ROOF SPF ACRYLIC

Extra Thick SPF Skin on an Avocado Storage Facility

BY **CLAIRE TRAGESER**
PHOTOS COURTESY **NATIONAL COATINGS CORPORATION**

For Lyle Orth, a recent job provided an interesting and unusual challenge: transforming a space where envelopes, postcards, and packages were sorted into a space where avocados would be stored. The project was to help convert a U.S. Postal Service Annex and Distribution Center into a cold storage facility for Mission Produce. It's an unusual transformation to be sure.

Signed, Sealed, Delivered

The packing, ripening, and distribution plant sits on the site of the old U.S. Postal Service Annex building in Oxnard, Calif. Its 180,000-square-foot (16,722 m^2) cold storage facility is used as ground zero for ripening about 32 million avocados at a time, according to the local newspaper, The Ventura County Star. It has 20 refrigerated docks to store the avocados before they are packed and shipped across the country and across the world.

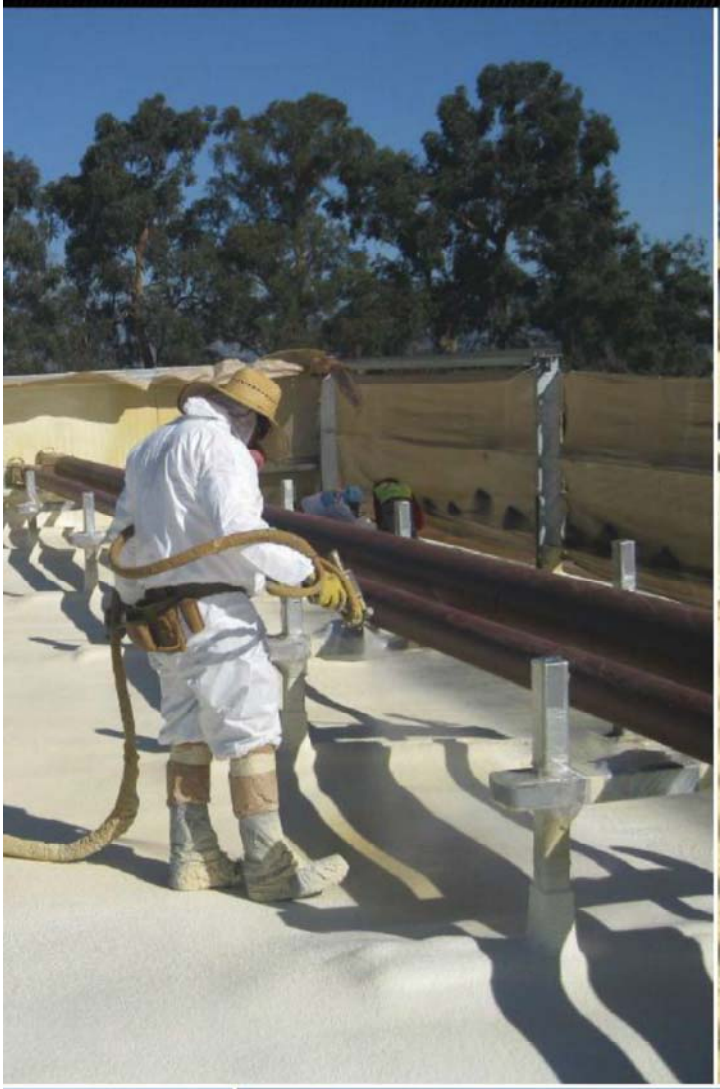
Orth and his wife, Paula, are the co-owners of San Marcos, California-based Common Sense Solutions, Inc., which is doing business as Cool-Roof Systems. Orth said they got this job through a referral from a former customer; he said the new client also checked with two of his other former customers and booked him after hearing positive reviews.

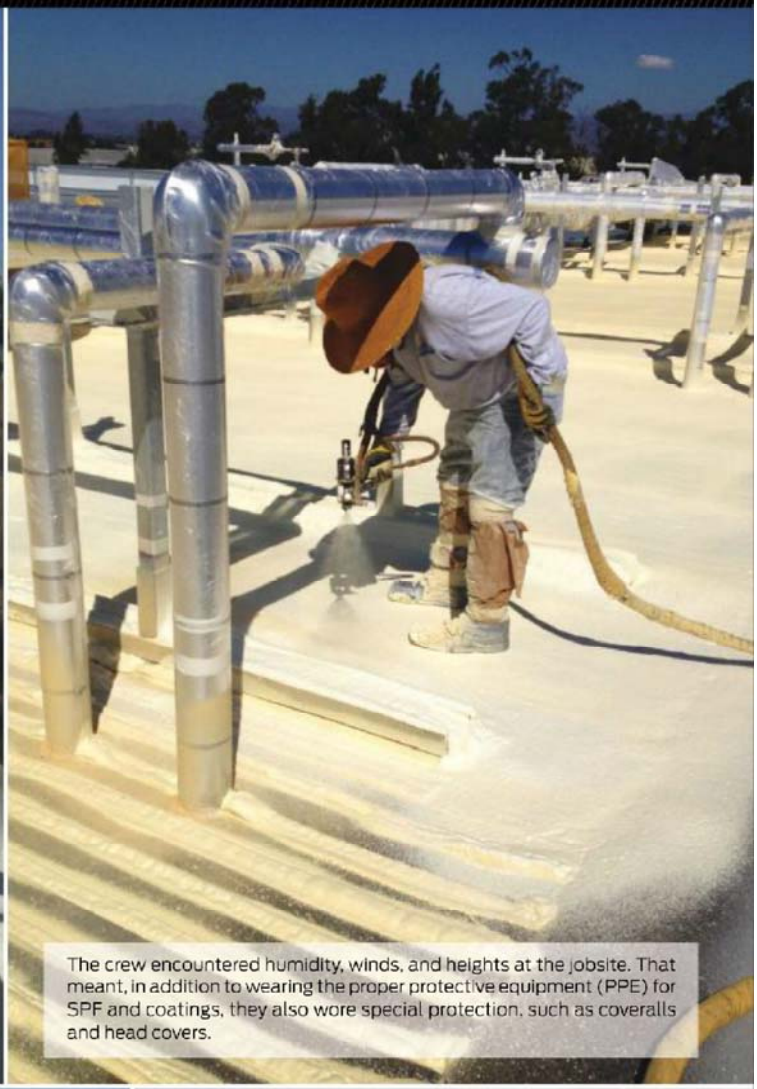
Cool-Roof Systems, which has nine field employees, has been in business since 2004. Orth runs the company as a foam contractor that focuses on "cool roofs," meaning spray polyurethane foam (SPF)-insulated roof systems using a coating. The company also does other types of SPF jobs.

Orth said Cool-Roof Systems was awarded the contract in November 2013. He was given side contracts in March 2014, but although the job was scheduled to start May 1 of that year, it was delayed. "Because of other changes in design, we weren't able to start until August 28," Orth said. "It was a long, drawn-out process."

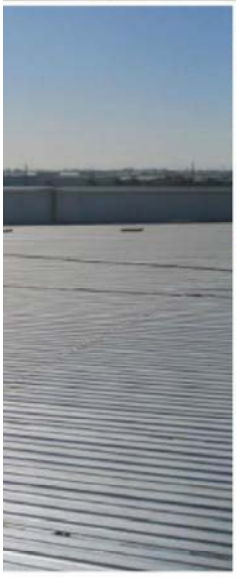
Some of the design changes included a redesign of the interior wall spaces and layout of the building on the inside,

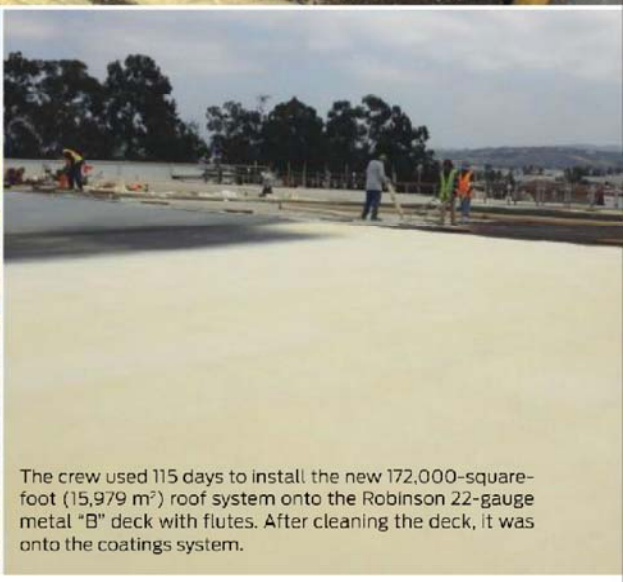
The 4–7-person Cool-Roof Systems crew had much to do to help turn a building into a cold storage facility for avocados. They used spray polyurethane foam (SPF) and coatings to get the job done.





The crew encountered humidity, winds, and heights at the jobsite. That meant, in addition to wearing the proper protective equipment (PPE) for SPF and coatings, they also wore special protection, such as coveralls and head covers.





The crew used 115 days to install the new 172,000-square-foot (15,979 m²) roof system onto the Robinson 22-gauge metal "B" deck with flutes. After cleaning the deck, it was onto the coatings system.

Orth said. Mission Produce converted a portion of the building to rapid cool storage, which meant that it changed some of the structural features so it could handle additional weight. The source of that weight was a solar system that grew before Orth's crew got on the job.

"They redesigned the solar system three times, and it kept getting bigger and bigger," Orth said. All of these upgrades meant Mission Produce used less and less of the original building, he said. And the upgrades were made to capitalize on improved energy efficiency and working-environment efficiency.

The changes also brought a big challenge for Orth's crew. Because they did not start the job until late August, it meant that they were spraying in colder months with more humidity. Orth said that by November, the crew was beginning to have to battle morning and evening dew. "Our effective spray time was only about five hours a day," he said. "That's not good. That's not what we wanted. If it had been earlier in the year, we would have had a much larger spray window." In fact, on some days, Orth explained, the crew could not spray at all because humidity stayed at or above 80 percent.

According to Orth, another environmental challenge was the wind. The jobsite was only 5 miles (8 km) off of the Pacific Ocean, and the building was situated in a small valley that acted like a wind tunnel. When the crew worked on the roof, they could see the ocean. While that makes for nice working scenery, it also brought a lot of wind to the jobsite.

"We were 45 feet (14 m) high," Orth said. "That, combined with the thickness of the foam we were spraying at 5 inches (13 cm), was a challenge because of the high wind situations." Despite these challenges, the crew was up for the job.

Flutes and Foam

Once the crew was finally able to get to work in August, they began by cleaning and pressure washing the building's deck. Then they began applying the spray polyurethane foam.

"We sprayed the roofing foam in the flutes of the corrugated metal deck," Orth said. Using a Gusmer GX-7 foam gun with a #1 module and a 70 pattern control disc (PCD), the crew filled the flutes with Bayer MaterialScience's Bayseal 2.7-pound (1.2 kg) foam.

"We had to fill the flutes, and then we had a mechanical scarifier from J. Calman Industries, LLC that would come in and trim the foam back level with the top part, so it's all a nice, uniform, flat surface," Orth said.

The foam rig used was a Graco A50 with a truck-mounted Ingersoll Rand 175 CFM (5 m^3/min.) air compressor, water separator, and air dryer; Multiquip 25 KW (34 hp) diesel generator; and 300 feet (91 m) of heated hose all mounted in a 24-foot (7 m) International medium-duty truck.

Once the flutes were filled, they sprayed between four and five passes of the same 2.7-pound (1.2 kg) foam in 1- to 1.5-inch (2.5–3.8 cm) thickness. That gave them the 5-inch (13 cm) nominal thickness they needed. This layer was done a bit differently than the flutes, though.

Typical jobs require 1–1.5 inches (2.5–3.8 cm) of foam, but this job required 5 inches (13 cm), according to co-owner Lyle Orth. The crew filled all flutes with ~940,000 board feet (2,218,153 L) of SPF.

Tony Samaoya, Cool-Roof's senior foreman, used a GX-7 foam gun with a #1 module and a 100 PCD to spray the full layer of foam. When the wind was not quite as strong, Samaoya was able to use the foam rig with the Graco A50 and would switch to a 38x38 mixing module with a 110 PCD, which gave him increased production. But the winds were usually too strong, making the overspray potential too much of a risk, Orth said.

The rest of the time, the crew used a foam rig with a Reactor E-30 with 6,000-pound (2,722 kg) onboard storage tanks customized by Intech, a Magnum 35 KW (48 hp) generator, FS-Curtis 16 CFM (0.5 m^3/min.) air compressor, and 300 feet (91 m) of heated hose assembly.

The leading edges of the foam were primed at the end of each day using National Coatings A450 Black Primer applied at about 1 gallon (3.8 L) per 350 square feet (33 m^2) using the Graco 433 with a 619 Reverse-A-Clean tip.

On days when the humidity levels rose faster than expected, the A450 Black Primer was applied to the field areas of the completed foam to speed up drying in the morning and to enhance the adhesion of the basecoat when it was applied the following day.

Once the foam was applied, they moved onto the coating system. Orth used National Coating's AcryShield High Tensile A-550 Acrylic Elastomeric as the basecoat and National Coating's AcryShield High Tensile A-550 Aquashield as the topcoat, but again, the humidity was a problem.

"Because we were getting into higher humidity levels, we couldn't spray 1.5 gallons (5.7 L) per 100 square feet (9 m^2) because it wouldn't dry fast enough, so we had to spray at 1 gallon (4 L) per 100 square feet (9.3 m^2)," Orth said. "And instead of putting that down in two passes for the basecoat, we had to put it down in three passes at 1 gallon (3.8 L) to achieve 3 gallons (11 L) per 100 square feet (9.3 m^2). And then we were having to do the same thing for the topcoat. The topcoat takes

"It's an exceptional system we're installing," Orth said. "We can provide them with a 25-year system warranty. Given the coating, thickness, and everything else, the solar panels should wear out before the coating does."

a long time to dry. It's very reflective; it doesn't absorb any heat. It's an awesome product, but it can be challenging at this time of year."

The crew also had some extra work to do, because the deck they were spraying looked a bit like Swiss cheese. It had 57,000 holes in it because of the use of a new "grappler" seam crimping device to interlock the "B" deck seams together for increased wind-up-lift resistance, Orth said.

"We worked with National Coatings to come up with a butyl seam tape installation that would seal the holes and give us that vapor barrier that was necessary. This required the installation of 57,000 pieces of butyl seam tape to seal every new hole. Seams had to be taped and inspected before we could pressure wash the roof deck," Orth said. "This was to protect the work on the interior, which was already under way." Because the structure was a cold storage facility, patching those holes was critical, he said. And expensive. The extra cost required a bit of ingenuity in coming up with a solution.

"We coordinated with the owners to mitigate costs for them; we taught their staff how to install the product and how to monitor that while we did our own work," Orth said. "That's something above and beyond; normally we wouldn't have to worry about something like that."

Safety From Start to Finish

For safety precautions, Orth had a structural pipe stand installed 6 feet (2 m) in from the low eave edges to serve as an anchor point for the crew's fall protection and overspray mitigation screens. An additional fall protection cable was installed by the owner at the perimeter structural post mounted on the exterior walls as an added safety measure, he said.

All of Cool-Roof Systems' fulltime staff receive Fall Protection training, Forklift Operator Certificate training, Scissor Lift training, and Basic First Aid training, he said. They are also required to attend weekly safety training and to

JOB AT **A GLANCE**

PROJECT:
Apply spray polyurethane foam (SPF) and coating to the roof of a cold storage facility used to store avocados and other produce

COATINGS CONTRACTOR:
Common Sense Solutions, Inc. DBA Cool-Roof Systems
836 Rancheros Dr., Suite B
San Marcos, CA 92069
(760) 747-5970
www.coolroofsprayfoam.com

SIZE OF CONTRACTOR:
9 people

SIZE OF CREW:
4–7 crewmembers

PRIME CLIENT:
Mission Produce, Inc.
2500 Vineyard Ave., Suite 300
Oxnard, CA 93036
(805) 981-3650
www.missionpro.com

SUBSTRATE:
Robinson 22-gauge metal "B" deck with flutes

CONDITION OF SUBSTRATE:
Used

SIZE OF JOB:
172,000 sq. ft. (15,979 m²) surface area

DURATION:
115 days

UNUSUAL FACTORS/CHALLENGES:
- Crew had to fill 57,000 holes in the deck, and taught the owner's staff how to fill the holes to mitigate costs
- Project's start was delayed, and the later start date meant humidity became a factor
- Jobsite was close to the ocean and high off the ground, so crew had to battle winds
- Extra thickness of the SPF meant additional passes

MATERIALS/PROCESSES:
- Cleaned and pressure washed the building's deck
- Filled flutes with ~940,000 board feet (2,218,153 L) of Bayseal 2.7-lb (1.2 kg) foam
- Sprayed between four and five passes of Bayseal 2.7-lb (1.2 kg) foam in 1- to 1.5-inch (2.5–3.8 cm) thickness
- Sprayed three passes of National Coating's AcryShield High Tensile A-550 Acrylic Elastomeric basecoat at 1 gallon (4 L) to achieve 3 gallons (11 L) per 100 square feet (9 m²)
- Sprayed three passes of National Coating's AcryShield High Tensile A-550 Aquashield topcoat at 1 gallon (4 L) to achieve 3 gallons (11 L) per 100 square feet (9 m²)

SAFETY CONSIDERATIONS:
- Wore fall protection, North silicone half-mask respirators with 7583P100 cartridges or full-face respirators for foam applicators, protective coveralls and head covers, and charcoal safety glasses

have taken, at a minimum, the American Chemistry Council (ACC) Spray Foam Online Safety Course for High-Pressure Foam Application.

The spray foam and coating applicators and assistants on the roof used North Silicone half-mask respirators with 7583P100 cartridges. Foam applicators could also opt for the full-face respirators. Foam sprayers are also required to wear protective coveralls and head covers. And because there were increased reflected ultraviolet (UV) rays, both the spray foam and coating crews were given charcoal safety glasses to reduce eye strain.

VENDOR TEAM

3M
Safety equipment manufacturer
3M Center
St. Paul, MN 55144
(888) 364-3577
www.3m.com

Bayer MaterialScience
SPF manufacturer
100 Bayer Rd.
Pittsburgh, PA 15205
(800) 289-8272
www.BaySystemsSpray.com

FS-Curtis
Equipment manufacturer
1905 Kienlen Ave.
St. Louis, MO 63133
(800) 925-5431
www.fscurtis.com

Graco Inc.
Equipment manufacturer
88 11th Ave. NE
Minneapolis, MN 55413
(612) 623-6000
www.graco.com

Ingersoll Rand
Equipment manufacturer
800-E Beaty St.
Davidson, NC 28036
(704) 655-4000
www.ingersollrandproducts.com

Intech Equipment & Supply
Equipment supplier
1921 W Grant St.
Phoenix, AZ 85009
(866) 652-9975
www.intechequipment.com

International Trucks by Navistar
Equipment manufacturer
2701 Navistar Dr.
Lisle, IL 60532
(800) 448-7825
www.internationaltrucks.com

J. Calman Industries, LLC
Equipment manufacturer
176 W King Tut Rd.
Lynden, WA 98264
(855) 580-7321
www.calmanindustries.com

Magnum Power Products LLC
Equipment manufacturer
215 Power Dr.
Berlin, WI 54923
(800) 926-9768
www.m-p-llc.com

Multiquip Inc.
Equipment manufacturer
18910 Wilmington Ave.
Carson, CA 90746
(800) 421-1244
www.multiquip.com

National Coatings Corporation
Coatings manufacturer
1201 Calle Suerte
Camarillo, CA 93012
(805) 388-7112
www.nationalcoatings.com

North by Honeywell
Safety equipment manufacturer
101 Columbia Rd.
Morristown, NJ 07960
(973) 455-2000
www.honeywell.com

Tyvek by DuPont
Safety equipment manufacturer
P.O. Box 80728
Wilmington, DE 19880
(800) 448-9835
http://www2.dupont.com/Tyvek/en_US/

To finish the roof's coating system, the crew had to work around the humidity again to get the desired result. Instead of two passes, they applied both the basecoat and topcoat in three passes each.

System Longevity

Orth said the job was unusual because of the thickness his crew needed to spray. "We've done jobs that were similar in size, but they typically only required 1 to 1.5 inches (2.5–3.8 cm)," he said. "This was the largest 5-inch (13 cm) application we have ever done. It's not the largest building, but the largest at 5-inch (13 cm) thickness."

According to Orth, that extra thickness required extra work and planning. "When you spray foam, you spray by the board foot," he said. "A typical roof of this size is 172,000 board feet (406 m^3), but this one required filling all the flutes, so with all the foam, we were at 950,000 board feet (2,242 m^3). So you've got five times as much material, roughly. With a typical job of this size, we would normally use about 58,000 pounds of foam (26,308 kg). With this job, because of the thickness and everything else, we used 300,000 pounds (136,080 kg) of foam. So it's a lot of spraying."

But, Orth said, all of the hard work paid off. "It's an exceptional system we're installing," he said. "We can provide them with a 25-year system warranty. Given the coating, thickness, and everything else, the solar panels should wear out before the coating does."

Orth said he did a job in 1991 or 1992 in the desert that only used a 1.5-gallon (6 L) base, and it's still not ready for a recoat.

"So I'll be long gone and retired before this coating wears out," Orth said. With a seasoned crew and a solid system, it's no wonder this project should last a long time. **CP**

Symbiotic System: SPF and Acrylic Coating

By ***Micah Smith, Registered Roof Observer with the Roof Consultants Institute and Field Technical Director for National Coatings Corporation***

Installing the roof of a 172,000-square-foot (15,979 m²) building is no small task. Many variables must be considered. With the rising costs of energy and the needs of Mission Produce to have the building climate-controlled 24/7, it made sense for the project team to select a system with superior insulation and low life-cycle costs.

The system specified was 5 inches (13 cm) of 2.7-pound (1.2 kg) closed-cell spray polyurethane foam (SPF) with a high tensile acrylic coating system. This was installed over a fluted metal deck. This SPF has a closed-cell structure, which traps gasses inside to give the insulation a high R-value (up to 6.5 per inch). R-values measure the thermal resistance of insulation. Couple this with a highly reflective and emissive acrylic coating, and the clients will have a system that will keep their building cool and the energy costs down.

What Is SPF?

SPF is a spray-applied plastic that can form a continuous insulation and air-sealing barrier on walls, roofs, corners, and all contoured surfaces. It is made by mixing and reacting unique liquid components at the jobsite to create foam. This is done with a high-pressure spray gun that combines the two parts of the material at the tip of the gun. The liquids react very quickly when mixed, expanding on contact to create foam that insulates surfaces, seals gaps, and has the ability to form moisture and vapor barriers. The SPF used in roof applications, such as the Mission Produce project, has a high density (2.5–3.0 pounds, or 1.2–1.4 kg) and can add both structural stability as well as a highly walkable surface to the rooftop.

The military developed SPF technology in the 1940s and, since then, the overall material and process of application (including equipment) have been in a constant state of refinement. Additives allow manufacturers to tailor the reaction of the two-part process to allow for a wide range of application temperatures — from 45° to 110° F (7–43° C) — as well as to achieve a much smoother finish texture.

Why Acrylic Coating?

Acrylics have been used to protect SPF from ultraviolet (UV) exposure for more than 50 years. During that time, the technology behind acrylics has advanced greatly. This has led to today's high-tensile coatings that not only provide excellent UV protection but also are extremely resistant to damage caused by impact and other stresses. Acryshield A550, the product selected for this project, has over three times the elongation and tensile strength of traditional

ASTM D6083 acrylic roof coatings. In addition, it also has a Solar Reflective Index (SRI) of 108. These two qualities make it a great option for protecting the SPF covered roof.

This acrylic is also self-cleaning, which means that it stays brighter longer and does not suffer from dirt and biological buildup the way some other coatings do. These properties create an extremely weather-resistant coating, which, in this project, is designed to last with minimal maintenance for 20+ years, thus keeping the life-cycle costs down.

System Strategy

When the SPF and an acrylic coating are installed together, they form a symbiotic relationship. Because SPF is not UV-stable and breaks down in direct sunlight, it needs a very competent UV barrier to protect it so it can perform and endure. On the other hand, the rigidity and thermal diffusive qualities of SPF make it an ideal substrate to apply acrylic coatings, which can fatigue from high flex and the repeated expansion and contraction of thermal shock and movement. The two products in conjunction form a system that will not only reflect almost 90 percent of the UV the hits the roof but also prevents the transference of that heat into the building.

With the R-value of 32 for the SPF insulation coupled with the reflectivity of the high tensile acrylic coating, energy costs are typically between 20–40 percent lower than a traditional asphalt built-up roof (BUR). When you consider that this building will also be conditioned at all times for the storage of fresh fruits and vegetables, the energy savings should be higher still. For this Mission Produce project in particular, the SPF and acrylic system was the right choice and will have long-lasting effects. CP