Projects Requiring SJFD Hazardous Materials Review

All projects with exception of R-3 single family residences and ADUs require the following (unless otherwise noted):

1. A completed Form 308 San Jose Fire Department (Building Occupancy Classification Inventory Information Form) shall be submitted with the Building Plan Review Application.
2. Hazardous Materials quantities listed on Form 308 that meet the minimum thresholds identified in the Tables below will trigger a Hazardous Materials Architectural Review process (Haz Mat Arch Review) associated with the Building Plan Review process.
3. Based on the Hazmat Arch Review, hazardous materials inspections may be required. (Plan reviewers will enter inspections required in the AMANDA info tab.)
4. Criteria for requiring Haz Mat Arch Review or Hazardous Materials Storage System Permit (HZ Permits) are indicated in the tables below.
   (The Tables provided below include typical equipment and installation types associated with hazardous materials – this is not an exhaustive list.)

Table 1: Hazardous Material Quantities for a Project Type Listed Below Should be Included in Form 308

Project Types	Potential Hazardous Materials Equipment and Minimum Thresholds
1. Medium or large construction projects	☐ Any projects without a temporary electrical connection onsite for trailer and construction equipment where portable generators are planned for electrical service. ☐ Diesel generators (any size) – (A temporary HZ Permit is required if the generator is onsite for 30 days or more and the size of the tank is 60+ gal)
2. Fire Pumps, Emergency and Standby Power Systems and Cell Sites	Many projects require emergency or standby power systems. A few examples of such projects are listed below: ☐ Batteries/Inverters/UPS/ESS systems. See Table 1A for review requirements. ☐ Flammable/Combustible Liquids (any size) – (HZ Permit required 60+ gal) ☐ Liquid Petroleum Gas (LPG - propane) gas cylinder storage. (HZ Permit required for fixed systems). ☐ Natural Gas cylinders or tanks - No Haz Mat review or inspection is required if plumbed directly from the utility natural gas line to the generator. ☐ Other projects including fuel cells of any size – Requires review for HZ Permit.

Project Types	Potential Hazardous Materials Equipment and Minimum Thresholds
3. Large Properties: • **Hotels,** • **Large Business Campus Offices** • **High-Rises** • **Private or Trade Schools, Colleges** • **Shopping Malls (not individual tenant spaces)** • **Gyms**	☐ Emergency or standby power systems listed in Project Type #2 ☐ Additional propane cylinders or tanks associated with grills, fire pits, or heaters for common area patios. (HZ Permit required for fixed LPG system) ☐ Maintenance shops (paint, welding carts, cleaners, and solvents) ☐ Water treatment chemicals associated with boilers, cooling towers, and swimming pools used or stored onsite. (HZ Permit is required for tanks 60+ gal) ☐ Bulk laundry chemicals stored onsite and bulk storage of sanitizing chemicals (HZ Permit required for tanks 60+ gal) ☐ Carbon dioxide storage associated with a cafeteria, bar, or restaurant listed in Project Type #5 ☐ Deferred submittals such as pools, etc. that have hazardous materials stored on site may need hazmat review and permit.
4. Retail	☐ All paint stores Sherwin-Williams, etc. ☐ All auto parts stores. ☐ All pool supply stores. ☐ All big box retail- e.g. Walmart, Home Depot, Target. ☐ Emergency or standby power systems listed in Project Type #2. ☐ Facilities that store hazardous materials for sale on racks or shelves.
5. Food Service: • **Restaurants** • **Food Service Facilities** • **Coffee Bars** • **Bars** • **Wineries** • **Breweries** • **Marijuana Dispensaries Serving Food** • **Grocery Stores**	☐ Emergency or standby power systems listed in Project Type #2. ☐ Indoor cooking oil or waste oil tanks, or other aboveground process tanks ≥60 gal, HZ permit is required. ☐ Beverage system, soda fountain dispensers, or beer taps with systems using or connected to 100+ pounds of Carbon Dioxide, HZ permit is required. ☐ Storage of helium or nitrogen, HZ permit required if 6000+ cubic feet at Normal Temperature and Pressure (NTP). ☐ Refrigeration rooms are covered in project type #6. ☐ Sanitizing chemicals bulk storage tanks above 60gal. HZ Permit required. ☐ Grills, fire pits, or heaters for common area patios and separate stationary fuel tank or separate storage of any portable propane tanks, and bolted-down LPG systems. HZ Permit is required.

Project Types	Potential Hazardous Materials Equipment and Minimum Thresholds
6. Mechanical Systems: • **Refrigeration Room** • **HVAC** • **Chillers**	☐ Refrigeration rooms (not just refrigerators) with A1 Group Refrigerants 220+ pounds and for any other group 30+ pounds see Table 1D from 2022 California Mechanical Table 1102.3 Refrigerants Groups and Properties and allowable quantities. No HZ Permit is required.
7. Public Storage or Warehouses	☐ Source emergency or standby power systems listed in project type #2 ☐ Need inventory for any chemicals stored, completed Form 308 is needed to determine HZ review and permit requirements. ☐ Water treatment chemicals for boilers, cooling towers, and swimming pools used or stored onsite. HZ permit is required for tanks 60+ gal. ☐ Performs hot work.
8. Auto Facilities • **Auto Repair Shops** • **Carwashes** • **Auto Showrooms** • **Auto Wrecking Yards**	☐ Storing any drums or tanks for used oil/used batteries, etc. ☐ Storing any cleaning or paint supplies. ☐ Stores, bodywork chemicals, paint, spray booths or dipping, ovens. ☐ Removing any fuels. ☐ Waste oil storage (any size) HZ permit is required if 60+ gallons. ☐ Performs hot work. ☐ Lithium battery storage of 15cuft or 1000lbs will require HZ permit.
9. Maintenance and Government (NOT Federal, State or County) Corporation Yards	For any facilities containing any of the following: ☐ Emergency or standby power systems listed in project type#2. ☐ Any hydrogen-compressed natural gas, diesel, or gasoline fueling stations need HZ Permits for storage above 60+gal –see Tables 1B and 1C. ☐ Water treatment chemicals for boilers, cooling towers, or swimming pools used or stored onsite. HZ permit is required for tanks above 60+ gal. ☐ Automobile or truck washing stations. ☐ Chemicals or hazardous equipment stored outside. ☐ Batteries, used oil, or chemical waste storage. ☐ Performs hot work

Project Types	Potential Hazardous Materials Equipment and Minimum Thresholds
10. Medical and Institutional • **Doctor's Office** • **Dentist's Office** • **Surgical Centers,** • **Cryogenic Therapies** • **Hospitals,** • **Elderly Care Facilities,** • **Other Institutional Care Facilities**	☐ Emergency or standby power systems listed in project type#2. ☐ Storing or using any medical gas e.g., oxygen, nitrogen, nitrous oxide gases, or cryogenic fluids –See Tables 1B and 1C for Permit Requirements. ☐ Laboratories and fume hoods. ☐ Water treatment chemicals for boilers, cooling towers, spas, swimming pools, or stored onsite shall require HZ permit tanks above 60+ gal. ☐ Bulk laundry onsite (not coin-operated) requires an HZ permit. ☐ Bulk storage and delivery of sanitizing chemicals requires an HZ permit. ☐ Cafeteria, room service, bar, or restaurant covered in project type#5. ☐ Grills, fire pits, or heaters for common area patios and separate stationary fuel tanks or separate storage of any portable propane tanks and bolted-down LPG systems. HZ Permit is required.
11. R & D Facilities & Data Centers	☐ Emergency or standby power systems listed in project type#2. ☐ Water treatment chemicals. ☐ Laboratories, fume hoods, and tools. ☐ Bulk chemical storage and delivery of chemicals. ☐ ESS systems.

Table 1A: Battery Technology and Minimum Capacity Review Criteria for Haz Mat Review

Battery Technology	Minimum Kilowatt-hours for Haz Mat Arch Review and HZ Permit	Range for Haz Mat Inspection and Plan Review	No Haz Mat Review or Inspection
Capacitor ESS	**3+ kWh**	**NA**	**<3 kWh**
Lead acid all types	***70+ kWh***	***<70 kWh and ≥10 kWh***	***<10 kWh***
Nickel-Cadmium (Ni-Cd)	***70+ kWh***	***<70 kWh and ≥10 kWh***	***<10 kWh***
Lithium, all types	***20+ kWh***	***<20 kWh and ≥10 kWh***	***<10 kWh***
Nickel metal hydride (Ni-MH)	***70+ kWh***	***<70 kWh and ≥10 kWh***	***<10 kWh***
Total Flow batteries	***20+ kWh***	***<20 kWh and ≥10 kWh***	***<10 kWh***
Other Battery Types	***10+ kWh***	***NA***	***<10 kWh***
Other Electrochemical ESS technologies	**3+ kWh**	***NA***	**<3 kWh**

Table 1B: Compressed Gas Exceeding Permit Quantity Criteria for HZ Construction Permit from 2022 CFC Table 105.5.9	
Class of Gas	**Amount (cubic feet at NTP)**
Carbon dioxide used in carbon dioxide enrichment systems and beverage systems	875 (100 lbs.)
Carbon dioxide used in insulated liquid carbon dioxide beverage dispensing applications	875 (100lbs)
Corrosive	200
Flammable (except cryogenic fluids and liquified petroleum gases)	200
Highly Toxic	Any amount
Inert and simple asphyxiant	6000
Oxidizing (including Oxygen)	504
Pyrophoric	Any
Toxic	Any

Table 1C: Cryogenic Fluids Minimum Permit Quantity Criteria for HZ Construction Permit from 2022 CFC Table 105.5.11		
Class of Cryogenic Fluid	**Inside Building Amount (gallons)**	**Outside Building Amount (gallons)**
Flammable	More than 1	60
Inert	-	500
Oxidizing	10	50
Physical or Health Hazard Not indicated above	Any	Any

Table 2: Good Reminders of Some Other Project Types Frequently Needing Hazardous Materials Architectural Review and Permits	
☐ Liquid Propane Gas ☐ Gas Stations ☐ Plating Shops ☐ Recycling Facilities ☐ Industrial Tool Installations with Storing Hazardous Materials ☐ Data Centers ☐ Dry Cleaning Businesses Installing New Machines ☐ Marijuana Laboratories, Grow and Processing Facilities	☐ Paint Booths/ Spray Rooms ☐ Chemical Waste Handling Businesses ☐ Roofing Materials Storage Businesses ☐ Fumigation Businesses ☐ Fire Pumps ☐ Facilities Using Fume Hoods ☐ Compressed Gas or Liquid Gas Systems ☐ Wineries and Breweries ☐ ESS battery system ☐ Carbon dioxide system/beverage systems ☐ Medical/Dental facilities.

TABLE 1102.3
REFRIGERANT GROUPS, PROPERTIES, AND ALLOWABLE QUANTITIES[8]
[ASHRAE 34:TABLE 4-1, TABLE 4-2]

REFRIGERANT	CHEMICAL FORMULA	CHEMICAL NAME[1] (COMPOSITION FOR BLENDS)	SAFETY GROUP[7]	OEL[2] (ppm)	POUNDS PER 1000 CUBIC FEET OF SPACE
R-11	CCl_3F	Trichlorofluoromethane	A1	C1000	0.39
R-12	CCl_2F_2	Dichlorodifluoromethane	A1	1000	5.6
R-12B1	$CBrClF_2$	Bromochlorodifluoromethane	—	—	—
R-13	$CClF_3$	Chlorotrifluoromethane	A1	1000	—
R-13B1	$CBrF_3$	Bromotrifluoromethane	A1	1000	—
R-14	CF_4	Tetrafluoromethane (carbon tetrafluoride)	A1	1000	25
R-21	$CHCl_2F$	Dichlorofluoromethane	B1	—	—
R-22	$CHClF_2$	Chlorodifluoromethane	A1	1000	13
R-23	CHF_3	Trifluoromethane	A1	1000	7.3
R-30	CH_2Cl_2	Dichloromethane (methylene chloride)	B1	—	—
R-31	CH_2ClF	Chlorofluoromethane	—	—	—
R-32	CH_2F_2	Difluoromethane (methylene fluoride)	A2L	1000	4.8
R-40	CH_3Cl	Chloromethane (methyl chloride)	B2	—	—
R-41	CH_3F	Fluoromethane (methyl fluoride)	—	—	—
R-50	CH_4	Methane	A3	1000	—
R-113	CCl_2FCClF_2	1, 1, 2-trichloro-1, 2, 2 — trifluoroethane	A1	1000	1.2
R-114	$CClF_2CClF_2$	1, 2-dichloro-1, 1, 2, 2 tetrafluoroethane	A1	1000	8.7
R-115	$CClF_2CF_3$	Chloropentafluoroethane	A1	1000	47
R-116	CF_3CF_3	Hexafluoroethane	A1	1000	34
R-123	$CHCl_2CF_3$	2, 2-dichloro-1, 1, 1, - trifluoroethane	B1	50	3.5
R-124	$CHClFCF_3$	2-chloro-1, 1, 1, 2 - tetrafluoroethane	A1	1000	3.5
R-125	CHF_2CF_3	Pentafluoroethane	A1	1000	23
R-134a	CH_2FCF_3	1, 1, 1, 2-tetrafluoroethane	A1	1000	13
R-141b	CH_3CCl_2F	1, 1-dichloro-1-fluoroethane	—	500	0.78
R-142b	CH_3CClF_2	1-chloro-1, 1-difluoroethane	A2	1000	5.1
R-143a	CH_3CF_3	1, 1, 1-trifluoroethane	A2L	1000	4.5
R-152a	CH_3CHF_2	1, 1-difluoroethane	A2	1000	2
R-170	CH_3CH_3	Ethane	A3	1000	0.54
R-E170	CH_3OCH_3	Methoxymethane (Dimethyl ether)	A3	1000	1

REFRIGERANT	CHEMICAL FORMULA	CHEMICAL NAME[1] (COMPOSITION FOR BLENDS)	SAFETY GROUP[7]	OEL[2] (ppm)	POUNDS PER 1000 CUBIC FEET OF SPACE
R-218	CF_3CF2CF_3	Octafluoropropane	A1	1000	43
R-227ea	CF_3CHFCF_3	1, 1, 1, 2, 3, 3, 3-heptafluoropropane	A1	1000	36
R-236fa	$CF_3CH_2CF_3$	1, 1, 1, 3, 3, 3-hexafluoropropane	A1	1000	21
R-245fa	$CHF_2CH_2CF_3$	1, 1, 1, 3, 3-pentafluoropropane	B1	300	12
R-290	$CH_3CH_2CH_3$	Propane	A3	1000	0.56
R-C318	$-(CF_2)_4-$	Octafluorocyclobutane	A1	1000	41
R-400	zeotrope	R-12/114 (50.0/50.0)	A1	1000	10
R-400	zeotrope	R-12/114 (60.0/40.0)	A1	1000	11
R-401A	zeotrope	R-22/152a/124 (53.0/13.0/34.0)	A1	1000	6.6
R-401B	zeotrope	R-22/152a/124 (61.0/11.0/28.0)	A1	1000	7.2
R-401C	zeotrope	R-22/152a/124 (33.0/15.0/52.0)	A1	1000	5.2
R-402A	zeotrope	R-125/290/22 (60.0/2.0/38.0)	A1	1000	17
R-402B	zeotrope	R-125/290/22 (38.0/2.0/60.0)	A1	1000	15
R-403A	zeotrope	R-290/22/218 (5.0/75.0/20.0)	A2	1000	7.6
R-403B	zeotrope	R-290/22/218 (5.0/56.0/39.0)	A1	1000	18
R-404A	zeotrope	R-125/143a/134a (44.0/52.0/4.0)	A1	1000	31
R-405A	zeotrope	R-22/152a/142b/C318 (45.0/7.0/5.5/42.5)	—	1000	16
R-406A	zeotrope	R-22/600a/142b (60.0/4.0/41.0)	A2	1000	4.7
R-407A	zeotrope	R-32/125/134a (20.0/40.0/40.0)	A1	1000	19
R-407B	zeotrope	R-32/125/134a (10.0/70.0/20.0)	A1	1000	21
R-407C	zeotrope	R-32/125/134a (23.0/25.0/52.0)	A1	1000	18
R-407D	zeotrope	R-32/125/134a (15.0/15.0/70.0)	A1	1000	16
R-407E	zeotrope	R-32/125/134a (25.0/15.0/60.0)	A1	1000	17
R-407F	zeotrope	R-32/125/134a (30.0/30.0/40.0)	A1	1000	20
R-407G	zeotrope	R-32/125/134a (2.5/2.5/95.0)	A1	1000	13
R-407H	zeotrope	R-32/125/134a (32.5/15.0/52.5)	A1	1000	19
R-407I	zeotrope	R-32/125/124a (19.5/8.5/72.0)	A1	1000	16
R-408A	zeotrope	R-125/143a/22 (7.0/46.0/47.0)	A1	1000	21
R-409A	zeotrope	R-22/124/142b (60.0/25.0/15.0)	A1	1000	7.1
R-409B	zeotrope	R-22/124/142b (65.0/25.0/10.0)	A1	1000	7.3
R-410A	zeotrope	R-32/125 (50.0/50.0)	A1	1000	26
R-410B	zeotrope	R-32/125 (45.0/60.0)	A1	—	27
R-411A[6]	zeotrope	R-1270/22/152a (1.5/87.5/11.0)	A2	990	2.9
R-411B[6]	zeotrope	R-1270/22/152a (3.0/94.0/3.0)	A2	980	2.8

REFRIGERANT	CHEMICAL FORMULA	CHEMICAL NAME[1] (COMPOSITION FOR BLENDS)	SAFETY GROUP[7]	OEL[2] (ppm)	POUNDS PER 1000 CUBIC FEET OF SPACE
R-412A	zeotrope	R-22/218/142b (70.0/5.0/25.0)	A2	1000	5.1
R-413A	zeotrope	R-218/134a/600a (9.0/88.0/3.0)	A2	1000	5.8
R-414A	zeotrope	R-22/124/600a/142b (51.0/28.5/4.0/16.5)	A1	1000	6.4
R-414B	zeotrope	R-22/124/600a/142b (50.0/39.0/1.5/9.5)	A1	1000	6
R-415A	zeotrope	R-22/152a (82.0/18.0)	A2	1000	2.9
R-415B	zeotrope	R-22/152a (25.0/75.0)	A2	1000	2.1
R-416A[6]	zeotrope	R-134a/124/600 (59.0/39.5/1.5)	A1	1000	3.9
R-417A[6]	zeotrope	R-125/134a/600 (46.6/50.0/3.4)	A1	1000	3.5
R-417B	zeotrope	R-125/134a/600 (79.0/18.3/2.7)	A1	1000	4.3
R-417C	zeotrope	R-125/134a/600 (19.5/78.8/1.7)	A1	1000	5.4
R-418A	zeotrope	R-290/22/152a (1.5/96.0/2.5)	A2	1000	4.8
R-419A	zeotrope	R-125/134a/E170 (77.0/19.0/4.0)	A2	1000	4.2
R-419B	zeotrope	R-125/134a/E170 (48.5/48.0/3.5)	A2	1000	4.6
R-420A	zeotrope	R-134a/142b (88.0/12.0)	A1	1000	12
R-421A	zeotrope	R-125/134a (58.0/42.0)	A1	1000	17
R-421B	zeotrope	R-125/134a (85.0/15.0)	A1	1000	21
R-422A	zeotrope	R-125/134a/600a (85.1/11.5/3.4)	A1	1000	18
R-422B	zeotrope	R-125/134a/600a (60.0/42.0/3.0)	A1	1000	16
R-422C	zeotrope	R-125/134a/600a (82.0/15.0/3.0)	A1	1000	18
R-422D	zeotrope	R-125/134a/600a (65.1/31.5/3.4)	A1	1000	16
R-422E	zeotrope	R-125/134a/600a (58.0/39.3/2.7)	A1	1000	16
R-423A	zeotrope	R-134a/227ea (52.5/47.5)	A1	1000	19
R-424A[6]	zeotrope	R-125/134a/600a/600/601a (50.5/47.0/0.9/1.0/0.6)	A1	970	6.2
R-425A	zeotrope	R-32/134a/227ea (18.5/69.5/12.0)	A1	1000	16
R-426A[6]	zeotrope	R-125/134a/600/601a (5.1/93.0/1.3/0.6)	A1	990	5.2
R427A	zeotrope	R-32/125/143a/134a (15.0/25.0/10.0/50.0)	A1	1000	18
R428A	zeotrope	R-125/143a/290/600a (77.5/20.0/0.6/1.9)	A1	1000	23
R-429A	zeotrope	R-E170/152a/600a (60.0/10.0/30.0)	A3	1000	0.81
R-430A	zeotrope	R-152a/600a (76.0/24.0)	A3	1000	1.3
R-431A	zeotrope	R-290/152a (71.0/29.0)	A3	1000	0.69
R-432A	zeotrope	R-1270/E170 (80.0/20.0)	A3	700	0.13

REFRIGERANT	CHEMICAL FORMULA	CHEMICAL NAME[1] (COMPOSITION FOR BLENDS)	SAFETY GROUP[7]	OEL[2] (ppm)	POUNDS PER 1000 CUBIC FEET OF SPACE
R-433A	zeotrope	R-1270/290 (30.0/70.0)	A3	880	0.34
R-433B	zeotrope	R-1270/290 (5.0/95.0)	A3	950	0.51
R-433C	zeotrope	R-1270/290 (25.0/75.0)	A3	790	0.41
R-434A	zeotrope	R-125/143a/134a/600a (63.2/18.0/16.0/2.8)	A1	1000	20
R-435A	zeotrope	R-E170/152a (80.0/20.0)	A3	1000	1.1
R-436A	zeotrope	R-290/600a (56.0/44.0)	A3	1000	0.5
R-436B	zeotrope	R-290/600a (52.0/48.0)	A3	1000	0.51
R-437A	zeotrope	R-125/134a/600/601 (19.5/78.5/1.4/0.6)	A1	990	5
R-438A	zeotrope	R-32/125/134a/600/601a (8.5/45.0/44.2/1.7/0.6)	A1	990	4.9
R-439A	zeotrope	R-32/125/600a (50.0/47.0/3.0)	A2	990	4.7
R-440A	zeotrope	R-290/134a/152a (0.6/1.6/97.8)	A2	1000	1.9
R-441A	zeotrope	R-170/290/600a/600 (3.1/54.8/6.0/36.1)	A3	1000	0.39
R-442A	zeotrope	R-32/125/134a/152a/227ea (31.0/31.0/30.0/3.0/5.0)	A1	1000	21
R-443A	zeotrope	R-1270/290/600a (60.0/40.0/5.0)	A3	580	0.19
R-444A	zeotrope	R-32/152a/1234ze(E) (12.0/5.0/83.0)	A2L	850	5.1
R-444B	zeotrope	R-32/152a/1234ze(E) (41.5/10.0/48.5)	A2L	890	4.3
R-445A	zeotrope	R-744/134a/1234ze (E) (6.0/9.0/85.0)	A2L	930	4.2
R-446A	zeotrope	R-32/1234ze(E)/600 (68.0/29.0/3.0)	A2L	960	2.5
R-447A	zeotrope	R-32/125/1234ze(E) (68.0/3.5/28.5)	A2L	900	2.6
R-447B	zeotrope	R-32/125/1234ze(E) (68.0/8.0/24.0)	A2L	970	23
R-448A	zeotrope	R-32/125/1234yf/134a/1234ze(E) (26.0/26.0/20.0/21.0/7.0)	A1	890	24
R-449A	zeotrope	R-32/125/1234yf/134a (24.3/24.7/25.3/25.7)	A1	830	23
R-449B	zeotrope	R-32/125/1234yf/134a (25.2/24.3/23.2/27.3)	A1	850	23
R-449C	zeotrope	R-32/125/1234yf/134a (20.0/20.0/31.0/29.0)	A1	800	23
R-450A	zeotrope	R-134a/1234ze(E) (42.0/58.0)	A1	880	20
R-451A	zeotrope	R-1234yf/134a (89.8/10.2)	A2L	520	5.3
R-451B	zeotrope	R-1234yf/134a (88.8/11.2)	A2L	530	5.3

REFRIGERANT	CHEMICAL FORMULA	CHEMICAL NAME[1] (COMPOSITION FOR BLENDS)	SAFETY GROUP[7]	OEL[2] (ppm)	POUNDS PER 1000 CUBIC FEET OF SPACE
R-452A	zeotrope	R-32/125/1234yf (11.0/59.0/30.0)	A1	780	27
R-452B	zeotrope	R-32/125/1234yf (67.0/7.0/26.0)	A2L	870	23
R-452C	zeotrope	R-32/125/1234yf (12.5/61.0/26.5)	A1	800	27
R-453A	zeotrope	R-32/125/134a/227ea/600/601a (20.0/20.0/53.8/5.0/0.6/0.6)	A1	1000	7.8
R-454A	zeotrope	R-32/1234yf (35.0/65.0)	A2L	690	28
R-454B	zeotrope	R-32/1234yf (68.9/31.1)	A2L	850	22
R-454C	zeotrope	R-32/1234yf (21.5/78.5)	A2L	620	29
R-460A	zeotrope	R-744/32/1234yf (3.0/21.5/75.5)	A2L	650	23
R-456A	zeotrope	R-32/134a/1234ze(E) (6.0/45.0/49.0)	A1	900	20
R-457A	zeotrope	R-32/1234yf/152a (18.0/70.0/12.0)	A2L	650	25
R-458A	zeotrope	R-32/125/134a/227ea/236fa (20.5/4.0/61.4/13.5/0.6)	A1	1000	18
R-459A	zeotrope	R-32/1234yf/1234ze(E) (68.0/26.0/6.0)	A2L	870	23
R-459B	zeotrope	R-32/1234yf/1234ze(E) (21.0/69.0/10.0)	A2L	640	30
R-460A	zeotrope	R-32/125/134a/1234ze(E) (12.0/52.0/14.0/22.0)	A1	650	24
R-460B	zeotrope	R-32/125/134a/1234ze(E) (28.0/25.0/20.0/27.0)	A1	950	25
R-460C	zeotrope	R-32/125/134a/1234ze(E) (2.5/2.5/46.0/49.0)	A1	900	20
R-461A	zeotrope	R-125/143a/134a/227ea/600a (60.0/5.0/32.0/5.0/3.0)	A1	1000	17
R-462A	zeotrope	R-32/125/143a/134a/600 (9.0/42.0/2.0/44.0/3.0)	A2	1000	3.9
R-463A	zeotrope	R-744/32/125/1234yf/134a (6.0/36.0/30.0/14.0/14.0)	A1	990	19
R-464A	zeotrope	R-32/125/1234ze(E)/227ea (27.0/27.0/40.0/6.0)	A1	930	27
R-465A	zeotrope	R-32/290/1234yf (21.0/7.9/71.1)	A2	660	2.5

REFRIGERANT	CHEMICAL FORMULA	CHEMICAL NAME[1] (COMPOSITION FOR BLENDS)	SAFETY GROUP[7]	OEL[2] (ppm)	POUNDS PER 1000 CUBIC FEET OF SPACE
R-500	azeotrope[3]	R-12/152a (73.8/26.2)	A1	1000	7.6
R-501	azeotrope[3]	R-22/12 (75.0/25.0)[4]	A1	1000	13
R-502	azeotrope[3]	R-22/115 (48.8/51.2)	A1	1000	21
R-503	azeotrope[3]	R-23/13 (40.1/59.9)	—	1000	—
R-504	azeotrope[3]	R-32/115 (48.2/51.8)	—	1000	28
R-505	azeotrope[3]	R-12/31 (78.0/22.0)[4]	—	—	—
R-506	azeotrope[3]	R-31/114 (60.1/44.9)	—	—	—
R-507A[5]	azeotrope[3]	R-125/143a (50.0/50.0)	A1	1000	32
R-508A[5]	azeotrope[3]	R-23/116 (39.0/61.0)	A1	1000	14
R-508B	azeotrope[3]	R-23/116 (46.0/54.0)	A1	1000	13
R-509A[5]	azeotrope3	R-22/218 (44.0/56.0)	A1	1000	24
R-510A	azeotrope3	R-E170/600a (88.0/12.0)	A3	1000	0.87
R-511A	azeotrope[3]	R-290/E170 (95.0/5.0)	A3	1000	0.59
R-512A	azeotrope[3]	R-134a/152a (5.0/95.0)	A2	1000	1.9
R-513A	azeotrope[3]	R-1234yf/134a (56.0/44.0)	A1	650	20
R-513B	azeotrope[3]	R-1234yf/134a (58.5/41.5)	A1	640	21
R-514A	azeotrope[3]	R-1336mzz(Z)/1130 (E) (74.7/25.3)	B1	320	0.86
R-515A	azeotrope[3]	R-1234ze(E)/227ea (88.0/12.0)	A1	810	19
R-516A	azeotrope[3]	R-1234yf/134a/152a (77.5/8.5/14.0)	A2L	590	7
R-600	$CH_3CH_2CH_2CH_3$	Butane	A3	1000	0.15
R-600a	$CH(CH_3)_2CH_3$	2-methylpropane (isobutene)	A3	1000	0.59
R-601	$CH_3CH_2CH_2CH_2CH_3$	Pentane	A3	600	0.18
R-601a	$(CH_3)_2CHCH_2CH_3$	2-methylbutane (isopentane)	A3	600	0.18
R-610	$CH_3CH_2OCH_2CH_3$	Ethoxyethane (ethyl ether)	—	400	—
R-611	$HCOOCH_3$	Methyl formate	B2	100	—
R-620	—	(Reserved for future assignment)	—	—	—
R-630	CH_3NH_2	Methanamine (methyl amine)	—	—	—
R-631	$CH_3CH_2(NH_2)$	Ethanamine (ethyl amine)	—	—	—
R-702	H_2	Hydrogen	A3	—	—
R-704	He	Helium	A1	—	—
R-717	NH_3	Ammonia	B2L	25	0.014
R-718	H_2O	Water	A1	—	—
R-720	Ne	Neon	A1	—	—
R-728	N_2	Nitrogen	A1	—	—
R-732	O_2	Oxygen	—	—	—

REFRIGERANT	CHEMICAL FORMULA	CHEMICAL NAME[1] (COMPOSITION FOR BLENDS)	SAFETY GROUP[7]	OEL[2] (ppm)	POUNDS PER 1000 CUBIC FEET OF SPACE
R-740	Ar	Argon	A1	—	—
R-744	CO_2	Carbon dioxide	A1	5000	3.4
R-744A	N_2O	Nitrous oxide	—	—	—
R-764	SO_2	Sulfur dioxide	B1	—	—
R-1130(E)	CHCl=CHCl	Trans-1,2-dichloroethene	B1	200	0.25
R-1132a	$CF_2 = CH_2$	1, 1-difluoroethylene	A2	500	2
R-1150	$CH_2=CH_2$	Ethene (ethylene)	A3	200	—
R-1224yd(Z)	$CF_3CF=CHCl$	(Z)-1-chloro-2,3,3,3-tetrafluoropropen	A1	1000	23
R-1233zd(E)	$CF_3CH=CHCl$	Trans-1-chloro-3, 3,3 -trifluoro-1-propene	A1	800	5.3
R-1234yf	$CF_3CF=CH_2$	2, 3, 3, 3-tetrafluoro-1-propene	A2L	500	4.7
R-1234ze(E)	$CF_3CH=CHF$	Trans-1,3,3,3- tetrafluoro-1-propene	A2L	800	4.7
R-1270	$CH_3CH=CH_2$	Propene (propylene)	A3	500	0.11
R-1336mzz(Z)	$CF_3CHCHCF_3$	Cis-1,1,1,4,4,4-hexaflouro-2-butene	A1	500	5.4

For SI units: 1 pound = 0.453 kg, 1 cubic foot = 0.0283 m3

Notes:

1 The preferred name is followed by the popular name in parenthesis.

2 The OEL are 8-hour TWA; a C designation denotes a ceiling limit.

3 Azeotropic refrigerants exhibit some segregation of components at conditions of temperature and pressure other than those at which they were formulated. The extent of segregation depends on the azeotrope and hardware system configuration.

4 The exact composition of this azeotrope is in question and additional experimental studies are needed.

5 R-507, R-508, and R-509 shall be permitted as alternative designations for R-507A, R-508A, and R-509A due to a change in designations after assignment of R-500 through R-509. Corresponding changes were not made for R-500 through R-506.

6 The RCL values for these refrigerant blends are approximated in the absence of adequate data for a component comprising less than 4 percent m/m of the blend and expected to have a small influence in an acute, accidental release

7 Refrigerant flammability classification of Class 2L shall comply with the requirements for flammability classification or Class 2.

8 In accordance with Section 1102.2, ammonia refrigeration systems are not regulated by this chapter. R-717 (ammonia) is included in this table because the table is extracted from ASHRAE 34 and is not capable of being modified.