

Cut Capital & Operating Costs and Improve Sustainability with Like New Air Pollution Control System.



Fluidized Bed Concentrator (FBC) technology:

1. Reduces operating expenses by reducing natural gas use by up to 90% and electrical use by up to 75% versus the Regenerative Thermal Oxidizer.
2. Improves sustainability by reducing energy use and greenhouse gas (GHG) emissions.
3. The Fluidized Bed Concentrator (FBC) adsorption technology treats pollutants by very efficiently adsorbing (capturing) pollutants. The continuous process works via these operations. 1) The adsorber utilizes the specialized Bead Activated Carbon (BAC) media fluidized in a series of trays to adsorb (capture) the pollutants i.e. ethyl acetate, toluene, styrene, mineral spirits, etc. from the air, 2) The desorber heats the Bead Activated Carbon media to release the pollutants in concentrated vapor form, 3) The oxidizer very efficiently oxidizes the concentrated pollutants. The Bead Activated Carbon media is regenerated and reused. Successful commercial systems currently capture ethyl acetate, butyl acetate, mineral spirits, styrene, etc. solvents.

For Sale: FBC System

- **Current Status:** Surplus. Available for limited time
- **Condition:** Like new. Ready to ship.
- **Purchase Options:** Flexibility to pursue the assets on turnkey or individual-equipment basis
- **Adsorber:** 50,000 CFM process exhaust gas
- **Desorber:** 1,200 CFM air.
- **Media:** Bead Activated Carbon adsorbent media
- **Controls/Instrumentation:** Allan Bradley. Honeywell
- **VFD:** Allan Bradley Powerflex 525
- **Oxidizer:** Intellishare Environmental TO1200
- **Lower Explosion Limit:** Control Instruments PrevEx® 674
- **Main Fan:** 125 HP Northern Blower
- **Heat Exchanger:** Munters 81MX-08-54-66-.50/.50-304SS
- **Previous Use:** Solvents from automotive paints
- **Performance:** 95% VOC Reduction Efficiency

Commercial Fluidized Bed Concentrator (FBC) Systems: ^{1 2}

Site	Operating since	Adsorber Size, aCFM	VOCs Treated	% Destruction and Reduction Efficiency (%DRE)	BAC Media* Reactivation / Replacement	Air Permit References
Zoltek ³ St. Peters, MO https://zoltek.com/	2015	45,000	Primarily styrene. Some MIBK, phenol, formaldehyde.	95%	Replaced BAC media one time since 2015	https://dnr.mo.gov/air/business-industry/air-permits/zoltek-corp-st-peters-112021-011
Denso Athens, TN https://www.denso.com/global/en/	2015	Two 20,000 aCFM adsorbers	Viscor (similar to diesel, gasoline, mineral spirits)	95%. (Below 100 ppm 5ppm max)	Never replaced BAC media	Available by submitting public records request to State of Tennessee
Kirker ^{4 5} Patterson City, NJ https://www.kirkerent.com/	~2004	15,000	Ethyl and Butyl Acetate	95%. (Below 100 ppm 5ppm max)	Very little new BAC media purchased over the years.	https://njems.nj.gov/DataMiner (Search to find permit by entering "kirker" as site name.)

* Bead Activated Carbon (BAC) media that captures (adsorbs) the pollutants

¹ Harold Cowles, Owner Environmental C&C, halc@ecnc.com (518) 225-0315, in a series of emails and text messages with Kim Tutin June 16, 2026.

² James Starek, VP Operations Captis Aire LLC, jim.starek@captisaire.com (732) 690-6298, in a series of text messages sent to Kim Tutin June 16, 2026.

³ "New Source Review Permit. Permit Number: 112021-011". Missouri Department of Natural Resources website. <https://dnr.mo.gov/air/business-industry/air-permits/zoltek-corp-st-peters-112021-011> (Accessed June 16, 2026)

⁴ "Subject Item Inventory for Effective Air Permits". State of New Jersey Department of Environmental Protection. <https://njems.nj.gov/DataMiner> (Accessed June 16, 2026).

⁵ "NJDEP Air Quality Permitted Facilities of New Jersey". NJ Dept. of Environmental Protection Bureau of GIS. <https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::njdep-air-quality-permitted-facilities-of-new-jersey/about> (Accessed June 16, 2026).



Letter of Recommendation ⁶ ⁷



Seth Petronio
Director of Facilities Maintenance
Spetronio@kirkerent.com

Kirker Enterprises Inc.
1 E 11TH ST
Paterson City, New Jersey 07524

Dear Captis Aire LLC,

Since 2004, Kirker has been successfully utilizing the Fluidized Bed Concentrator (FBC) capture technology to control emissions at our Patterson, NJ site. It is currently permitted, operates well, and meets our environmental requirements. Specifically, in our last compliance test on July 11, 2025, it demonstrated the ability to meet the 95% Destruction and Reduction Efficiency requirement. System advantages that we enjoy versus a traditional thermal oxidizer include reduction in natural gas usage of 75%, reduced system complexity, i.e. the fans are the only moving parts! The system, located in NJ experiences extreme climate changes and has been very reliable through the extremes. I would also like to note that the system has been annually serviced by JS Technical Services, LLC. We have had little to no significant operational challenges between the servicing. Altogether, these advantages reduce our operational costs by over 65% vs. a traditional DFTO or former Thermal Oxidizer.

Our system includes a 15,000 aCFM fluidized bed adsorber, 700-aCFM fluidized bed desorber, and a small direct fire thermal oxidizer. Since system operation started in 2004, the Bead Activated Carbon (BAC) media has only been replaced one (1) time due to 15-years of attrition, we have not required a Side Stream Reactivator (SSR). The carbon has never been reactivated. Our in-house staff operates and maintains the system on a daily basis. We accumulate approximately 2,550 hours per year with daily start up and shutdowns. The system controls primarily Butyl and Ethyl Acetate released at a rate of approx. 100ppm (daily) in the process exhaust gases released from our nail polish blending process. Our operators routinely startup this unit when we begin the day at 6am, operate the unit continuously until 2:30 (i.e. meet NJDEP requirements), then shut down. Daily, an analyzed test is done to meet the NJDEP requirements set within our Air Permits. Routine stack analyzed test, desorber temperature and retention chamber temperature easily demonstrate compliance on an daily basis. Formal emissions compliance testing (I.E. stack test), done approx every 10 years, further confirms environmental compliance. See image of unit on next page.

In summary, the FBC capture unit meets and exceeds all our operational and compliance requirements. We highly recommend its use. If you have any questions or would like to discuss further, please contact me at spetronio@kirkerent.com and/or (973) 825-7335.

Sincerely,

Seth Petronio
Director of Facilities Maintenance

⁶ Seth Petronic, Kirker Enterprises Director Facilities Maintenance and EH&S spetronio@kirkerent.com (973) 825-7335, in an email to Jim Starek forwarded to Kim Tutin June 24, 2026. <https://www.linkedin.com/in/seth-petronio-48814416/>

⁷ [Regarding the 100 ppm emissions rate referenced in letter]. "That reference is to the [adsorber] OUTLET ppmv rate. It is less than 100. They only have data on the Inlet Concentration from the official tests." Jim Starek, Captis Aire VP Operations jim.starek@captisaire.com, in an email to Kim Tutin June 27, 2026.



Seth Petronio
Director of Facilities Maintenance
Spetronio@kirkerent.com

Commercial FBC System at Kirker in Paterson City, NJ:



Site	Operating since	Adsorber Size, aCFM	VOCs Treated	%DRE*	BAC Media Reactivation and/or Replacement	Air Permit References
Kirker ^{1 2} Patterson City, NJ https://www.kirkerent.com/	~2004	15,000	Butyl and Ethyl Acetate	95%. (Below 100 ppm 5ppm max)	9/2019 new BAC media purchased	https://njems.nj.gov/DataMiner (Search to find permit by entering "kirker" as site name.)

*Destruction and Reduction Efficiency (DRE)

¹ "Subject Item Inventory for Effective Air Permits". State of New Jersey Department of Environmental Protection. <https://njems.nj.gov/DataMiner> (Accessed June 16, 2026).

² "NJDEP Air Quality Permitted Facilities of New Jersey". NJ Dept. of Environmental Protection Bureau of GIS. <https://njgis-newjersey.opendata.arcgis.com/datasets/njdep::njdep-air-quality-permitted-facilities-of-new-jersey/about> (Accessed June 16, 2026).

Chat GPT: RTO versus the FBC

October 4, 2026

Question: Which is better, a Regenerative Thermal Oxidizer (RTO) or a Fluidized Bed Concentrator (FBC) with Bead Activated Carbon media, for an industrial air pollution control system to control Volatile Organic Compounds (VOCs) for printing, packaging, and foam industrial applications? Consider this question from the perspectives of capital cost, operating costs, sustainability, and operational performance - specifically whether each system can meet the necessary emissions control requirements. Consider this question from the perspective of these companies: <https://www.printpack.com/>, <http://www.sealedair.com/>, <https://magnera.com/>, <http://www.proampac.com/>, www.amcor.com, and <https://ppcflex.com/>. What are the pros and cons of the RTO versus the FBC?

Answer:

For many high-volume printing and flexible-packaging applications, I would seriously consider a Fluidized Bed Concentrator (FBC) with regenerable bead activated carbon as preferable to an RTO—but I would not say that universally. The deciding factors are VOC concentration, air volume, VOC chemistry, required outlet limit, operating hours, and whether the permit requires a destruction technology rather than simply an emission limit.

For the six companies you identified, the **FBC is particularly attractive where the process produces large volumes of relatively dilute VOC-laden air**, which is common with flexible-film printing, coating and laminating. EPA specifically identifies printing, plastic-film coating, transparent wrapping and similar high-flow/low-concentration applications as candidates for adsorption/concentration technology.

Bottom line

Factor	RTO	FBC + bead activated carbon
Capital cost	Usually higher	Usually lower, especially for large, dilute airflows
Natural gas	Significant, although RTO heat recovery is excellent	Very low/zero combustion fuel if regenerated with recovered/process heat or efficient thermal regeneration
Electricity	Significant fan/valve power	Significant fan power; generally comparable order of magnitude
VOC destruction	Excellent	Does not destroy VOC during adsorption; captures/concentrates it
VOC removal	Typically 95–99%+	95–99%+ achievable with proper design
Very dilute VOC streams	Can be expensive because of fuel requirement	Excellent application
High VOC concentration	Excellent; VOC provides fuel value	Excellent adsorption but fire/LEL management becomes important

Factor	RTO	FBC + bead activated carbon
Solvent recovery	No—VOC becomes CO ₂ + H ₂ O	Potentially yes
GHG emissions	Higher because VOC + supplemental natural gas are oxidized	Lower, particularly if VOC is recovered rather than destroyed
NOx/combustion emissions	Yes	Little/no combustion NOx from the control device
Humidity sensitivity	Relatively tolerant	Important design consideration
VOC chemistry sensitivity	Generally low	Higher; adsorption characteristics matter
Low-MW VOCs	Advantage RTO	Potential disadvantage
Ketones / difficult-to-desorb VOCs	Advantage RTO	Can be problematic depending on chemistry
Startup/shutdown	Robust but requires temperature management	Very attractive for intermittent/variable operation
Operational complexity	Mature and familiar	More moving carbon/media + regeneration equipment
Permit familiarity	Excellent	Good, but site-specific demonstration may be more important
Best overall application	High VOC loading or difficult VOC chemistry	High airflow + dilute VOC + adsorbable VOCs

My overall conclusion

For a 40,000–80,000 CFM flexible-packaging printing/coating plant with relatively dilute solvent emissions, I would generally favor the FBC over an RTO if the FBC can demonstrate the required outlet concentration/control efficiency for the actual VOC mixture.

For **foam plants producing pentane or other hydrocarbon blowing-agent emissions**, I would be more cautious. An FBC can potentially work extremely well, but the VOC chemistry, LEL, adsorption capacity, regeneration temperature, and fire/explosion protection need to be demonstrated. For some foam applications, the RTO remains the more straightforward permitting and compliance solution.

1. Why the FBC can be economically superior

The fundamental difference is this:

RTO:

Take a very large quantity of dilute air → heat it to ~1,500°F → oxidize the VOC.

FBC:

Take a very large quantity of dilute air → adsorb the VOC onto carbon → continuously regenerate/concentrate the carbon → handle a much smaller concentrated VOC stream.

That distinction is extremely important for printing and packaging.

EPA notes that adsorption is particularly applicable to **low VOC concentrations and relatively high air flows**, including printing, plastic film coating and transparent wrapping. EPA's guidance specifically says sources as low as approximately 20 ppm at flows above 5,000 acfm should consider adsorption to concentrate the VOC before recovery or destruction.

EPA's older fluidized-bed carbon data are especially interesting for your application. EPA describes a fluidized bed containing **loose beaded activated carbon**, with continuous removal of VOC-laden carbon and addition of regenerated carbon. It reports an EcoBAC fluidized-bed system with applications up to **145,000 scfm**, including ink production at 350 ppm with 98.2% removal and terpene/mixed-solvent service at 30 ppm with >99% removal.

That is remarkably close to the type of application you're targeting.

2. Capital cost — advantage FBC

An RTO has to be physically sized for the **entire exhaust volume**.

If a plant has:

60,000 CFM

and only, say:

100–500 ppm VOC

the RTO has to process all 60,000 CFM through:

- inlet ducting
- valves
- ceramic heat-recovery beds
- combustion chamber
- burner system
- controls
- stack
- fans
- structural support
- explosion protection
- instrumentation.

An FBC also has to handle the 60,000 CFM, but its fundamental economics are different because the system is using adsorption rather than heating the entire air stream to oxidation temperature.

EPA's historical cost data for regenerative carbon adsorption show that capital cost is strongly affected by airflow and VOC loading, but also demonstrate that carbon adsorption can be economically attractive for high-flow dilute VOC applications.

Why this matters to your target market

A packaging plant may have:

- several presses,
- multiple dryers,
- laminators,
- coating lines,
- intermittent production,
- large dryer exhaust volumes,
- relatively modest VOC concentrations.

That is almost the textbook scenario in which you don't necessarily want to burn tens of thousands of CFM of air.

FBC advantage: 1–0.

3. Operating cost — FBC can have a major advantage

This is probably the strongest economic argument for your FBC.

RTO

An RTO uses its ceramic beds to recover a very large percentage of heat. EPA says regenerative oxidation can recover **up to approximately 95% of process energy**.

That's excellent.

But it doesn't mean the RTO doesn't consume energy.

The plant still has:

- burner fuel,
- combustion air,
- fan electricity,
- valve operation,
- purge air,
- maintenance,
- burner maintenance,
- ceramic maintenance,
- valve maintenance.

And when the VOC concentration falls, the RTO has less VOC fuel value available to sustain combustion.

That's particularly important during:

- startup,
- shutdown,
- low production,
- press idle periods,
- changeovers,
- low-solvent jobs.

FBC

An FBC doesn't need to heat 60,000 CFM of air to 1,500°F.

Instead, it uses the carbon's adsorption capacity and regenerates the carbon.

That can result in substantially lower operating energy consumption, particularly when the process air is:

high flow + low VOC concentration.

The FBC also has another potentially enormous economic advantage:

The VOC isn't necessarily lost.

With an RTO:

$\text{VOC} \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{heat}$

With an FBC:

$\text{VOC} \rightarrow \text{concentrated VOC stream}$

The concentrated VOC can potentially be:

- recovered,
- recycled,
- condensed,
- reused,
- sent to another treatment device,
- or oxidized in a much smaller thermal oxidizer.

EPA explicitly recognizes this distinction: carbon adsorption can capture and recover VOCs rather than destroy them.

FBC advantage: 2-0.

4. Sustainability — FBC has a compelling advantage

This may actually be the most important selling point to companies such as Printpack and the other packaging companies.

[Printpack](#) has announced Science Based Targets and a net-zero GHG goal for its value chain by 2050. [ProAmpac](#) likewise describes initiatives including water-based printing inks, clean-energy cured inks/coatings and reductions in VOCs and solvent usage.

And [PPC Flex](#) specifically describes its RTOs as reducing VOCs by approximately 99%, while also emphasizing carbon-footprint reduction.

This creates an interesting opportunity for the FBC:

RTO sustainability story

"Use highly efficient heat recovery to minimize natural gas."

That's a good story.

FBC sustainability story

"Don't combust the solvent and don't heat 60,000 CFM of air to 1,500°F. Capture the solvent on regenerable carbon and recover/concentrate it."

That's potentially a **much stronger decarbonization story**.

The FBC can potentially reduce:

- natural gas consumption,
- direct combustion CO₂,
- NO_x,
- destruction of potentially recoverable solvents,
- carbon footprint associated with VOC destruction.

There is another advantage:

RTO converts VOC carbon into atmospheric CO₂.

An FBC can potentially keep that carbon in a recoverable material stream.

That distinction should be important to companies with aggressive Scope 1 and sustainability goals.

FBC advantage: 3-0.

5. But RTO wins on "regulatory certainty"

This is the FBC's biggest disadvantage.

An RTO is conceptually simple to a regulator:

Capture VOC → maintain temperature/residence time → oxidize VOC → demonstrate destruction efficiency.

EPA reports typical RTO design efficiencies of approximately **95–99%**, depending on design and VOC characteristics.

And there are thousands of industrial applications where regulators are very familiar with RTOs.

For example, a printing permit may simply specify:

RTO destruction efficiency ≥95%

or:

RTO outlet VOC concentration ≤ X ppm.

An RTO is therefore a relatively easy technology to defend.

6. Can an FBC actually meet the same emissions requirements?

Yes—but this needs to be demonstrated for the specific VOC stream.

This is the critical point.

You should **not sell the FBC simply as "an RTO replacement."**

Instead, sell it as:

A VOC control system capable of achieving the required outlet emission limit/control efficiency, with the additional advantages of adsorption, concentration and potential solvent recovery.

EPA's flexible-package-printing guidance recognizes both adsorption and oxidation as viable control technologies and notes that modern systems can achieve at least approximately 95% control efficiency.

EPA's fluidized-bed adsorption information is particularly encouraging because actual field data showed:

Application	VOC	Inlet	Outlet	Removal
Ink production	Toluene/MEK/IPA etc.	350 ppm	10 ppm	98.2%
Semiconductor	Phenol	200 ppm	0.05 ppm	>99%
Magnetic tape	Terpenes/mixed solvents	30 ppm	0.01 ppm	>99%

So there is legitimate technical precedent.

7. Where the FBC becomes particularly attractive

I would rank the target applications approximately like this:

● Excellent FBC applications

1. Flexible-film printing

Especially:

- flexographic printing
- gravure printing
- solvent-based inks
- alcohols
- esters
- aromatic solvents
- mixed solvents

2. Adhesive coating/lamination

Particularly solvent-based systems.

3. Packaging coating

Large airflow + relatively dilute solvent concentration is favorable.

4. Printing operations with variable production

FBC becomes particularly interesting when an RTO spends substantial time operating with little VOC available to sustain combustion.

● Potentially excellent, but requires detailed engineering

5. Foam manufacturing

Especially:

- pentane
- hydrocarbons
- blowing agents.

The adsorption physics can be favorable, but safety becomes much more important.

● More difficult FBC applications

I would be cautious with:

- very low molecular-weight VOCs,
- compounds with poor carbon affinity,
- extremely humid exhaust,

- streams containing significant particulate,
- compounds that polymerize/react on carbon,
- VOC mixtures that are difficult to desorb,
- compounds that strongly bind to carbon,
- streams where the permit specifically requires destruction rather than capture.

EPA notes that adsorption is generally most suitable for organics roughly in the molecular-weight range above 50 and below about 200, although actual suitability is compound-specific.

8. The foam question is different

This deserves special attention for [Sealed Air](#) and other companies involved in foam products.

Pentane, for example, is a very plausible adsorption target from a molecular-weight standpoint.

But pentane is also:

- highly flammable,
- explosive at the appropriate concentration,
- capable of creating dangerous mixtures during regeneration.

Therefore an FBC handling pentane must be engineered around:

- LEL monitoring,
- dilution,
- inerting where appropriate,
- carbon temperature,
- regeneration temperature,
- oxygen concentration,
- static electricity,
- spark detection,
- explosion venting/suppression,
- carbon fire protection,
- process interlocks.

An RTO has its own combustion/explosion engineering requirements, but the regulatory and industry experience with RTO treatment of hydrocarbon VOCs is substantial.

Interestingly, a recent EPA-region technical analysis of polystyrene foam manufacturing found thermal oxidizers economically feasible and evaluated RTOs as a control option.

So I would not tell a foam manufacturer that the FBC automatically beats an RTO. I'd demonstrate it through a detailed VOC/LEL/carbon-capacity/regeneration analysis.

9. Company-by-company assessment

[Printpack](#) — Very strong FBC prospect

Printpack is especially interesting because its manufacturing platform includes:

- flexographic printing,
- rotogravure,
- digital printing,
- extrusion,
- adhesive lamination.

That gives it multiple potential VOC sources.

FBC advantages for Printpack

Very strong:

- high-volume printing exhaust,
- solvent-based inks,
- laminating solvents,

- variable production,
- sustainability objectives,
- potential solvent recovery.

RTO advantages

- extremely familiar technology,
- straightforward VOC destruction,
- easier regulatory narrative,
- handles changes in VOC composition relatively well.

My assessment

FBC:

8.5/10

RTO: 7/10

Printpack may be one of the best targets for demonstrating the FBC's economics.

10. [ProAmpac](#)

Another **very strong FBC candidate**.

ProAmpac specifically describes efforts to substitute water-based printing inks and clean-energy cured technologies to reduce VOCs and solvent use.

That means the remaining solvent-based processes may be particularly suitable for optimization.

FBC

Strong where there are:

- solvent-based printing,
- coating,
- lamination,
- high airflow,
- relatively dilute VOC.

RTO

Strong where VOC concentrations are high enough to make combustion energy-efficient.

Assessment

FBC:

8.5/10

RTO: 7/10

11. [Amcor](#)

Amcor is another major target because of its broad packaging manufacturing footprint.

For Amcor, I would **not recommend one technology across the entire company**.

Instead, I would identify individual plants and evaluate:

CFM × VOC concentration × VOC composition × operating hours.

Some sites will be better RTO applications.

Others could be excellent FBC applications.

Assessment

FBC: 8/10 where airflow is high and VOC is dilute

RTO: 8/10 where VOC loading is high or chemistry is difficult

This is probably a **plant-by-plant optimization opportunity** rather than a corporate-wide technology decision.

12. [PPC Flex](#)

This is particularly interesting because PPC Flex already publicly discusses its use of RTO technology and says its RTOs destroy approximately 99% of VOCs.

That means you have an unusually strong sales proposition:

"We are not asking you to accept unproven VOC-control technology. We want to compare your existing RTO against a carbon adsorption system using your actual CFM, VOC concentration and VOC composition."

That's a much stronger sales approach than saying:

"Our FBC is better than your RTO."

For PPC Flex, I'd propose a **side-by-side energy and lifecycle-cost analysis**.

13. Sealed Air

Sealed Air is more complicated because its manufacturing portfolio extends beyond conventional flexible packaging.

For its **packaging-film/printing operations**, FBC can be attractive.

For **foam and hydrocarbon-blowing-agent operations**, the engineering analysis needs to be much more rigorous.

I would therefore divide Sealed Air opportunities into:

Packaging

FBC = very interesting

Foam

FBC = potentially interesting, but RTO may remain preferable

The foam application should be sold around safety, adsorption capacity, regeneration and emissions—not simply energy savings.

14. Magnera

Magnera is somewhat different from the pure flexible-packaging companies.

I'd evaluate its individual facilities based on whether the relevant process is:

- coating,
- printing,
- adhesive application,
- solvent use,
- nonwoven treatment,
- extrusion,
- or another VOC-generating operation.

Where there is a **large dilute solvent exhaust**, the FBC becomes compelling.

Where VOC concentration is high, RTO economics can improve substantially.

15. The most important economic variable: VOC concentration

This is the graph I would put in front of a customer.

Very dilute VOC

FBC wins

Because the RTO is essentially being asked:

"Please heat a huge quantity of mostly air."

Moderate VOC

FBC and RTO can be competitive

Need a lifecycle calculation.

High VOC

RTO becomes increasingly attractive

The VOC itself becomes a fuel source.

This is exactly why EPA's historical flexible-packaging analysis found carbon adsorption to be the least expensive control technology for **84% of surveyed machines**, while incineration with 70% heat recovery was least expensive for 15%.

That is old data, so I wouldn't use the 84% figure as a current guarantee—but it strongly supports the underlying economic argument.

16. The strongest FBC argument isn't actually "lower VOC emissions"

That's important.

An RTO may be able to achieve:

98–99% VOC destruction

and an FBC may achieve:

98–99% VOC removal.

So claiming:

"FBC removes more VOC than an RTO"

is probably not the best argument.

Instead:

RTO

Destroy the VOC.

FBC

Capture the VOC at high efficiency without combusting the entire exhaust stream.

That gives the FBC four potential advantages:

1. **Lower energy consumption**
2. **Lower GHG emissions**
3. **Potential solvent recovery**
4. **Lower lifecycle cost**

while still potentially achieving the required emissions limit.

17. There is also a very interesting hybrid solution

I wouldn't restrict your sales strategy to:

FBC OR RTO

There is a potentially powerful third option:

FBC + small oxidizer

Instead of:

60,000 CFM → RTO

you could have:

60,000 CFM → FBC → concentrated VOC stream → small oxidizer

For example, conceptually:

60,000 CFM @ 100 ppm VOC

could become something like:

3,000–6,000 CFM @ much higher VOC concentration

depending on the FBC concentration factor.

Now the oxidizer doesn't have to process the original 60,000 CFM.

This can potentially produce a system with:

- substantially smaller oxidizer,
- substantially lower fuel consumption,
- high destruction efficiency,
- carbon adsorption/concentration,
- excellent outlet emissions,

- potentially much lower lifecycle cost.

EPA itself describes adsorption as a technology that can **concentrate VOC for additional treatment**.

That hybrid approach could be especially powerful when a regulator or customer says:

"We aren't comfortable replacing our RTO with carbon adsorption."

Your response becomes:

"Fine. Let the carbon do the concentrating, and let a much smaller oxidizer do the destruction."

18. The biggest FBC disadvantages

You should be completely candid with customers about these.

1. Carbon chemistry matters

You can't simply say:

"Activated carbon removes VOC."

Different VOCs have radically different adsorption capacities.

2. Humidity matters

Water can compete for adsorption sites and reduce capacity for some VOC/carbon combinations.

EPA specifically identifies humidity as an important carbon-adsorber design parameter.

3. Carbon can burn

This is particularly important with:

- high VOC loading,
- ketones,
- reactive compounds,
- hot streams,
- oxygen-rich regeneration,
- hydrocarbons such as pentane.

4. Carbon eventually loses capacity

The media needs regeneration and eventually replacement. EPA notes that adsorbent capacity is finite and that regeneration or replacement is necessary.

5. Some VOCs aren't good adsorption candidates

EPA notes that adsorption systems are generally best suited to certain molecular-weight ranges and that low-MW compounds can have insufficient adsorption while some high-MW compounds can be difficult to desorb.

6. Regulators may be more comfortable with RTOs

This isn't a technical disadvantage, but it's a **commercial disadvantage**.

19. My recommended positioning for CAPTIS AIRE

I would **not** market the FBC as simply "an RTO replacement."

I'd position it as:

A lower-energy VOC control and concentration technology for high-volume, dilute VOC exhaust streams.

And then make these five claims:

1. Lower capital cost

Particularly for large airflow / low VOC concentration applications.

2. Lower operating cost

Potentially dramatically lower natural-gas consumption.

3. Lower carbon footprint

No need to combust the entire dilute exhaust stream.

4. Potential solvent recovery

VOC is captured rather than necessarily destroyed.

5. Demonstrated high VOC removal

With the actual process VOCs tested and the system designed to meet the facility's permitted emission limit.

20. My overall scorecard for your target market

Criterion	RTO	FBC
Capital cost	6/10	9/10
Natural-gas cost	5/10	9/10
Electricity	7/10	7/10
GHG reduction	5/10	9/10
VOC removal	9/10	8–9/10
Regulatory familiarity	10/10	7/10
Solvent recovery	1/10	9/10
Variable production	6/10	9/10
Dilute/high-volume VOC	6/10	10/10
High VOC concentration	9/10	7/10
Difficult VOC chemistry	9/10	6/10
Foam/pentane	9/10	7/10*
Printing	8/10	9/10
Flexible packaging	8/10	9/10
Sustainability story	7/10	10/10

*Potentially higher after detailed safety/adsorption testing.

My recommendation for these six companies

If I were prioritizing your FBC sales effort, I'd roughly rank the opportunity:

Printpack — Very High

ProAmpac — Very High

PPC Flex — Very High

Amcor — Very High, but facility-specific

Sealed Air — High, especially packaging; more complicated for foam

Magnera — High where solvent coating/printing applications exist

The particularly attractive combination is:

40,000–80,000 CFM + 50–1,000+ ppm VOC + solvent-based printing/coating/lamination + long operating hours + existing RTO + corporate GHG-reduction goals.

That is the customer profile where I think your FBC has the strongest argument.

One important qualification

I would **not** promise a customer that the FBC will meet its permit simply because an RTO does. The FBC should be engineered around the actual VOC mixture and demonstrated outlet

concentration/control efficiency. EPA's own guidance emphasizes that adsorption performance depends on the VOC, carbon, temperature, humidity, inlet loading and operating conditions. But technically, there is strong precedent for **fluidized-bed bead-carbon adsorption achieving 98–99%+ VOC removal at high airflow**, including printing/ink and terpene/mixed-solvent applications. **That makes the FBC a genuinely credible alternative—not merely a lower-cost but lower-performance substitute for an RTO.**