



Release Agents: The Essentials on Type and Application

Presented by: Bob Waterloo, Hill and Griffith Company


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- Got a question?
- Ask away!




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- Form Release agents don't solve all problems and don't cause all problems



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- If you learn nothing else today, just remember that
 - “Thinner is Better”
 - (Less is better)



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- One of their smallest concerns
- One of their largest potential problems



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- Why Use Form Release?



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DEFINITION AND PURPOSE OF RELEASE AGENTS

- Clean release
- Protect the pallet/form
- Contribute to the quality of casting
- Block-out units



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New Requirements

- Better castings
- EPA
- OSHA
- Employee Safety



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TYPES OF RELEASE AGENTS


- Barrier
- Reactive



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BARRIER RELEASE AGENTS

- Waxes
- Water emulsions
- Non-reactive coatings with volatile solvents
- Soaps
- Plain petroleum oils



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BARRIER RELEASE AGENTS

- Barrier release agents have a tendency to encapsulate air on side walls resulting in more surface defects (bug holes).




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REACTIVE RELEASE AGENTS

- Vegetable oil


- Petroleum-based



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Chemistry Lesson Part I

- pH—Hydrogen-ion capacity to determine acidity and alkalinity
- 1-7 pH is acidic
- 7.0 pH is neutral
- 7-14 pH is alkaline (basic)



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REACTIVE RELEASE AGENTS

- Fatty acids
- Occasional use of Tall Oils




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Chemistry Lesson Part II

- pH—Hydrogen-ion capacity to determine acidity and alkalinity
- 1-7 pH is acidic
- 7.0 pH is neutral
- 7-14 pH is alkaline (basic)

- Fatty acid is 6.8 pH
- Cement is 12.0-13.0 pH



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REACTIVE RELEASE AGENTS

- Fatty acids
- Neutralization/Saponification
- Metallic soap



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METALLIC SOAPS


- Fine Powder
- Chemically Inert



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TYPES OF FORMING OPERATIONS

- DRY CAST----
- WET CAST/SCC----



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TYPES OF FORMING OPERATIONS

- DRY CAST—Coat whatever stays with the form.
- WET CAST/SCC-Coat whatever stays with the form.



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BOTTOM LINE

- Coat anything that comes in contact with the concrete and stays in contact with the concrete.
- (Thinner is better)



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METHOD OF APPLICATION


- **MANUAL**
 - Spraying/Spray Tips (Viscosity/Temperature)
 - Swabbing or painting
 - Hand
 - Dipping



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Spray Tips

- 1. Fan, not Cone
- 2. 0.1 gpm @ 40 psi
- 3. Typically 45° Angle



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APPLICATION

- Put release agent on the pallet/form, not on the ground
- Be sure to coat the entire area that stays in contact with the concrete



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HOW TO REMOVE THE COATING


- Wear off during production
- Mineral spirits
- Grinding
- Blasting



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COATINGS NEW FORMS

- Impact of non-removal
 - Staining
 - Poor finish
 - Sticking
- Seasoning



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SEASONING

- Raw metal
- Fatty acid affinity for raw metal
- Metallic oleate barrier
 - Spray/reaction
 - Wipe down



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RUSTY PALLETS, TOP RINGS AND FORMS


- Rust is oxidized metal
- Non-removal results in sticking and staining



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SEASONING

- Raw metal
- Fatty acid affinity for raw metal
- Metallic oleate barrier



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CLEANING OF METAL PALLETS, TOP RINGS AND FORMS


- Manual
 - Minimize grinding
 - Scrapers & putty knives



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Urethane Form Liners


- Need to check for compatibility
- Immersion test



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BIODEGRADABILITY

- “Readily Biodegradable:”
Half Life of 28 days or less
- “Inherently Biodegradable:”
Half-Life of 60 days or less



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Personal Safety

- The “Old” HMIS System



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Personal Safety

- Red (Fire)
 - “3” Flammable (less than 140 F flash point)
 - “2” Combustible (141-200 F flash point)
 - “1” Non-regulated (>200 F flash point)
 - “0” Will not burn
- Blue (Health)
- Yellow (Reactivity)
- White (Personal Protection)



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Personal Safety

GHS


- Globally Harmonized System
- (Replaces HMIS)



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REGARDING RASHES


- “The presence of alkalis in the cement is also that cause of chemical skin burns which can result from excessive contact with fresh concrete. Sodium and potassium oxides in combination with water form hydroxides (also known as caustic soda and caustic potash) which attack the skin. Portland cement is a chemical and should be handled carefully.”



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EPA-VOC REGULATIONS


- Initial publication September 11, 1998
- Effective September 13, 1999



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Additional Information


- [“Centralized Spray Systems for the Precaster”](#)
– *MC Magazine*, March/April 2004* (See Tech Notes)
- [“Form Release and the Law”](#)
– *Precast Inc.*, Jan/Feb 2006
- [“Care and Seasoning of Metal Form and Rings”](#)
– *MC Magazine*, Jan/Feb 2007
- [“Biodegradability Redefined and Volatile Organic Compounds Update”](#)
– *Precast Inc.*, Jan/Feb 2010



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Additional Information

- [“How Safe \(and Legal\) is Your Concrete Form Release?”](#)
– *Precast Inc.*, Jan/Feb 2011
- [“The New Globally Harmonized System: The Right to Know?”](#)
– *Precast Inc.*, Mar/April 2014
- [“5 Options for Dip Tank Maintenance”](#)
– *Precast Inc.*, May/June 2015



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Additional Information

- [“Don’t Jump to any rash Conclusions”](#)
– *Precast Inc.*, Sept/Oct 2016
- [“How to Lose a Customer in 10+ Easy Ways”](#)
– *Precast Inc.*, May/June 2018
- AVAILABLE TECH NOTES:
 - **“Pressurized Spray Tanks”*
 - *“Easier Clean-Up of Mixers and Transfer Buckets”*
 - *And more*



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Thank You!

- Any Questions?



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system, it is best to use spraying media that does not react with the fatty acid. If you are using a medium that is reactive, metallic oleate will form in the tanks and spray system lines, which will slightly reduce the amount of reactive material meant to react with the concrete. Also, lines may plug, residual sludge will form in the bottom of the holding unit and spray tip orifice size will increase or plug. Plugging will occur when under lower pressures while increased orifice size will increase under higher pressures. The use of lined spray or holding tanks, non-reactive transport lines and non-reactive wands and spray tips are always best. Fatty acid will not react with stainless steel or plastic, so specify these in your operations whenever possible.

Swabbing and painting

Swabbing or painting the form release by hand is an acceptable method of application, as it eliminates the majority of airborne particulate. On the negative side, application tends to be heavier than needed. With swabbing, excess form release generally ends up on the ground.

Fogging

Fogging is a very acceptable method of application, but experienced personnel are needed in order to get thorough coverage, and to be able to adjust the fogger to minimize the airborne particulate while at the same time assuring complete coverage on the form.

Hand Applications

Wiping the release agent on the form with a sponge or soaked rag will normally give the thinnest application, typically less than .003 of an inch, but it is very labor intensive. It is not unusual to see burial vault and architectural precast manufacturers use this method, not as they are trying to save money on form release, but because they end up with the best surface finish after pouring and stripping. Regrettably, this method of application is quite labor-intensive and most precast operations are not allowed this luxury.

Automatic Application

Spraying

Here is where pressure and orifice size of the nozzle is most important. Multiple spray tips can be used to assure complete coverage, and actual misting of the release agent can be accomplished. Viscosity of the release agent being used, along with nozzle size and the amount of pressure, can be controlled more closely than by hand operation. As before, we want the release agent on the pallets or forms, not in the air or on the floor. Also as before, stainless steel or plastic nozzles are preferred to eliminate the possible reactivity between the fatty acid and the spray tips.

Dipping

Dipping is automatic, fast and labor efficient. Also, you are assured complete coverage. Care must be taken, however, to allow the excess material to drip freely from the pallets and head rings. Under normal circumstances, the thicker application from a dip tank is not going to be detrimental to the casting, but slightly more material may be used as compared to other methods. Labor cost, consistent application rates and fewer rejects must also be considered. Also, with the dip tank, excess material is contained by dripping back into the holding tank. Air assist is also available to reduce the amount of release agent that stays with the dipped area.

So to reiterate:

- Put the release agent on the form, not in the air or on the ground
- Be sure to coat the entire area that comes in contact and stays with the concrete
- Thinner is better

VI. COATINGS ON NEW FORMS

Coatings are often put on new forms to prevent them from rusting during storage and transit. The protective coatings can be resins, petroleum-based gels, or acrylic sealers. In all cases, the protective coating should be removed and the form seasoned before making the first cast.

The need to remove protective coatings is especially important when using reactive release agents. You can normally remove the protective coating by:

- Allowing it to wear off during normal production
- Removing it with mineral spirits (or other solvent) with a lot of elbow grease
- Grinding it off
- Using a blasting media

How or if you remove the protective coating is your decision, but let's go one step further.

Impact of Non-Removal of Protective Coatings

The impact on your operation with new forms without removing the protective coating can result in staining, poor finish, poor release and sticking, until the protective coating is worn off and the forms are seasoned. Seasoning is very important and can be done through normal production, which results in more sticking, and poor finish until the forms are seasoned, or you can season the forms before putting them into production. Surprisingly, seasoning is quite simple.

Seasoning of New Forms

Once the protective coating is removed from the form or grinding is done to the form or pallet, new, raw metal is exposed. Remember that fatty acids have an affinity for raw metals, and will react with the raw metal until metallic oleate or a protective coating is formed. When seasoning forms, you are forming a protective coating, or barrier, on the metal surface, which will not react with the fatty acid in the release agent.

To season the forms, or to have this metallic oleate barrier formed, you can take a high concentrate of fatty acid, spray the forms liberally, allow them to set for 24 hours, wipe down and repeat the process again. You are then ready to put the form into regular production and apply your normal release agent. You can accomplish the same results with the use of your reactive release agent, but it will take longer, and as the fatty acid has already attacked the raw metal, there is little or no fatty acid left available to react with the free lime on the surface of the concrete.

Now, as the fatty acid reacts with the raw metal, a protective film is formed. As the fatty acid portion of the release agent will not react with a metallic oleate, the release agent, containing the fatty acid, is then absorbed into this coating and the fatty acid is held for reaction with the free lime.

You will be ahead if you take the time to remove the protective barrier from the new forms and pallets, and season them before putting them into production.

VII. CLEANING OF FORMS AFTER CASTING AND STRIPPING

Ideally, you would not have to clean your forms after stripping. It is possible to minimize your labor and costs in this area, as there are release agents on the market that will help you do that. Not surprisingly, the less you have to clean your forms, the less subsequent sticking you will have. Also your cleaning touch-up costs will be reduced.

Cleaning should, of course, be done as necessary, but minimize it whenever you can. Severe abrasive cleaning with metal brushes can, and will, wear off the metallic oleate protective coating and expose raw metal. Again, back to the fatty acid and its affinity for raw metal. If raw metal is available, the fatty acid will start to react with it immediately in order to form a new barrier, negating the available fatty acid to react with the free lime on the surface of the concrete, which again, assists in the release and finish. Use your cleaning equipment, but use it wisely and gently.

Also, if possible, use copper brushes or copper wool instead of steel brushes and steel wool. Copper is less abrasive and is less likely to remove the metallic oleate. If you haven't already tried it, get a stiff brush broom and see how much you can remove before resorting to a more abrasive cleaning method.

Finally, use a form release that assists in cleaning your forms to help reduce labor costs and minimize exposed metal.

So...

- Minimize grinding
- Use a stiff brush broom
- Use ice scrapers and putty knives
- Use copper brushes/wool instead of steel brushes/wool

Rusty forms

Rusty forms, used as is, will promote sticking and staining. Rust should be removed, normally by steel brush grinders, and the forms seasoned before being put back into production. Rust is nothing more than oxidized metal and the fatty acid in your release agent will attack it immediately. If the rust is not removed, you will encounter stained castings and stickers until the rust is eradicated and the new metallic oleate forms its protective coating.

Further, as the majority of release agents on the market are petroleum-based, if forms are coated with the release agent before being sent to storage, it will help eliminate, or at least reduce the amount of rust generated.

There are a number of rust inhibitors on the market, but many are of the nature that the rust inhibitor must be removed, again manually, before the forms are put back into production. Use a rust inhibitor that provides sufficient protection against rusting, and is compatible with your release agent so no cleaning is necessary before putting the forms back into production.

VIII. REGULATORY REQUIREMENTS

State Department of Transportation (DOT):

If you are doing any work for a state's department of transportation, you will want to know if your form release agent has to be, or is, approved for DOT projects. Some states' DOTs do not have requirements for form release agents, while others will require it to be on their Quality Product Listing (QPL), which lists all materials, normally by trade name and product category, that have been approved for DOT work. You can get this information by contacting the state DOT office for which you are doing work.

IX. ENVIRONMENTAL PROTECTION AGENCY VOLATILE ORGANIC COMPOUND REGULATIONS

September 14, 1999, was the effective date of the Environmental Protection Agency's 40-page document of regulations on Volatile Organic Compounds (VOCs) that applies to products that are used in the concrete industry. The ultimate purpose, based on the EPA's estimates, is to reduce VOC emissions by 113,000 tons per year in the United States. The estimate is that this reduction is 20% less than 1990 levels.

VOCs can be quickly categorized as compounds that create ozone at ground level, and which contribute to air pollution, or smog. Form release agents is an area where it was felt the new limitations of VOCs could be met with existing technology and with reasonable additional costs. The limits for form release agents used in the concrete industry were set at 450 g/l or 3.8 lbs./gal based on EPA Method 24.

While the Method 24 test appears simple, it is considerably more complicated than it appears and uncertified labs may give false readings as to compliance with the EPA regulations. An EPA certified lab is your best bet and you can ask your release agent supplier for a copy of his test results that you may want to keep in your files.

Not all petroleum-based form release materials are creators of ozone or smog. In fact, some petroleum-based materials are not photochemically reactive (the cause of ozone) and should be exempt from these rules and regulations. While the EPA does have a test developed for determining photochemical reactivity, it is cumbersome and so expensive that it is seldom pursued. Few suppliers can justify the expense and find it easier to just comply with the new VOC regulations.

Also, most concrete producers are subject to regulations regarding contamination due to water runoff. The concern is not only to storm sewer water, but also with possible seepage to the aquifer. Be sure you are up to date with your own local and state regulations to avoid serious problems. Also, keep in mind that some states have more stringent rules on VOC regulations than does the EPA. Check your local and state regulations to be sure you are in compliance.

Castings to Be Used With Potable Water

If your castings are to be used with potable water, such as cisterns or aqueducts, you may want to check if your release agent has been approved by the National Sanitation Foundation (NSF International). In response to a competitive request for proposals from the United States Environmental Protection Agency, a consortium led by NSF International agreed to develop voluntary third-party consensus standards and a certification program for all direct and indirect drinking water additives. The two standards, 60 and 61, were developed to establish minimum requirements for the control of potential adverse human health effects from products added directly to water for its treatment, and indirectly to water via contact with treatment, storage, transmission and distribution components. Checking for NSF International approval can be easily done by checking with the NSF International Register for approved products, or by calling the NSF and asking them if a particular release agent is approved.

X. SELECTION OF A RELEASE AGENT

In selecting a release agent, you can ask yourself (or your supplier) a number of questions regarding the release agent you should be using. Here are some of the questions you may want to ask.

Is it water/petroleum/etc-based?

Does it meet state/local/federal VOC requirements?

Is it labor-effective for application?

Is it easy to apply?

Is it compatible with my admixture?

Is it cost effective?

Does it have to be mixed before using?

Does it need agitation to keep in suspension?

Is it non-staining?

Is it readily available?

Is it environmentally responsible?

Does it build up on forms or create excessive dusting?

Is it safe for employee use (non-carcinogenic)?

Is it considered flammable or combustible (transportation & storage)?

Is it sprayable in both warm and cold temperatures?

Does it assist with smooth, defect-free surfaces?

Does it satisfy OSHA requirements?

Does it help minimize cleaning of forms?

Does it help minimize touch-up and repair of castings?

Does it evaporate – how long can it stay on the form before reapplication is necessary?

Does it have to dry before casting (drying time)?

Does it help to reduce surface voids (bug holes)?

Is it subject to DOT regulations for transportation (commercial trucks and/or your own trucks)?

Does it leave a residual coating on the casting surface that must be removed?

Is it NSF Certified for potable water?

Does it help to clean forms and prevent build-up (labor savings)?

Does it help to minimize stickers and sticking?

Does it have an offensive odor, or no odor?

Is it a suspected carcinogen (check MSDS)?

Is it suitable for seasoning of forms?

Does it separate if frozen/teetered?

Does it have a limit on freeze (teeter)/thaw cycles?

Is it State DOT approved?

REFERENCES:

Do New Release Agents Work?; de Brits, Jorge, Branco, Fernando A, dos Santos, Robert, Concrete International; May 1999, pp. 55-60.

Avoiding a Caustic Handshake; Yelton, Rick, The Concrete Producer, May 1999, pp. 21-23.

Guide to Occupational Exposure Values – 1997; Compiled by the America Conference of Government Industrial Hygienists.

Recommended Practices and Selection and Use of Form Release Agents for Precast Plants; Austin, Robert, National Precast Concrete Association Tech Notes, Nov. 1995.

Federal Register; Vol. 63, No. 176, Friday, September 11, 1998/ Rules and Regulations, pp. 48848-48887.

NSF Listings, Drinking Water Treatment Chemicals and System Components-Health Effects; August 13, 1999.

Federal Register, Title 16 – Commercial Practices, Chapter 1 – Federal Trade Commission, Subchapter B – Guides and Trade Practice rules, Part 26- - Guides for the use of environmental marketing claims (16 CFR 260.7)

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