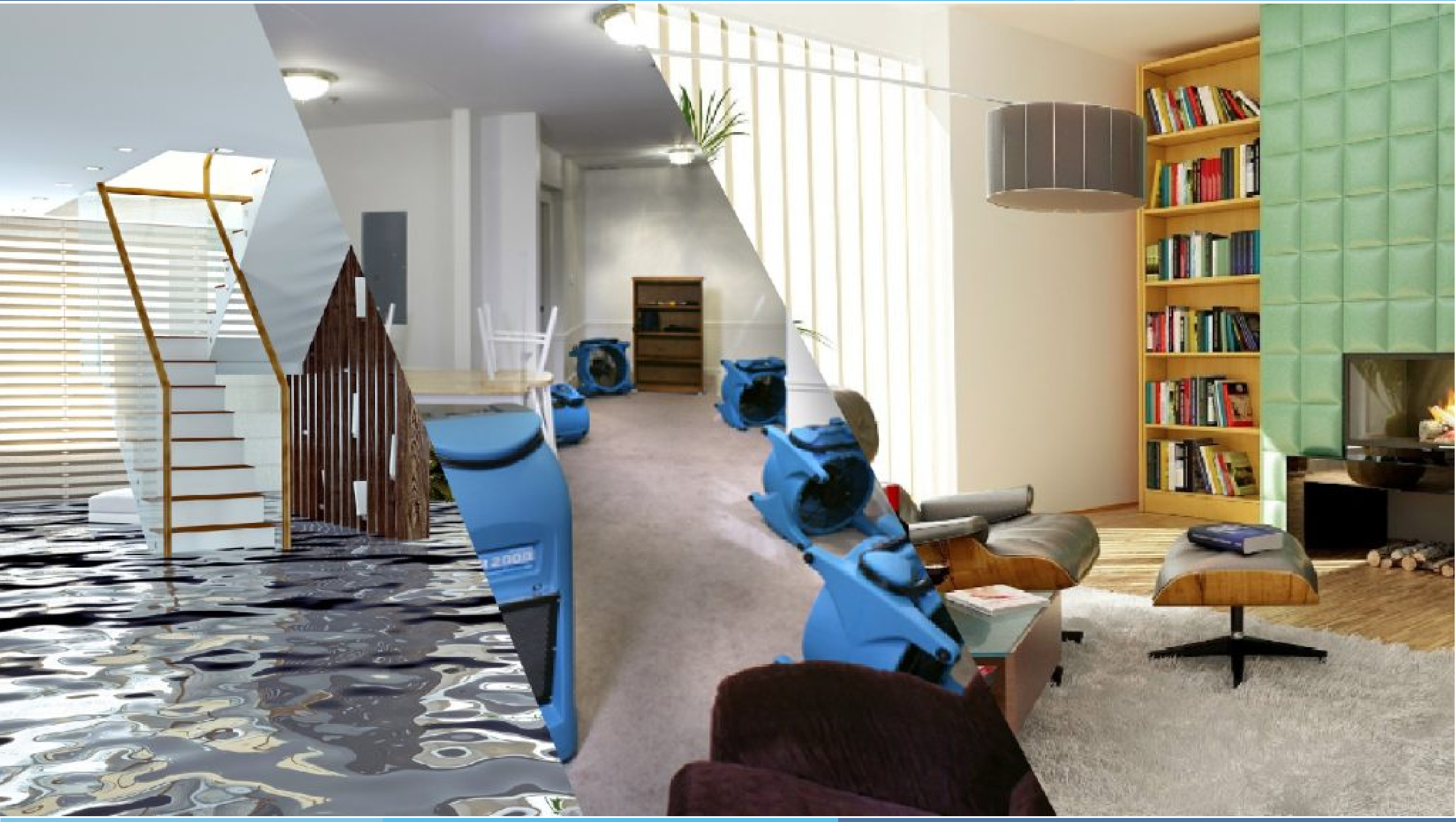
Water Damage Restoration

Guide to the Risks of Structural Drying



Drying, Disinfection, & Remediation Science
For Contractors, PAs, Attorneys

Caution for Homeowners

Insurance Carriers promote what they term **Structural Drying** commonly called **"In-Place" Drying**. Structural or In-Place Drying (IPD) is no longer an approved method in IICRC S500-2015.

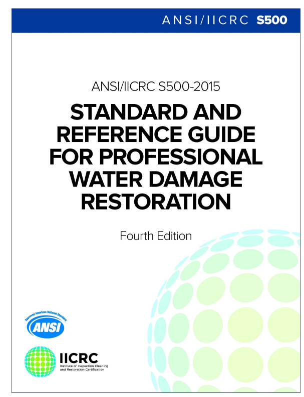
In-Place Drying (IPD) makes heavy use of equipment to accelerate drying, and may reduce costs, time, and the inconvenience related to replacement and repairs – <u>but there are risks with IPD.</u>

Specialized training is required if IPD is to work – under the best circumstances. But typical training for Water Damage Restoration technicians is only 3 days.

IPD was featured in the earlier IICRC S500-2006 (3rd Edition), but since has been discredited and removed from the current S500-2015 (4th Edition) because IPD almost always results in mold and/or bacteria contamination and/or hidden pockets of water saturation after drying. I.E. IPD almost always results in failed or incomplete drying which then must be remediated.

So there are risks with IPD. Be sure to understand the risks before agreeing to have your home or office dried In-Place.

Water Damage Restoration Guidelines



IICRC S500-2015 (4th Edition) outlines the principles behind safe and effective water damage restoration. It is approved by ANSI [American National Standards Institute) and is the industry standard for professional water damage restoration.

Structural or In-Place Drying are not even mentioned in IICRC S500-2015. S500-2015's sole focus is **Restorative Drying**.

Before starting S500-2015 compliant Restorative Drying, determining the **Category of Water** is first and foremost.

Category of water "refers to the range of contamination in water, considering both its originating source and its quality after it contacts materials present on the job site". Category of Water identifies the cleanliness of the water not only at the time of release <u>but also by the time the dry-out crew arrives.</u>

Time and temperature affect the cleanliness of the water. Clean water will change to non-clean water quite quickly as bacteria and mold grow fast once materials get wet.

Only a Category 1 water event (Clean Water) is allowed to be dried per S500-2015. When water has turned (as determined by odor or microbial growth), IICRC S500-2015 requires that wet porous or semi-porous bacteria or mold contaminated materials such as carpet and pad; drywall; or cabinets be replaced and not dried.

Per IICRC S500-2015 only clean (not microbial contaminated) water is permitted to be dried. If not clean, remediate before drying.

[1]ANSI/IICRC S500-2015 Standard and Reference Guide for Professional Water Damage Restoration – Fourth Edition

IICRC Category of Water

Category of Water[1]

- **Category 1:** Category 1 water originates from a sanitary water source and does not pose substantial risk from dermal, ingestion, or inhalation exposure. Examples of Category 1 water sources can include, but are not limited to: broken water supply lines; tub or sink overflows with no contaminants; appliance malfunctions involving water-supply lines; melting ice or snow; falling rainwater; broken toilet tanks; or toilet bowls that do not contain contaminants or additives.
    - Category 1 water can deteriorate to Category 2 or 3. Category 1 water that flows into an uncontaminated building does not constitute an immediate change in the category. However, Category 1 water that flows into a contaminated building can constitute an immediate change in the category. Once microorganisms become wet from the water intrusion, depending upon the length of time that they remain wet and the temperature, they can begin to grow in numbers and can change the category of the water. Odors can indicate that Category 1 water has deteriorated.
- **Category 2** – : Category 2 water contains significant contamination and has the potential to cause discomfort or sickness if contacted or consumed by humans. Category 2 water can contain potentially unsafe levels of microorganisms or nutrients for microorganisms, as well as other organic or inorganic matter (chemical or biological). Examples of Category 2 water can include, but are not limited to: discharge from dishwashers or washing machines; overflows from washing machines; overflows from toilet bowls on the room side of the trap with some urine but no feces; seepage due to hydrostatic pressure; broken aquariums; and punctured water beds.
    - Category 2 water can deteriorate to Category 3. Once microorganisms become wet from the water intrusion, depending upon the length of time that they remain wet and the temperature, they can begin to grow in numbers and can change the category of the water.
- **Category 3** – Category 3 water is grossly contaminated and can contain pathogenic, toxigenic or other harmful agents and can cause significant adverse reactions to humans if contacted or consumed. Examples of Category 3 water can include, but are not limited to: sewage; wasteline backflows that originate from beyond any trap regardless of visible content or color; all forms of flooding from seawater; rising water from rivers or streams; and other contaminated water entering or affecting the indoor environment, such as wind-driven rain from hurricanes, tropical storms, or other weather-related events.

IICRC Class of Water

Class of Water[1]

According to IICRC S500, the Class of Water is a determination of how hard it is to dry in a timely manner. Timely means before there is microbial growth. The goal is to dry within 3 days because according to the EPA/FEMA/CDC mold can start to grow after 3 days. Class of Water is used in calculating the initial amount of drying equipment.

Class of Water is based on the type of materials affected (porosity and permeance) and the amount of wet surface area in the room or space that was flooded.

Class of Water is defined as four separate descriptions: Class 1, 2, 3 & 4:

- **Class 1** – least amount of water, absorption, and evaporation load. Water intrusion where wet, porous materials (e.g., carpet, gypsum board, fiber-fill insulation, concrete masonry unit (CMU), textiles) represent less than ~5% of the combined floor, wall, and ceiling surface area in the space; and where materials described as low evaporation materials (e.g., plaster, concrete, wood).
- **Class 2** – significant amount of water, absorption, and evaporation load. Water intrusion where wet, porous materials (e.g., carpet, gypsum board, fiber-fill insulation, concrete masonry unit (CMU), textiles) represent l ~5% to ~40% of the combined floor, wall, and ceiling surface area in the space; and where materials described as low evaporation materials (e.g., plaster, wood, concrete, masonry) or low evaporation assemblies (e.g., multilayer wallboard, multilayer subfloors, gym floors, or other complex, built-up assemblies) have absorbed minimal moisture.
- **Class 3** – greatest amount of water, absorption, and evaporation. Water intrusion where wet, porous materials (e.g., carpet, gypsum board, fiber-fill insulation, concrete masonry unit (CMU), textiles) represent more than ~40% of the combined floor, wall, and ceiling surface area in the space; and where materials described as low evaporation materials (e.g., plaster, wood, concrete, masonry) or low evaporation assemblies (e.g., multilayer wallboard, multilayer subfloors, gym floors, or other complex, built-up assemblies) have absorbed minimal moisture.
- **Class 4** – deeply held or bound water. Water intrusion that involves a significant amount of water absorption into low evaporation materials (e.g., plaster, wood, concrete, masonry) or low evaporation assemblies (e.g., multilayer wallboard, multilayer subfloors, gym floors, or other complex, built up assemblies). Drying may require special methods, longer drying times, or substantial water vapor pressure differentials.

Keep in mind that Structural/In-Place Drying can almost never accurately determine either Category of Water or Class of Water.

Why? Because with Structural/In-Place Drying there is no inspection or moisture measurement inside of materials, components, or assemblies. This increases risk of failure.

Microbial Ecology

Microbiology of Water Damage

Environmental bacteria and fungi are ubiquitous in the indoor environment. They are typically introduced as cells and spores from outdoors through openings between interior and exterior spaces, from carriage on clothing, and from tracked-in soil.

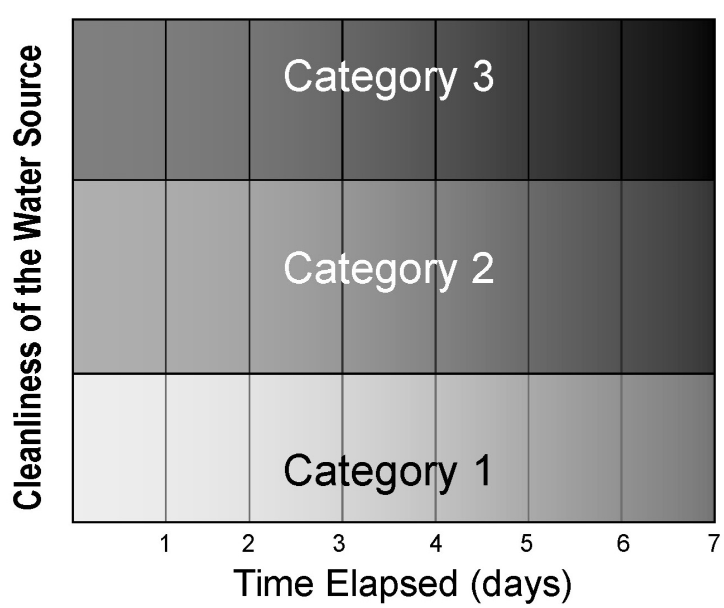
Once indoors, these biological agents interact with the inanimate environment by collecting or settling in or on a variety of surfaces or materials. Such collecting places, or "micro-environments" or "reservoirs," include carpet, upholstered furniture, wood, and various painted surfaces such as walls and ceilings, a variety of contents materials, and heating, ventilating, and air-conditioning (HVAC) systems.

Both bacteria and fungi, along with their various components and by-products, constitute a major portion of indoor dusts. In a dry environment subject to routine cleaning (e.g., dust removal), such reservoirs are normally non-problematic. However, as water intrudes, or moisture condenses onto surfaces and materials, the microbial ecology begins to change.

Both time and temperature affect the cleanliness of the water. After a water intrusion event, the normal indoor ecology can quickly shift as microorganisms and microbes grow. Restorers must have a basic understanding of the normal and shifting ecologies of water damage events.

How quickly is quick? Many restorers question whether there ever is a clean water loss by the time the dry-out crews arrive or after they leave 3-4 days later claiming to have successfully dried the prpoerty – based on surface moisture measurements.

Combined Category & Time Effect



Successful Restorative Drying

Steps of Restorative Drying

- Bulk water extraction.
  - Pre-restorative drying assessment / evaluation [intrusive]
- Demolition/ removal of unsalvageable components
- Surface evaporation/dehumidification accelerated by air movers
  - Controlled demolition to accelerate drying.
- Post restoration assessment/ evaluation [intrusive]

Bulk Water Extraction

Removal/extraction of bulk water is at least 500 times more efficient than evaporation/dehumidification. The more water that can be extracted, the quicker the structure will dry.

Different types of bulk liquid extraction tools:

- Light wand – Primarily used around the perimeter of the water loss to extract glue-down carpets
- Stationary tool (e.g., water claw) – A subsurface extraction tool used to extract carpet and cushion (pad)
- Self-propelled tools (e.g., Rover; Xtreme Xtractor) – A riding extraction tool, some with multi-speeds, used to extract carpet and cushion
- Vacuum squeegee – Squeegees are used to move large volumes of water, mud, debris, waste, and snow on concrete; hardwood; vinyl; and laminate
- Wet vacs and mops

Air Movement to Remove Surface Moisture

Following the removal of as much bulk water as possible, high velocity air movers such as axial fans or centrifugal blowers facilitate the evaporation/ removal of surface moisture.

Rapid air movement across wet surfaces of materials or assemblies is a critical component of effectively and efficiently drying the surfaces of those materials and assemblies. Air movers release surface moisture to the air to be removed by evaporation/dehumidification.

Examples are given below of specialty air movers that aid in removing not only surface moisture but also tightly bound interior moisture. Popular in the industry, but before injecting air into any cavities or assemblies one must rule out by intrusive inspection any pre-existing microbial contamination otherwise risk spreading the microbial contaminants throughout the living space.

- Structural Cavity Drying Systems (SCDS)
  - Vented (e.g., Turbovents 18”-48” widths; Octi-dry; Omni-dry; Air Wolf)
  - Injected (e.g., Injectidry; Dri-Force; Direct-it In)
- Floor Drying Systems
  - Vented (e.g., Air Wolf)
  - Injected – negative air mats (e.g., Dri-Force; Injectidry)

Dehumidification

Dehumidification

As the surface moisture is forced into the air by air movers, it evaporates and becomes water vapor (moisture in the air.) Dehumidifiers are used to remove this moisture from the air.

Dehumidifiers used in restoration are typically either low-grain refrigerant (LGR) dehumidifiers or and conventional refrigerant dehumidifiers.

Conventional refrigerant dehumidifiers are the basic type of dehumidifier. They remove water from the air by condensing moisture out of the air onto cooling coils.

Conventional refrigerant dehumidifiers operating under ideal temperature conditions 70°–90° F (21°–32° C) can reduce humidity to about 40% relative humidity (RH). If the dehumidifier is not labeled LGR, then it is likely a conventional dehumidifier.

LGR (Low Grain Refrigerant) dehumidifiers pre-cool the intake air, which results in more water removal, drier processed air, and greater energy efficiency. LGR dehumidifiers outperform conventional dehumidifiers, but LGR dehumidifiers perform exceptionally well drying dense, hard to dry (Class 4) materials. LGRs can reduce humidity down to about 30% RH and perform well over a larger range of temperature than conventionals.

S500-2015 Section 13.5.6.2 Controlling Humidity and Determining Initial Dehumidification Capacity
When a closed drying system using mechanical dehumidification equipment is planned, restorers should establish an initial dehumidification capacity. Initial dehumidification capacity refers to the amount of humidity control needed for the estimated evaporation load, and may be modified at any point after setup based on psychrometric readings. The restorer should document factors considered to determine the initial dehumidification capacity. Considerations may include but are not limited to:

1. *types of building materials, assembly and build-out characteristics*
2. *class and size of the affected area*
3. *prevailing weather conditions over the course of the drying effort*
4. *power available on the project*
5. *type and size of drying equipment available*

After the initial installation, appropriate adjustments (e.g., increase, decrease, reposition) in dehumidification equipment capacity should be made based on psychrometric readings. In Class 4 intrusions involving significant water absorption into low evaporation materials and assemblies, it can be beneficial once surface water has evaporated to reduce airflow velocity across the surfaces and the vapor pressure differential should be increased (e.g., increase temperature of wet materials; reduce humidity of the surrounding air; or a combination of both).

As one can see based on the IICRC section above, there are many complexities to consider in order to establish initial dehumidification capacity. And after initial installation it is equally or more complex to adjust/fine tune. How many dry-out technicians are adequately trained? How many have the experience? How many have the time to make the appropriate adjustments?

High Temperature = Risk

Temperature Control

The temperature within a work area, and the temperature of wet materials themselves, significantly impacts the rate of evaporation. Increasing the temperature of wet materials can be accomplished by using the thermal energy/heat generated by air movers, dehumidification, or heating equipment.

The greater the temperature of wet materials, the more energy is available for evaporation to occur – the faster the drying.

While cooler air slows evaporation, however overly hot air reduces the dehumidifiers effectiveness. And overly hot air can damage content.

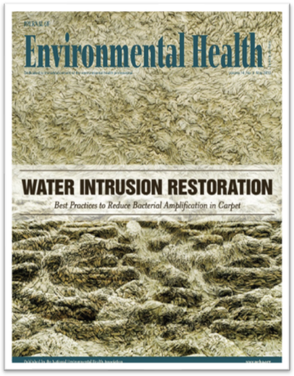
The key is temperature control. Depending on the season, it should be possible to keep the area to be dried at the desired temperature range because of the cooling effect of moisture evaporation and the heat generated by the drying equipment can to some extent balance one another. If needed, drying chambers (containments) can be used to concentrate the warmer temperature in the affected areas.

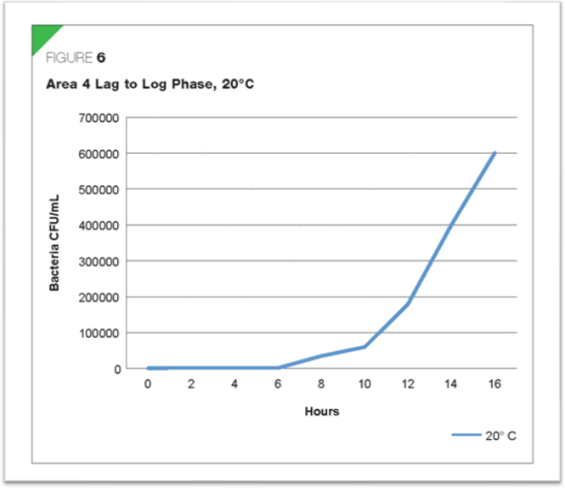
The key to evaporation acceleration is higher temperatures. By raising the temperature to accelerate evaporation, the restorer can dry faster, saving time and money.

The higher the temperature, the faster the drying – sounds good doesn't it?

The concern and risk is that even though raising temperature accelerates drying, higher temperatures greatly increase the rate of microbial growth, resulting in the bad practice of using biocides to attempt to control [cover up] microbial growth and odor.

In 2012, Jim Holland, key architect of both S500 and S520, published an important study in Environmental Health on the growth rate of bacteria after a water event.





Holland: After 8 hours, Clean water even at relatively cool 20° C is no longer clean due to bacteria growth and no longer can be dried. In the real world, there is rarely if ever a clean water loss.

Documentation & Inspections

Daily moisture readings should be included in the drying record to include air, equipment, and HVAC, equipment, and moisture content levels for wet materials and assemblies to show the progress of drying.

The problem with these readings is that they are typically surface readings only and do not track conditions inside of walls, ceilings, or under or behind cabinets but should. IICRC requires inspection of not only surfaces but also interiors.

IICRC S500-2015**:** *Evaluating layers or assemblies of materials should be done when it is suspected that water has migrated under or into it. Restorers should understand the particular construction in order to determine the best restoration approach. Properly inspecting, cleaning, drying, and restoring these assemblies can require removal of surface or multiple layers of them.*

If finished wall material (e.g., gypsum board, plaster) requires replacement, restorers should commence removal first; then properly dry exposed sub-surfaces and framing to the predetermined drying goal prior to reinstallation of finish materials.

IICRC S500-2015 Initial Inspection

*Restorers should inspect and document the source and time of the water intrusion, visible material deterioration, pre-existing damage and visible microbial growth. Professional moisture detection equipment should be used to inspect and document the extent of water migration and moisture intrusion **into** building materials and contents.*

IICRC S500-2015 Final Inspection (Completion)

*Drying equipment should remain in operation on site until it has been verified and documented that the drying goals have been achieved **in** the materials being dried. It is recommended that materially interested parties be provided access to documentation on the restoration process.*

Inspection Equipment

These are some of the tools professionals use:

- Moisture meters – pin type and non-pin type; determines surface moisture content; establishes, monitors, and determines when dry standards are met;
- Infrared cameras – measures surface temperatures. Unable to determine which layer is wet or when dry.

The problem is that none of this inspection equipment looks/ measures moisture inside of walls. Cavities must be opened to determine the true extent of hidden moisture and verify the rate and success of drying.

CONCLUSIONS

CONCLUSIONS

- Structural or In-Place drying is risky. One does not check inside of walls, ceilings, behind cabinets for pre-existing damage before drying or check inside of walls, ceilings, cabinets, built-ins after drying to determine if the drying was a success.
- Structural or In-Place drying is no longer an approved procedure in IICRC S500-2015.
- Often or usually with Structural or In-Place Drying, contractors cover up mold and bacteria using [often illegal] biocides/ anti-microbials. We recommend insisting on green, chemical free techniques.
- If Structural or In-Place drying is proposed for a home or office make sure to have a 3rd party independent IEP or Mold Assessor perform an <u>intrusive</u> Post Restoration inspection to double check that the drying was effective. If not Remediate/Remove.
- Or better yet, require that Restorative Drying be **properly** performed per IICRC S500-2015 which means:
    - ✓ Opening components and assemblies <u>before</u> drying to make sure there is no pre-existing microbial damage and;
    - ✓ Then checking inside and behind components such as cabinets or built ins or wall assemblies <u>after</u> drying.
- Require that the drying include a warranty from a qualified independent third party that guarantees at the conclusion of the drying that the water damaged areas are restored to "as new":
    - ✓ Mold free;
    - ✓ Free of residual moisture not only on surfaces but within structures and assemblies;
    - ✓ Without the use of biocides that leave a toxic residue.

D·D·R·S
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For Contractors, PAs, Attorneys