Part 494 Variance Application Form

version 1.2

(Submission #: HQG-4NJK-GBHGN, version 1)

Details

Submitted	10/6/2025 (0 days ago) by Scott Stone
Submission ID	HQG-4NJK-GBHGN
Status	Submitted

Form Input

Applicant and Variance Information

Project Name
VRF Variance Manufacturers Joint Variance

Applicant (Business Entity) Contact Information

[redacted]

Application Contact Information

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1. Applicant Business Ownership Status
This joint application is submitted by Daikin Comfort Technologies North America, Inc.; LG Electronics U.S.A., Inc.; Mitsubishi Electric U.S., Inc.; and Samsung HVAC America, LLC. Each is a U.S. subsidiary of a multinational parent, operating as a distinct entity manufacturing, importing, and distributing HVAC equipment, including VRF systems, for sale in New York. Applicants are not a trade association and file solely as manufacturers.

2. Describe the product or system and the Applicant's business and relationship to the product or system.
Applicants are the manufacturers and importers responsible for supplying variable refrigerant flow (VRF) systems for installation in New York State. Applicants manufacture and distribute these systems and their components.

3. Describe any other relevant parties that may require a variance.
This variance request is submitted on behalf of the Applicants in their capacity as manufacturers and importers of VRF systems. No additional parties are included in this application. If granted, the variance would apply to the Applicants' supply of covered VRF systems for installation and operation in New York in accordance with the terms of the approved variance.

4. If this is a resubmission of a previous application, provide the submission date of the initial application.
08/18/2025

5. Briefly describe the reason you are applying for this variance.
Applicants seek a variance under 6 NYCRR § 494-1.8(b)(1) (impossibility) for new VRF installations using components manufactured or imported before January 1, 2026, through December 31, 2026. Compliance with the prohibition at § 494-1.4(e)(2)(vi), effective January 1, 2026, is not possible despite the Applicants§ best efforts. Technical, regulatory, and logistical barriers§including pending A2L equipment certifications, state and local code updates, installer training requirements, and long project design and procurement lead times§prevent timely transition. Without a variance, affected projects face cancellation or substitution with alternative technologies that are less efficient and would result in higher overall GHG emissions than VRF systems.

6. Select the specific type of variance you are applying for (see Part 494-1.8(b)).
Impossibility (The Applicant exercised best efforts but still was unable to comply with the regulatory requirements of the regulation for reasons beyond their control despite exercising foresight to prevent the noncompliance.)

7. Select the specific section(s) of Part 494 that you are requesting a variance for.
494-1.4 Prohibitions

7(a). If you selected Part 494-1.4 Prohibitions, provide the specific subsector(s) and prohibition date(s) that you are requesting a variance from.
494-1.4(e)(2)(vi). January 1, 2026.

8. Describe all efforts made to timely fulfill the requirements of the section(s) and subsector(s) from which a variance is being requested.
Applicants began development and commercialization of VRF platforms using lower-GWP refrigerants (e.g., R-32) as early as 2019, in anticipation of the federal HFC phasedown. Because R-32 is classified as an A2L refrigerant, deployment requires redesign, testing, certification, code adoption, and installer training. Despite early investment, compliance by January 1, 2026, is not possible due to several interrelated constraints:

Project design and permitting cycles: VRF projects with refrigerant charges exceeding 50 pounds are typically designed 18–30 months in advance. Many projects now in construction or procurement were specified around R-410A systems. Redesign to accommodate A2L refrigerants would trigger building code reviews, safety approvals, and redesign fees that cannot be executed within the short timeframe. In some cases, layout changes would exceed mechanical room allowances or ASHRAE Standard 15 concentration limits, requiring structural and safety modifications not feasible before the deadline.

Certification and training status: Several R-32 VRF models remain in the UL certification process, with final listings not yet issued. A2L-specific installer training and local code coordination are ongoing but incomplete. Applicants have initiated training programs and submitted products for certification, but these processes cannot be concluded at scale by January 1, 2026.

Code adoption: State and local building code amendments necessary to permit A2L refrigerants remain uneven across New York jurisdictions. Coordination with authorities having jurisdiction is underway, but approvals will not be fully in place before the prohibition date.

Because of these constraints, compliant equipment and components necessary to complete already-designed projects are not currently or potentially available in time. Lower charge substitutes or alternative system designs are not practicable for many large projects due to thermal and zoning requirements and would trigger additional ASHRAE 15 safety infrastructure not budgeted or permitted.

Absent a variance, cancellations or substitutions with less efficient systems (e.g., fossil-fuel boilers or packaged rooftop units) would increase lifetime GHG emissions and undermine statewide electrification goals. Affected projects include affordable housing, schools, and hospitals designed to comply with the Energy Conservation Construction Code of New York State. Forcing substitution would increase emissions and conflict with the Climate Leadership and Community Protection Act (CLCPA), which requires agencies under § 7(2) to evaluate and mitigate climate impacts of discretionary actions.

Length of Variance

Provide the time duration of the variance being requested, or when you expect to undertake an activity that is not in compliance and when you expect to achieve compliance. These dates must align with information included in the rest of the application and will be included in the terms of any variance issued by the Department.

The start date or beginning of noncompliance may be the earliest date that the Applicant will begin selling noncompliant products, will install a noncompliant system, or has identified a leak that must be repaired. If you do not have a start date, you may request an immediate start date (use today's date).

The end date or expected date of compliance may be the earlier date by which the Applicant will stop selling noncompliant products, replace noncompliant systems, or repair a leak. A complete application must have a specific and reasonable end date that complies with all relevant requirements in Part 494.

9. Start date / Beginning of noncompliance
01/01/2026

10. End date / Expected date of compliance
12/31/2026

11. Describe any exemptions from Part 494-1.5 that are relevant to this variance request. Cite the relevant exemption and provide an explanation.
Applicants have reviewed the exemptions in § 494-1.5, including the one-year building-permit exemption in § 494-1.5(a)(12). No exemptions apply to the VRF installations included in this application, and any projects qualifying for § 494-1.5(a)(12) have been screened and excluded.

Confidential Business Information

If the Applicant self-identifies Confidential Business Information (CBI) to be within this application form, the Department will determine whether to except such information from disclosure to the public as set forth in 6 NYCRR Part 616.7. The Applicant must provide adequate justification attached as supporting documentation.
616.7 Records containing trade secrets, confidential commercial information, or critical infrastructure information.

12. Is there CBI in this application form or in the attached documents?
Yes

12(a). Describe the CBI and the specific location in this application form or in the attached documents.
CBI information is located in the individual VRF manufacturer spreadsheets and labeled as CBI protected. Such spreadsheets will be submitted separately, as the Applicants did not find a way to upload these spreadsheets on this form.

12(b). Confidential Business Information Statement
03 - Confidential Business Information Statement 22Sep25.pdf - 10/06/2025 03:56 AM
Comment
NONE PROVIDED

Compliance and Mitigation Plans

Compliance Plan

A variance application must include a Compliance Plan that describes in detail how, if a variance is granted, compliance will be achieved as expeditiously as possible.

CP1. Describe the efforts you will take to achieve compliance if you were issued a variance.
Pursuant to 6 NYCRR § 494-1.8(c)(9), Applicants will transition fully to refrigerants that meet Part 494 prohibitions by January 1, 2027, consistent with the federal compliance date under the AIM Act. No VRF systems using R-410A will be sold or installed after that date.

During 2026, installations covered by this variance will use R-410A components manufactured before January 1, 2026, subject to the mitigation measures described in the Mitigation Plan section of this application. This ensures that any continued use of R-410A during the variance period is both limited in scope and accompanied by emissions-control measures.

In parallel, Applicants will continue the transition that has been underway for several years: developing and certifying product lines using lower-GWP refrigerants such as R-32, preparing installer training and technical guidance, and coordinating with distributors and customers for the 2027 transition. New York State has updated its building codes and regulations to allow A2L refrigerants, including R-32, effective December 31, 2025, with additional fire code provisions forthcoming. These updates provide the regulatory foundation for compliant VRF systems to be widely available in New York beginning in 2027.

This compliance plan ensures that the requested variance remains temporary and transitional, bridging the one-year gap created by New York's earlier prohibition date while aligning with federal requirements and the state's long-term refrigerant transition framework.

CP2. Describe the efforts that may be implemented to curtail noncompliance in lieu of obtaining a variance.
If a variance is not granted, Applicants will cease installations of covered R-410A VRF systems and pursue allowable compliance pathways on a project-specific basis. These may include redesigning projects to use compliant refrigerants where feasible, or deferring installation until compliant systems are available. In parallel, Applicants will continue training programs and supply-chain preparations for lower-GWP VRF systems to support a full transition by January 1, 2027.

While these measures would avoid formal noncompliance, they would also result in significant negative consequences. Many projects already in development would be cancelled or substantially delayed, imposing economic impacts and forcing substitution with less efficient or fossil-fuel-based systems. Such outcomes would increase lifetime greenhouse gas emissions compared to VRF systems and conflict with New York's electrification and decarbonization goals.

Milestone Achievements and Dates

List past and future milestones in the tables below. For Past Milestones, list all milestones that are relevant to this application that occurred before this application is submitted, including before the Part 494 regulation went into effect (January 9, 2025). For Future Milestones, list all expected milestones that relate to this application, such as the earliest date by which an approval, repair, or new system installation will occur. Provide full titles or names such as for permits (no acronyms) and legal references, where applicable (e.g., Part 494-1.4 or 40 CFR Part 84.54).

You may attach supplemental documents to substantiate this information, but these documents must be referenced below. The Department is not responsible for locating information that is not referenced in this form.

Past Milestones

Milestone	Date	Attachment File Name
Initiated development and certification planning for low-GWP VRF platforms	01/01/2019	*NONE PROVIDED*

Milestone	Date	Attachment File Name
Began installer and service technician training programs addressing A2L refrigerant safety.	01/01/2024	*NONE PROVIDED*
Submitted VRF product lines for UL certification and coordinated with state and local code updates allowing A2Ls.	01/01/2025	*NONE PROVIDED*

Future Milestones

Milestone	Date	Attachment File Name
Completion of product certification and building code alignment for low-GWP VRF systems.	12/01/2026	*NONE PROVIDED*
Full deployment of installer training and workforce transition programs .	12/01/2026	*NONE PROVIDED*
Supply chain and logistics transition to compliant VRF systems.	12/01/2026	*NONE PROVIDED*
Market readiness confirmation for compliant VRF product lines.	12/15/2026	*NONE PROVIDED*
Full compliance with refrigerant transition for all VRF installations.	12/31/2026	*NONE PROVIDED*

Milestones Documentation

NONE PROVIDED

Comment

NONE PROVIDED

Mitigation Plan

A variance application must include a mitigation plan that demonstrates how the Applicant will reduce excess emissions of regulated substances to a level equal to or below what would have been emitted had the Applicant complied and how the Applicant will mitigate any negative impacts to human health or the environment.

MP1. Describe the mitigation activities you will take to reduce excess emissions of regulated substances to a level equal to or below what would have been emitted if you were in compliance with Part 494. You must clearly explain a. how each activity would result in emission reductions and b. how each activity is additional (i.e., not otherwise required).

Leak-Rate Mitigation Through Enhanced Installation and Leak-Prevention Practices

Applicants will apply enhanced installation and leak-prevention practices for all VRF systems installed under this variance. These measures reduce operational leakage rates, thereby lowering projected lifetime emissions from R-410A equipment installed during 2026.

All installations will be performed by technicians with EPA Section 608 certification, together with OEM training on VRF and A2L procedures. While Section 608 is mandatory nationwide, the OEM training and the practices below are not required under federal regulation and are applied here as additional mitigation under 6 NYCRR § 494-1.8(c)(9)(v).
The enhanced installation practices include:

Limiting installation to technicians who are both Section 608 certified and trained in OEM VRF and A2L procedures;

Using brazed joints in inaccessible locations and precision flare tools with calibrated torque wrenches for field connections;

Conducting high-pressure nitrogen testing (=500 psig) and deep-vacuum dehydration (=500 microns with hold) before charging;

Performing leak checks of accessible joints using electronic detectors or bubble solution;

Verifying charge by line-length calculation, weighing, and recording in commissioning records; and

Installing locking service port caps and providing charge logs and leak-test results to the owner at turnover.

For durability and qualitative sensitivity, see I4 and I7; sources are in MP1.

In emissions modeling, Applicants apply the annual operational leak structure in 6 NYCRR § 494-1.3(a)(47) and a one-time 10 percent end-of-life loss under § 494-1.3(a)(22). For covered VRF systems, each row is modeled as connection class >10 with an annual leak rate of 0.10. Where the enhanced practices are assumed, a 50 percent reduction is applied to the annual leak rate only; the end-of-life loss remains 10 percent. All calculations use GWP20 values consistent with § 494-1.3(a)(10).

These measures are not otherwise required under Part 494 or federal law. They are therefore additional for variance purposes and provide a credible basis for modeling reduced emissions relative to business-as-usual installation.

The following sources support the measures above as recognized practices to achieve leak-tight refrigeration systems and thus support modeling a reduced operational leak-rate percentage relative to business-as-usual installation. They do not set a single percentage reduction but substantiate the linkage between these practices and lower in-service refrigerant loss.

U.S. Environmental Protection Agency, GreenChill Partnership, Best Practices Guideline: Ensuring Leak-Tight Refrigeration Equipment Installations.

Air Conditioning Contractors of America (ACCA), ANSI/ACCA 5 QI-2015: HVAC Quality Installation Specification (2015).

ASHRAE, Standard 147-2013 (RA 2018): Reducing Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems.

ASHRAE, ASHRAE Handbook: Refrigeration (latest ed., chapters on leak testing, evacuation, charging, commissioning).

California Energy Commission, Building Energy Efficiency Standards, Residential Appendices RA3.2: HVAC System Quality Installation and Verification (most recent code cycle).

Use of Reclaimed Refrigerant for Field-Applied Charge

Applicants will source reclaimed R-410A meeting AHRI Standard 700 purity from EPA-certified reclaimers for approximately 75 percent of the field-applied charge fraction.
Emissions accounting under Part 494 remains strictly physical: mass leaked multiplied by GWP20, with no adjustments for upstream effects.

A peer-reviewed life-cycle assessment by Yasaka and colleagues using plant data from Japan and Europe compared reclamation and destruction across multiple refrigerants, including R-410A, and found that reclamation avoids approximately 5.7–15.9 kg CO2e per kg and about 82.5–250.6 MJ per kg of energy use, relative to destruction. See Yoshihito Yasaka et al., Sustainability 15:473 (2023).

Daikin Europe reported in 2022 that reuse of reclaimed refrigerant reduces the carbon footprint by about 72 percent for R-410A and up to about 90 percent for R-32 and R-134a, compared to virgin production. See Daikin Europe N.V., Assessing the Carbon Footprint of Reclaimed Refrigerant for Reuse and Virgin Refrigerant Production (2022).

EPA's 2024 analysis documented increases in reclaimed HFC volumes from 2021 through 2023, with R-410A among the largest fractions returned to commerce. See U.S. Environmental Protection Agency, Analysis of the U.S. Hydrofluorocarbon Reclamation Market: Stakeholders, Drivers, and Practices 4–5, 27–28 (Sept. 2024).

Applicants will retain supplier documentation, including certificates of analysis demonstrating AHRI-700 compliance, to confirm reclaimed sourcing for field charges under this variance.

MP2. Confirm that these emission mitigation activities are additional to any applicable legal requirements.
Yes, I can confirm that these activities are not already required.

MP3. Describe the potential negative impacts to human health or the environment that would result from this variance. This must include risks from any remaining greenhouse gases. You may focus on impacts that are most relevant to the facility or surrounding region. If you reference any reports, provide a citation.
Direct GHG emissions: Refrigerant emissions during the variance period are modeled using annual operational leakage together with a one-time end-of-life loss and GWP20 values, as specified in this application. Quantified results are provided in the attached spreadsheets.

Under this modeling, the mitigated variance case is at or below the compliant reference case, and the variance is limited to installations occurring in calendar year 2026.

Climate-related impacts in New York State: DEC evaluates potential impacts in relation to the 2025 New York State Climate Impacts Assessment, which describes risks such as extreme heat events, more intense precipitation and flooding, and accelerated sea level rise. Those risks are defined at the statewide greenhouse-gas level; the Assessment provides the context in which DEC considers potential impacts.
Scope and duration: Applicants emphasize that the mitigation measures and the one-year scope and duration of this variance are intended to reduce and contain any potential risks in that context.

MP4. Describe the mitigation activities that you will take to address the negative impacts identified above. (This is separate from the emissions mitigation activities described above.) Explain how these efforts are additional to any applicable legal requirements.

Even with the mitigation measures described in this application, installations covered by this variance will use regulated greenhouse gases (GHGs) and will have residual GHG emissions over equipment life, including operational leakage and end-of-life losses.

GHG emissions contribute to climate-related impacts relevant to New York State, as identified in the 2025 New York State Climate Impacts Assessment. Applicants quantify potential emissions using the structure required in 6 NYCRR § 494-1.3(a)(47) and (a)(22), comparing business-as-usual, mitigated, and compliant reference cases. Residual emissions remain in all scenarios but are materially lower under the enhanced installation and leak-prevention practices described in MP1 and reflected in the attached modeling spreadsheet.

This response describes general environmental and public-health impacts associated with GHG emissions in New York State and does not attribute specific or localized effects to any individual installation or project.

In addition to MP1, Applicants will, as appropriate and to the extent feasible given the joint applicant nature of this variance application, implement measures identified in their published sustainability strategies to mitigate potential human-health and environmental impacts from climate-related stressors during the variance period. Illustrative measures include: (i) owner-facing turnover packages that include severe-heat operating guidance and emergency procedures; (ii) documented owner training on leak response and extreme-heat operations; (iii) early-life leak surveillance with electronic detection and defect-correction logs; (iv) water and flood-risk practices consistent with site conditions (e.g., protecting equipment from inundation, drainage/valving checks); and (v) waste and materials stewardship aligned with circular-economy programs (e.g., documented recovery/recycling practices for materials and refrigerants).

These and associated actions are undertaken to mitigate potential impacts (e.g., reducing likelihood, duration, and magnitude of releases; improving resilience during heat or flood events) and are additional to applicable legal requirements.

For further information, please see the following sources:

Daikin Industries, Ltd., Daikin Group Sustainability Report 2025 (2025).

Mitsubishi Electric Corporation, Integrated Report 2024 (2024).

Samsung Electronics Co., Ltd., Samsung Electronics Sustainability Report 2025 (2025).

LG Electronics Inc., 2024–2025 Sustainability Report (2025).

These sources evidence corporate programs on climate resilience, water management, pollution control, and circularity that Applicants may reference and, where appropriate, apply during the variance term to mitigate potential impacts beyond GHG emissions.

MP5. Confirm that these impact mitigation activities are additional to any applicable legal requirements.
Yes, I can confirm that these activities are not already required.

Impossibility Variance Application

I1. Have you ever received a related variance or approval from another state or federal agency, such as under 40 CFR Part 84.54?
No

GHG Emissions Analysis

Part 494-1.8(c)(9)(iii) and (v) describe the required GHG emissions analyses that correspond to the Compliance Plan and Mitigation Plan. Review these requirements before completing this section. Attach a spreadsheet file with all calculations and any supplemental documents that substantiate the data sources or methods used. The answers provided below must provide the public sufficient information to evaluate this analysis, absent the attached spreadsheet. The information provided below must match the information in any attachments, or the application may be deemed incomplete.

Business As Usual Emissions

I2. Enter total estimated GHG emissions from regulated substances in New York State that may result from this variance, calculated per Part 494-1.8(c)(9)(iii) and as found in the attached spreadsheet . Enter these values as metric tons CO2e. Variance requests with an end date that corresponds to the equipment's end-of-life (such as the expected date of decommissioning or replacement) must include expected end-of-life emissions.
1395484.41

I3. Describe the emission sources subject to this variance. For example, provide how many and what type of products or systems, regulated substances and their GWP20, charge sizes, and duration (lifespan) are encompassed by the variance application and were considered in the attached spreadsheet.
The emission sources subject to this variance are VRF systems to be installed in New York during 2026 using R-410A components manufactured or imported before January 1, 2026.

The variance covers 2,361 air-cooled heat recovery systems with an average charge of 35.82 kg, 2,071 air-cooled heat pump systems with an average charge of 43.81 kg, and 373 water-cooled systems with an average charge of 27.00 kg.

All use R-410A with GWP20 of 4705, modeled over a 15-year lifetime with an annual leak rate of 0.10 plus a one-time 10 percent end-of-life loss.

Comparative modeling includes the compliant R-32 reference case, which has a GWP20 of 2690.

I4. Describe the methods and data sources used for this analysis. Describe all GWP values, emission factors, or assumptions that were used, such as leak rates or sales volumes, including citations.
The analysis for this variance used data inputs from the four applicant manufacturers, aggregated into a public spreadsheet and key. The calculations apply the annual operational leak structure under 6 NYCRR § 494-1.3(a)(47) together with a one-time 10 percent end-of-life loss under § 494-1.3(a)(22). For VRF systems, each row was modeled as connection class greater than ten, which requires a 10 percent annual leak rate. A 15-year lifetime was assumed.

GWP20 values come from Part 494: R-410A = 4705 and R-32 = 2690. Total lifetime emissions were calculated as refrigerant charge § system count § (annual leak § lifetime + 10% EOL) § GWP20, converted from kg to metric tons CO2e. The compliant reference used the same structure with R-32. The mitigated R-410A case applies a 50 percent reduction to the annual leak rate (not to end-of-life) to reflect the enhanced installation and leak-prevention practices described in MP1, with supporting industry and technical references cited therein.

The 50 percent reduction is applied to the annual leak term to reflect installation-time practices that act on the primary causes of field leakage (joint integrity, dehydration, pressure integrity, post-charge checks, charge accuracy). Authorities cited in MP1 recognize these practices as effective for achieving leak-tight systems. Because they change the as-built condition of the circuit (for example, brazed joints in inaccessible locations and verified dehydration/pressure holds), their effect is expected to persist over equipment life; no additional time trend is assumed. Results are directionally sensitive to the realized effectiveness of these practices. If field performance is lower than the central assumption, the mitigated totals would still be proportionally lower than business-as-usual under the same accounting structure.

Additional context on upstream impacts from use of reclaimed refrigerant was drawn from published life-cycle assessments, including Yasaka et al., Sustainability 15:473 (2023), Daikin Europe N.V. (2022), and U.S. EPA, Analysis of the U.S. Hydrofluorocarbon Reclamation Market (Sept. 2024). These studies were cited narratively, but emissions accounting in the variance strictly used physical leakage § GWP20 with no upstream credit.

GHG Mitigation

I5. Enter the total estimated GHG emission reductions from the BAU estimate above that will result from the Mitigation Plan, calculated per Part 494-1.8(c)(9)(v) and as found in the attached spreadsheet.
654133.32

I6. Describe all GWP values, emission factors, data sources, assumptions used, and any applicable citations.
FORMULA AND ASSUMPTIONS KEY

This response provides the calculation trace for manufacturer and aggregate emissions spreadsheets submitted under 6 NYCRR § 494-1.8(c). Formulas are visible in the workbooks; this key summarizes columns, constants, and a sample check row. All results are reported in metric tons of CO2e (MTCO2e); the §/1000§ term converts kg CO2e to MTCO2e. In the example formulas, §3§ denotes the first data row; apply the same formulas to each data row.

MANUFACTURER SPREADSHEETS (CBI Protected)

Column Definitions and Formulas

Number of Systems (C) § Applicant input.

Charge per System (kg) (D) § Applicant input.

Refrigerant Type (E) → "R-410A" (variance case) or "R-32" (reference case).

GWP20 (F) → Formula:

=IF(E3="R-410A",4705,IF(E3="R-32",2690,""))

Annual Leak Rate (%) (G)

The analysis applies the annual operational leak structure required by 6 NYCRR → 494-1.3(a)(47) together with a one-time 10 percent end-of-life loss under → 494-1.3(a)(22). For the VRF systems in this variance, each row is modeled as connection class greater than 10 and therefore uses 0.10 (10 percent per year) as the annual rate. This class-based convention implements the required annual-plus-EOL method and avoids any use of a single "lifetime leak rate."

Lifetime (years) (H) → Formula: =15

Total Lifetime Emissions (MTCO2e) (I) → Formula:

=(C3*D3*F3*G3*H3 + C3*D3*F3*0.10)/1000

Compliant R-32 Reference (MTCO2e) (J) → Formula:

=(C3*D3*2690*(G3*H3+0.10))/1000

Mitigated R-410A (MTCO2e) (K) → Formula:

=(C3*D3*(4705*G3*0.5*H3 + 4705*0.10))/1000

Difference (Mitigated vs R-32) (MTCO2e) (L) → Formula:

=K3-J3

Constants

R-410A GWP20 = 4705

R-32 GWP20 = 2690

Lifetime = 15 years

End-of-life leakage = 10 % (applied once)

Annual leak rates = 2 % / 5 % / 10 % (per connection class)

Mitigation factor = 50 % reduction of annual leak only; EOL unchanged

Sample Check Row

Inputs:

Number of Systems = 1

Charge per System = 50 kg

Refrigerant Type = R-410A

Annual Leak Rate = 0.10

Results:

Total Lifetime Emissions (I) = 376.4 MTCO2e

Mitigated R-410A (K) → 199.96 MTCO2e

Difference (L) → 15.24 MTCO2e

AGGREGATE SPREADSHEET

Column Definitions and Formulas

Number of Systems (C) – Sum of manufacturer system counts.

Charge per System (kg) (D) – Weighted average charge (by system count).

Refrigerant Type (E) – –R-410A.–

GWP20 (F) – Formula:

=IF(E3="R-410A",4705,IF(E3="R-32",2690,""))

Annual Leak Rate (%) (G)

The aggregate analysis uses the annual operational leak structure in 6 NYCRR – 494-1.3(a)(47) and a one-time 10 percent end-of-life loss under – 494-1.3(a)(22). Each VRF row is treated as connection class greater than 10 and therefore uses 0.10 (10 percent per year) as the annual rate. This class-based convention implements the required annual-plus-EOL method and avoids any use of a single –lifetime leak rate.–

Lifetime (years) (H) – Formula: =15

Total Lifetime Emissions (MTCO2e) (I) – Formula:

=(C3*D3*F3*G3*H3 + C3*D3*F3*0.10)/1000

Compliant R-32 Reference (MTCO2e) (J) – Formula:

=(C3*D3*2690*(G3*H3+0.10))/1000

Mitigated R-410A (MTCO2e) (K) – Formula:

=(C3*D3*(4705*G3*0.5*H3 + 4705*0.10))/1000

Difference (Mitigated vs R-32) (MTCO2e) (L) – Formula:

=K3-J3

Constants

(same as manufacturer spreadsheets)

R-410A GWP20 = 4705

R-32 GWP20 = 2690

Lifetime = 15 years

End-of-life leakage = 10 % (applied once)

Annual leak rates = 2 % / 5 % / 10 % (per connection class; 0.10 used for VRFs)

Mitigation factor = 50 % reduction of annual leak only; EOL unchanged

NOTE:

The workbook presents the 50 percent central case; end-of-life remains 10 percent and only the annual leak term is adjusted to reflect recognized installation practices, as described in MP1 and I4.

I7. Explain how the proposed emission mitigation activities in the Mitigation Plan will result in the specific emission reductions above. For example, if this analysis assumes a 50% reduction in annual emissions, explain how the proposed mitigation activities lead to that conclusion.
The mitigation activities in the application directly tie to the 50 percent reduction applied to the annual leak rate in the emissions modeling. Applicants commit to enhanced, refrigerant-agnostic installation and leak-prevention practices that go beyond legal requirements.

These include requiring EPA Section 608 certification and adherence to OEM VRF procedures, brazed joints in inaccessible locations, precision flare tools with calibrated torque for field connections, high-pressure nitrogen testing, deep-vacuum dehydration, calibrated post-installation leak detection, accurate charge verification, and provision of charge logs and leak-test results at turnover. A2L training is workforce-transition context and is not relied upon to reduce R-410A emissions.

Collectively, these practices are expected to reduce operational leakage relative to the default 10 percent per year assumption for VRF systems under 6 NYCRR § 494-1.3(a)(47). Supporting industry and technical references for these practices are cited in MP1.

Durability. The practices listed here address physical failure modes at the time of installation and are expected to yield a stable reduction in the annual leak term over the modeled life. The analysis assumes a one-time improvement realized at installation and held constant over 15 years; the one-time 10 percent end-of-life term is unchanged. A2L training is workforce-transition context and is not relied upon for R-410A reductions.

I8. GHG Emissions Calculations Spreadsheet

04 - Aggregated VRF Manufacturers Emissions Spreadsheet 22Sep25.xlsx - 10/06/2025 05:01 AM
05 - CBI - Daikin Emissions Spreadsheet 22Sep25.xlsx - 10/06/2025 05:02 AM
06 - CBI - LG Emissions Spreadsheet 22Sep25.xlsx - 10/06/2025 05:02 AM
07 - CBI - Mitsubishi Emissions Spreadsheet 22Sep25.xlsx - 10/06/2025 05:02 AM
08 - CBI - Samsung - Emissions Spreadsheet 22Sep25.xlsx - 10/06/2025 05:02 AM

Comment
Individual manufacturer spreadsheets are CBI protected.

Demonstration of Criteria

In order for the Department to issue an impossibility variance, this application form must demonstrate the criteria in Part 494-1.8(b)(1) have been met. Provide clear and convincing evidence of the following three items. You may attach documentation to substantiate your answers, and these documents must be referenced in the application form. The Department is not responsible for locating information that is not referenced in this form.

I9. A compliant substance (i.e., a regulated substance with a GWP below the applicable limit) is not currently or potentially available or a component needed for repair is not currently or potentially available.
A compliant refrigerant such as R-32 is not currently or potentially available for VRF systems in New York within the timeframe of this variance. R-32 is classified as an A2L refrigerant and its deployment requires product redesign, UL certification, code amendments, and installer training.

Several VRF product lines remain in the certification process and final listings have not been issued. State and local building and fire code updates to permit A2L refrigerants will not take effect until December 31, 2025, and adoption remains uneven across jurisdictions. Training programs are ongoing but cannot be completed at scale by January 1, 2026.

Because of these constraints, compliant refrigerant systems are not available in time for projects already designed and procured around R-410A. This is why the Applicants seek a one-year variance, with full compliance feasible by January 1, 2027, in alignment with federal requirements under the AIM Act.

I10. A variance will not increase the overall risk to human health or the environment. This specifically includes risks from regulated substances as greenhouse gases.
The requested variance will not increase overall risk to human health or the environment. All emissions during the one-year variance period are modeled using the required annual leak-rate plus end-of-life structure. Under the stated assumptions, the mitigated R-410A case is at or below the compliant R-32 reference.

The Mitigation Plan is modeled to reduce emissions relative to business-as-usual through enhanced, refrigerant-agnostic installation and leak-prevention practices described in MP1, with supporting references cited there. A2L training is workforce-transition context and is not relied upon to reduce R-410A emissions. Use of reclaimed refrigerant for the field-applied charge is described in MP1; no upstream credit is taken in the emissions totals.

The scope of the variance is limited to systems manufactured or imported before January 1, 2026, and installed only in calendar year 2026. It expires January 1, 2027, which aligns with the federal AIM Act compliance deadline.

Because the variance is temporary and transitional, and because the mitigation measures are modeled to reduce leakage below the compliant baseline under the stated assumptions, the variance does not increase risks from regulated substances as greenhouse gases or create additional risks to health or the environment. MP3 addresses general New York relevant impacts from remaining GHGs, and MP4 addresses impact-mitigation measures separate from emissions mitigation.

I11. The Applicant has used best efforts to anticipate and address the impossibility and any potential noncompliance.
The Applicants have used best efforts to anticipate and address the impossibility and any potential noncompliance. Development of low-GWP VRF platforms began years ago in anticipation of the HFC phasedown, with product redesigns, certification submissions, and installer training programs already underway.

Applicants initiated UL certification for R-32 VRF systems, coordinated with state and local authorities on code changes, and launched training programs for technicians on A2L refrigerants; this training is part of workforce transition and is not relied upon in this application to reduce R-410A emissions. They also planned and initiated supply-chain adjustments to support the transition.

Despite these early actions, compliance by January 1, 2026, is not possible because certification processes remain incomplete, building and fire code amendments do not become effective statewide until December 31, 2025 (with uneven adoption), and workforce training cannot be concluded at scale before the prohibition date.

Applicants have screened out any projects qualifying for exemptions, limited the variance strictly to 2026 installations using components manufactured before 2026, and put in place a compliance plan with milestones supporting full transition by January 1, 2027. These efforts demonstrate proactive steps to anticipate regulatory requirements and to minimize the scope and duration of any potential noncompliance.

I12. Describe any supporting documentation that is being included to support the information provided above to demonstrate these criteria have been met.
The Applicants cite as supporting documentation the Biden Administration EPA final rule, Phasedown of Hydrofluorocarbons: Restrictions on the Use of HFCs Under the AIM Act in Variable Refrigerant Flow Air Conditioning Subsector, 89 Fed. Reg. 100,381 (Dec. 12, 2024), and the accompanying proposed rule, 89 Fed. Reg. 53,373 (June 26, 2024).

In that nationwide notice-and-comment rulemaking, conducted just last year, in 2024, the Biden EPA evaluated the use of VRF components manufactured before 2026 for installation through January 1, 2027, and then adopted that schedule in the final rule.

This variance seeks the same relief for New York on the same timeline and for the same reasons the Biden EPA cited in its final rule, i.e., mitigating stranded inventory and aligning with construction timelines. The Biden EPA further concluded such an extension was appropriate and would not undermine the AIM Act or the Kigali Amendment to the Montreal Protocol or otherwise negatively affect the Biden Administration's climate goals.

I13. Documentation of Criteria
TT VRF Proposed Rule - 26June2024.pdf - 10/06/2025 07:40 AM
TT VRF Final Rule - 12December2024.pdf - 10/06/2025 07:40 AM
Comment
NONE PROVIDED

Public Comment Period

DEC will determine if this application for an impossibility variance should be released for a 30-day public comment period. You may provide a clear and brief recitation of facts that DEC should consider in making this determination, such as specific legal or financial deadlines. You may attach additional documentation to support these facts.

AGGREGATED VRF MANUFACTURERS EMISSIONS SUMMARY

This document presents the aggregated emissions data submitted by Daikin, LG, Mitsubishi, and Samsung as part of their joint variance application under 6 NYCRR Part 494. The information is drawn from the consolidated spreadsheet prepared for public release. Individual manufacturer data remain designated as Confidential Business Information (CBI) and are not disclosed here.

The information below shows system counts, average charges, and modeled emissions results for each VRF equipment type. Emissions are calculated using the required annual-plus-end-of-life structure with GWP20 values. The presentation includes (i) total lifetime emissions for R-410A systems, (ii) the compliant R-32 reference case, (iii) the mitigated R-410A case reflecting enhanced leak-prevention and reclaimed refrigerant use, and (iv) the difference between the mitigated case and the compliant reference.

The final section provides consolidated totals across all equipment categories.

Air-Cooled Heat Recovery

Number of Systems: 2,361

Average Charge: 35.82 kg

Refrigerant Type: R-410A

GWP20: 4705

Annual Leak Rate: 0.10

Lifetime: 15 years

Total Lifetime Emissions: 636,650.64 $MTCO_2e$

Compliant R-32 Reference: 363,993.67 $MTCO_2e$

Mitigated R-410A: 338,220.65 $MTCO_2e$

Difference (Mitigated – R-32): –25,773.02 $MTCO_2e$

Air-Cooled Heat Pump

Number of Systems: 2,071

Average Charge: 43.81 kg

Refrigerant Type: R-410A

GWP20: 4705

Annual Leak Rate: 0.10

Lifetime: 15 years

Total Lifetime Emissions: 683,019.28 $MTCO_2e$

Compliant R-32 Reference: 390,504.12 $MTCO_2e$

Mitigated R-410A: 362,853.99 $MTCO_2e$

Difference (Mitigated – R-32): –27,650.12 $MTCO_2e$

Water-Cooled

Number of Systems: 373

Average Charge: 27.00 kg

Refrigerant Type: R-410A

GWP20: 4705

Annual Leak Rate: 0.10

Lifetime: 15 years

Total Lifetime Emissions: 75,814.49 $MTCO_2e$

Compliant R-32 Reference: 43,345.58 $MTCO_2e$

Mitigated R-410A: 40,276.45 $MTCO_2e$

Difference (Mitigated – R-32): –3,069.14 $MTCO_2e$

Totals (all categories)

Total Lifetime Emissions: 1,395,484.41 $MTCO_2e$

Compliant R-32 Reference: 797,843.37 $MTCO_2e$

Mitigated R-410A: 741,351.09 $MTCO_2e$

Difference (Mitigated – R-32): –56,492.28 $MTCO_2e$