May spread coliforms and fecal coliforms, but *E. coli* is highly improbable and not from their GI tracts
Case Study Reviews

• Case Study 1: potable water filtration rupture, immediate remediation
  • IICRC Category?
  • Material removal supported?
• Case Study 2: dishwasher water supply, initial remediation same day
  • IICRC Category?
  • Material removal (floor tiles, carpet, etc.)?
• Lab analyses for PA swab sample testing (+) for coliform bacteria in both Cases; your response?
Conclusions

• IICRC water categorization is based on contamination, but the definition may be misinterpreted or misappropriated
• A contaminant in drinking water is not the same as on a floor; exposure risk is dramatically different
• Presence of coliform bacteria (+ PA test) is not “grossly contaminated”
• Potable water release with immediate mitigation and remedial efforts is a Category 1 release
• The IICRC S500 does not prescribe specific material removal based on water release category or bacterial sample results; cleaning is an option
Conclusions

• IICRC makes no reference to specific bacterial genera or classification of bacterial groups regarding water contamination categories
• IICRC: Contamination – the presence of undesired substances; the identity, location and quantity of which are not reflective of a normal indoor environment, and may produce adverse health effects…
• Coliforms are not pathogenic, and most E. coli are not; presence of Coliforms may be reflective of a normal indoor environment in some locations; a PA test does not quantify
Bibliography


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Questions?

Jeff Wilemon
Jeffrey.Wilemon@ghd.com