YOUR GUIDE TO

BLASTING SOLUTIONS FOR POWER GENERATION FACILITIES

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Power plant professionals, including OEMs and servicers, face a high a bar for productivity and efficiency in an industry where a reliable and continuous supply of energy for its customers is the baseline expectation.

At the same time, production has to be safe, cost-effective and environmentally compliant. Preventive maintenance of equipment is a central requirement for achieving these goals.

Because power generation equipment adherents can be challenging to remove various cleaning methods have become popular, but their introduction of water, chemicals or residual debris can introduce a variety of new problems. This is why dry ice blasting has become a compelling industrial cleaning alternative in power plants, alone and in combination with other blasting methods.

This guide will help you understand the pros and cons of each blasting method used in cleaning power generation equipment so you can choose which is best for your application.

WHAT IS DRY ICE BLASTING?

Dry ice blasting leverages specialized nozzles, equipment, and frozen CO_2 pellets to remove dirt, grime and other buildup without water, chemicals or added debris. Dry ice pellets sublimate upon contact and can be blasted at adjustable levels of force for cleaning even delicate surfaces on electrical equipment like control panels, generator windings, transformers, and insulated electrical components — without prolonged shutdowns or the use of water or abrasive materials that require additional cleanup.

Unlike conventional methods that rely on physical abrasion, water or chemical agents, dry ice blasting uses the thermal shock effect to dislodge dirt and other adherents. Traditional methods often require extensive cleanup, pose a risk of damaging delicate machinery, and can introduce moisture or chemical residues — none of which are concerns with dry ice blasting.

Depending on the application, dry ice blasting can be used in combination with abrasive blasting methods to tackle areas that require more abrasive force. The right blasting method or combination of methods is based on factors that include the type and stubbornness of the adherents, substrate type, and the setting.

SUMMARY OF BENEFITS

This guide will introduce you to the many applications for using dry-ice blasting, along with a review of its key benefits. Here's an overview:

- **Non-Abrasive:** dry ice is soft and won't cause damage to delicate components
- **No Secondary Waste:** since dry ice sublimates on contact, there's no additional waste, just the contaminants removed from the surface
- **Decreased Downtime:** components can often be cleaned in place with no disassembly
- **Environmentally Responsible:** dry ice blasting uses no chemicals, and the CO_2 used is often sourced from industrial byproducts
- **Safe for Electrical Components:** Water-free dry ice blasting can be used to safely clean electrical components

ADDITIONAL BLASTING METHODS

Some applications require a higher level of abrasive force for removal. Steam turbines, for example, accumulate mineral deposits that require a more aggressive force than dry ice blasting can provide. At times, the best results are achieved with a combination of dry ice, sponge blasting and more abrasive blasting methods.

Here is an overview of various blasting types and the advantages and disadvantages of each.

CLEANING TECHNIQUE	PROS	CONS
Dry Ice Blasting	• No secondary waste • Non-abrasive • Extremely effective for cleaning natural gas turbines • Water-free, chemical-free and safe for electrical equipment • Environmentally friendly	• Stubborn adherents may require more abrasive power
Abrasive Blasting	• Versatility (Choice of grit sizes and materials) • Effective profiling for paint or decal adhesion	• Produces secondary waste • Respiratory risks from inhaling dust
Abrasive Blasting / Sponge	• Ability to switch out media for various levels of abrasiveness • Effective dust suppression resulting in far less dust than traditional grit / abrasive blasting • Effective for steam turbine cleaning	• Higher media cost • Can be slower than other methods
Abrasive Blasting / Aluminum Oxide	• Common for removing stubborn scale, fouling & mineral deposits from steam turbines	• More expensive • Produces secondary waste

CLEANING TECHNIQUE	PROS	CONS
Hydroblasting	• Chemical-free • Versatile (Adjustable pressure)	• Requires drying time • Slower • Produces secondary waste • Not safe for electrical equipment • Not safe for insulation & refractory
Hand Cleaning	• Precise control • Little equipment required	• Labor intensive • Time consuming • Ineffective for stubborn adherents • Often requires chemical solutions
Chemical Cleaning	• Selective cleaning based on specific tasks • Inexpensive materials	• Environmental concerns from chemical residues • Exposure can pose health risks • Potential for damage or corrosion from incorrect chemical use • Labor and time intensive

POWER GENERATION BLASTING APPLICATIONS

Power generation facilities contain machinery and equipment that demand meticulous maintenance for optimal efficiency and safety. Here are some of the top applications:

Turbine Cleaning

Turbines, including **natural gas** and **steam turbine** blades, discs, rotors, cases, and stators, are prone to the accumulation of contaminants, particulates, and lubricating residues.

Natural Gas Turbines

There is no faster, more effective, or more consistent cleaning method for natural gas turbines than dry ice blasting. Effective cleaning helps prevent planned outage time allocated for turbine cleaning and inspections by 60-90% for turbine OEMs (including GE and Siemens), turbine servicing companies, and power plant maintenance managers.

Dry ice blasting reduces cleaning time from several days to a few hours. What can take up to a week with other cleaning methods typically takes Polar Clean two shifts to complete. Dry ice blasting can also be performed with the turbine in place and does not require full disassembly.

Power Generation Blasting Applications

- Turbines
- Heat-Recovery Steam Generators
- Circuit Breakers
- Rotators
- Field Frames
- Generator Windings
- Compressors & Generators
- Switch Gears
- Stators
- Substation Isolators & Bushings
- Rotating Equipment
- AC/DC Motors
- Insulators
- Pad-mounted Switchgear
- Hammer Mill
- ID Fans
- Thermal Oxidizers
- Selective Catalytic Reduction Systems (SCRs)
- Silos
- CO Catalysts

Steam Turbines

Removing mineral deposits, rust, fouling, scale, and other buildup on steam turbines is most effectively done with abrasive blasting options.

ALOX (aluminum oxide) blasting is often specified for removing stubborn mineral deposits on steam turbines. This finely graded abrasive is also effective in other applications because of its ability to leave a surface profiled (Mohs 9).

Sponge blasting uses a synthetic sponge particle embedded with abrasive material like aluminum oxide. As the sponge refracts and returns to shape, it suppresses dust by up to 90% compared with other abrasive methods. It's also effective for use in small spaces where other abrasive options can damage nearby equipment and create a safety hazard to operators.

Additional options for blast cleaning of steam turbines, or when a different profiling of the surface is desired, include garnet and glass bead media, which can be used in different formulations, depending on the application and the need for dust control.

Turbine Generators

Cleaning turbine generators during a planned shutdown, both for steam and natural gas turbines, takes special care to prevent damage to their windings and core. Dry ice blasting is particularly effective in this application because of the ability to carefully calibrate the blasting pressure for "dusting" delicate equipment.

During a major outage, windings and insulation are removed from the generators and dry ice blasting is used to remove the adhesive residue left behind, in preparation for re-winding and the installation of new insulation.

HRSG Cleaning

Ammonia salts, sulfur deposits, insulation, iron oxide deposits, and other types of corrosion and debris can develop within heat-recovery steam generator (HRSG) tubes, reducing the thermal efficiency of your system. If left uncleaned, combustion turbine backpressure can rise, potentially increasing the heat rate and damaging your system.

Additionally, given the height of HRSG units and the challenging layout of tube modules, cleaning poses a challenge to many plant operators.

Fortunately, dry ice blasting offers a way to swiftly and effectively clear out tubes without damaging the system so that you can stay ahead of mishaps, tube damage, and more. It's recommended that you monitor backpressure readings and stack temperature to gauge the timing of your next cleaning. Scheduling dry ice blasting during plant downtime can prevent unexpected (and costly) downtime from occurring.

SCR Systems Cleaning

For SCR systems, the removal of nitrogen oxide (NOx) emissions at peak capacity depends on diligent maintenance and cleaning processes, especially when their honeycomb compartments get plugged with fly ash – the toxic byproduct of combusted coal that settles into the small crevices and hardens.

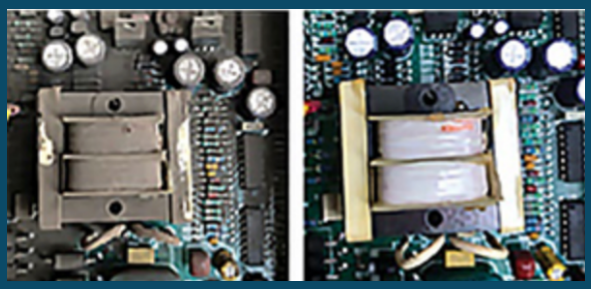
Abrasive cleaning methods are powerful, but they leave behind debris and pose a risk of damage to the SCR. Vacuum and manual cleaning are safe but laborious and time consuming, which is why neither is recommended for SCR cleaning.

Because it uses tiny bits of synthetic sponge soaked with abrasive media, sponge blasting results in 90% less dust than other abrasive blasting methods. More effective when used by highly trained technicians, sponge blasting introduces foreign material, so some amount of vacuuming and hand cleaning are still required.

Dry ice blasting thoroughly cleans SCRs in record time and with no need for vacuuming and hand cleaning.

Electrical Equipment

When dust and grime collect around the most delicate electrical equipment, like control panels, insulators, and circuit boards, some plant operators turn to tedious and time-consuming hand cleaning.



Others may put off the cleaning of breakers, motor windings, and switch gears because of the risk of damage. But delay carries its own risk of damage as accumulated dirt and debris can lead to equipment damage, shorts and even fire.

That's why many power plant operators come to rely on dry ice blasting, which has the unique ability to blast away stubborn debris and coatings but can also be applied with a feather-like dusting safe enough for the most delicate equipment. Such adaptability makes it equally effective at blasting away encrusted debris like bird waste that accumulates on exposed substation surfaces.

ADDITIONAL CONSIDERATIONS

Some power generation cleaning projects require additional planning and techniques to ensure safety and effectiveness, including:

CONTAINMENT

Containment planning may be necessary to prevent debris from contaminating the environment or areas in use. This also minimizes the amount of collateral cleanup and ensures the best results.

Though containment is routinely required for other blasting methods, it can also be required for dry ice blasting, depending on the amount and type of debris that is blasted off – dry ice sublimates on contact, so does not require containment by itself.

HEIGHTS & SCAFFOLDING

Height and accessibility can pose additional challenges in cleaning some areas of power generation facilities. Ensuring safety and effective results can require specialized scaffolding and harnesses as well as training and certifications:

- OSHA Aerial Lift Training
- OSHA Scaffolding Training
- Rappelling Training

CONFINED SPACES

When blasting in confined spaces, personal protective equipment (PPE) and supplied air are required, as well as training and certifications:

- OSHA PPE training
- Permit-required confined space entry training
- Respirator fitness certification
- Supplied Air User training

HAZARDOUS SUBSTANCES

If lead or asbestos is involved, additional training and certifications are required:

- Asbestos awareness certification
- EPA Lead Renovation, Repair and Painting (RRP) Rule certification

THE POLAR CLEAN ADVANTAGE FOR POWER PLANT CLEANING

Polar Clean takes pride in our ability to handle complex cleaning projects, delivering rapid and efficient service, and providing a wide range of solutions to ensure the safest and most effective results.

From patented nozzles and other proprietary equipment to meticulous processes for planning, staging and execution, Polar Clean provides reliable and professional alternatives to soggy, chemical-heavy, overly abrasive, equipment-damaging and environmentally risky cleaning options that can leave behind as big a mess as they eliminate. Polar Clean is committed to achieving the high-quality results that your project needs.

Consultation & Solutions for Complex Issues

Before initiating work, Polar Clean conducts an in-depth consultation to understand the customer's needs. Our technical expertise allows us to provide comprehensive solutions to complex issues, enabling us to tackle even the most challenging scenarios with precision and efficiency.

Rapid Service with Minimal Downtime

At Polar Clean, we understand the importance of rapid, efficient service that minimizes downtime. Our processes are streamlined to deliver fast results without compromising quality.

Array of Blasting Solutions

Every project is unique, and a one-size-fits-all approach often falls short. That's why Polar Clean offers a wide array of cleaning solutions, and if necessary, we can deploy a combination of methods to achieve the desired outcome. Whether it's dry ice blasting, sponge blasting, abrasive blasting, or other methods, we have the equipment, processes, training, and experience to get the job done right.

Additional Reading

- Why Use Dry Ice Blasting?
- Abrasive Blasting Guide
- Natural Gas Turbine Cleaning
- Blasting Solutions for Steam Turbines
- HRSG Tube Cleaning
- SCR Cleaning

About Polar Clean

Since 2011, facility managers, turnaround managers and restoration professionals have relied on Polar Clean, a division of Premium Plant Services, for safe, efficient and mess-free cleaning needed for challenging commercial and industrial environments. Without the collateral damage and containment challenges of hydroblasting and other abrasive cleaning methods, dry ice blasting is ideal for preventive maintenance, shutdowns, emergencies, and restoration – for oil refineries, petrochemical plants, power plants, food processing facilities, manufacturing plants, and other sensitive environments. We offer hydroblasting and other abrasive blasting services when they are a better fit. To determine the right cleaning method for your facility, contact a member of the Polar Clean Premium Plant Services team for a dry ice blasting assessment: **https://polarclean.com**