Incident Summary #II-1310863-2022 (#25692) (FINAL)

SUPPORTING INFORMATION	Incident Date		January 6, 2022
	Location		Charlie Lake
	Regulated industry sector		Gas - Propane system
	Impact – Injury	Qty injuries	1
		Injury description	Second degree burns to arms, hands, upper torso, and face.
		Injury rating	Major
	Impact – Damage	Damage description	A residence was destroyed by an explosion and fire. Vehicles and additional propane tanks and cylinders were damaged by flying debris and heat damage from the fire.
		Damage rating	Major
	Incident rating		Major
	Incident overview		During an unseasonable stretch of extreme cold weather, two 100-pound propane cylinders were brought inside a residence and used for heating. A leak from one of the propane cylinders inside of the residence caused an explosion and fire.
INVESTIGATION CONCLUSIONS	Site, system and components		The occupant was residing in a small building on the property that was serviced by RV style appliances connected to multiple propane tanks and cylinders outside. Several other propane tanks and cylinders were also stored around the outside of the building. Propane is a fuel commonly stored and transported as a liquid and used as a vapour. The liquid vaporizes in the storage container until it reaches a pressure that stabilizes which causes the remaining liquid to stop vaporizing. The pressure of the vapour inside of a propane cylinder is relative to the temperature of the fuel. The lower the temperate the lower the vapour pressure. Propane has a boiling point of -42 degrees Celsius. At that temperature and below, the propane liquid will not vaporize and will not produce vapour pressure for use. In areas that can reach these temperatures the propane fuel is commonly heated by use of electric or gas fueled propane liquid vaporizers or tank heaters to ensure enough vapour pressure to meet demand. A cylinder mounted infrared propane heater mounts directly to a propane cylinder and creates heat for space heating use. The heater operates with a mesh type burner which keeps a flame small and radiates heat from the face of the burner. Propane cylinders and heaters of this type are not permitted inside any human living quarters.
	Failure scenario(s)		During an extreme cold weather snap with temperature lows of -37 degrees Celsius, an occupant brought two 100-pound propane cylinders inside their residence to operate a small cylinder mounted infrared heater to assist in heating the space. The occupant switched the tank mounted infrared heater from one propane cylinder to another. When the occupant opened the service valve of the full cylinder, a leak occurred. The leaking propane vapour mixed with air and was contained within the building and contacted a source of ignition causing an explosion and subsequent fire.

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Facts and evidence	**Site observations** • Two 100-pound cylinders were found inside the residence at the time of initial investigation (Photo 1). • Several propane tanks, cylinders and auto propane tanks were found surrounding the building some with regulators and gas lines attached to RV style propane appliances (Photo 2 and 6). • Almost the entire building structure was destroyed, and fire damage was observed on vehicles parked next to the building (Photo 4 and 7). **Interview statement** • The occupant stated he had brought the cylinders inside to use with a cylinder mounted heater. • The occupant stated the cylinder began leaking after changing the heater from an empty cylinder to a full cylinder. • The explosion had blown him out of the building, and he gained consciousness on the ground outside. • Additional explosions were heard from other propane containers during the fire. **Historical weather data** The area was experiencing extreme cold temperatures. The two days leading up to and the day of the incident the temperatures were highs of -32 and lows of -37 degrees Celsius. The historical average temperature for that month is -12 degrees Celsius.
Causes and contributing factors	It is most likely that full propane cylinders being used indoors with an infrared heater to supply heat allowed escaping gas from a leaking cylinder to accumulate within the structure causing the explosion incident and subsequent fire. The extreme cold weather may be a contributing factor to the incident.

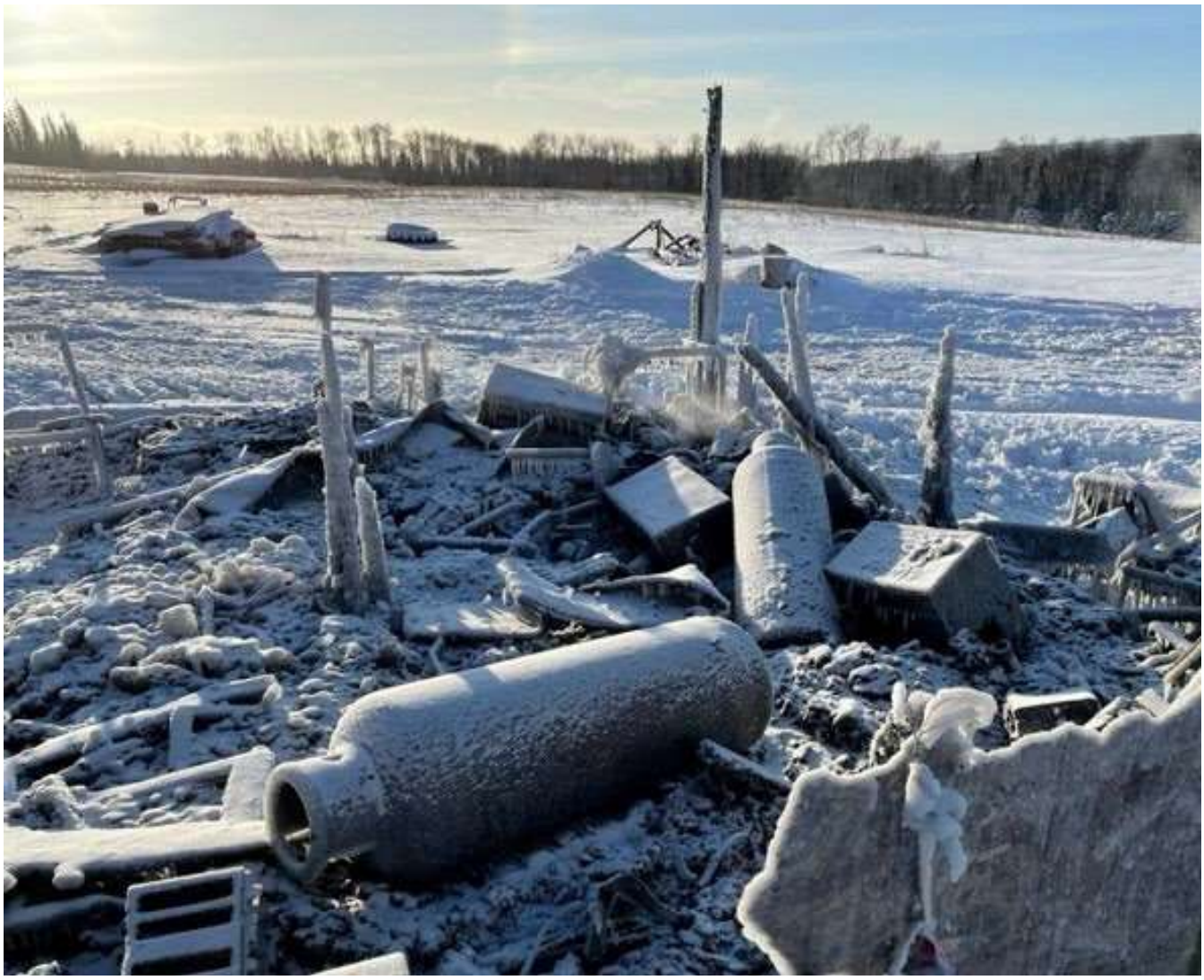

Photo 1 – Two 100-pound propane cylinders inside the remnants of the residence.

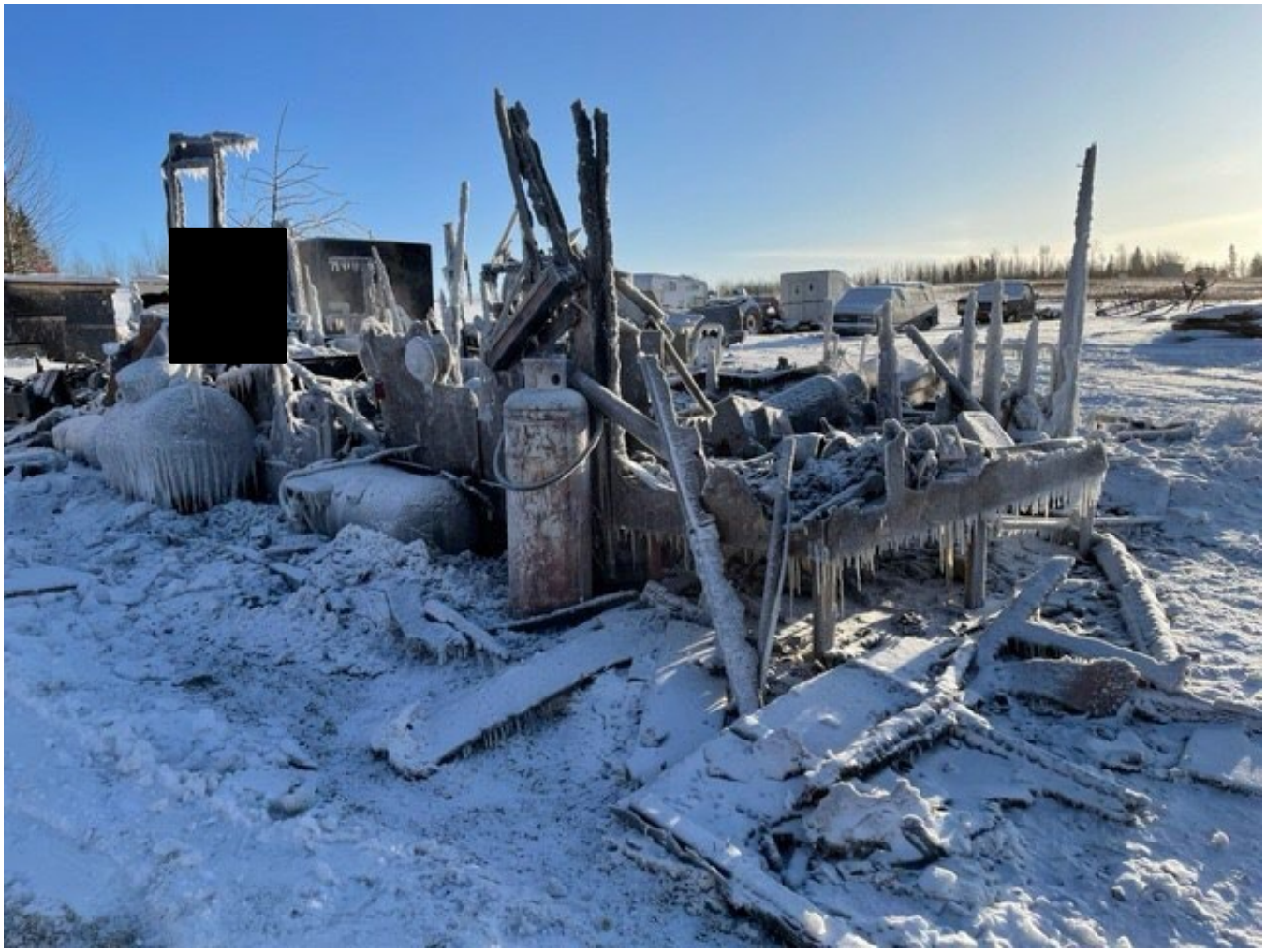

Photo 2 – The remaining structure of the residence showing multiple propane containers along the outside wall.

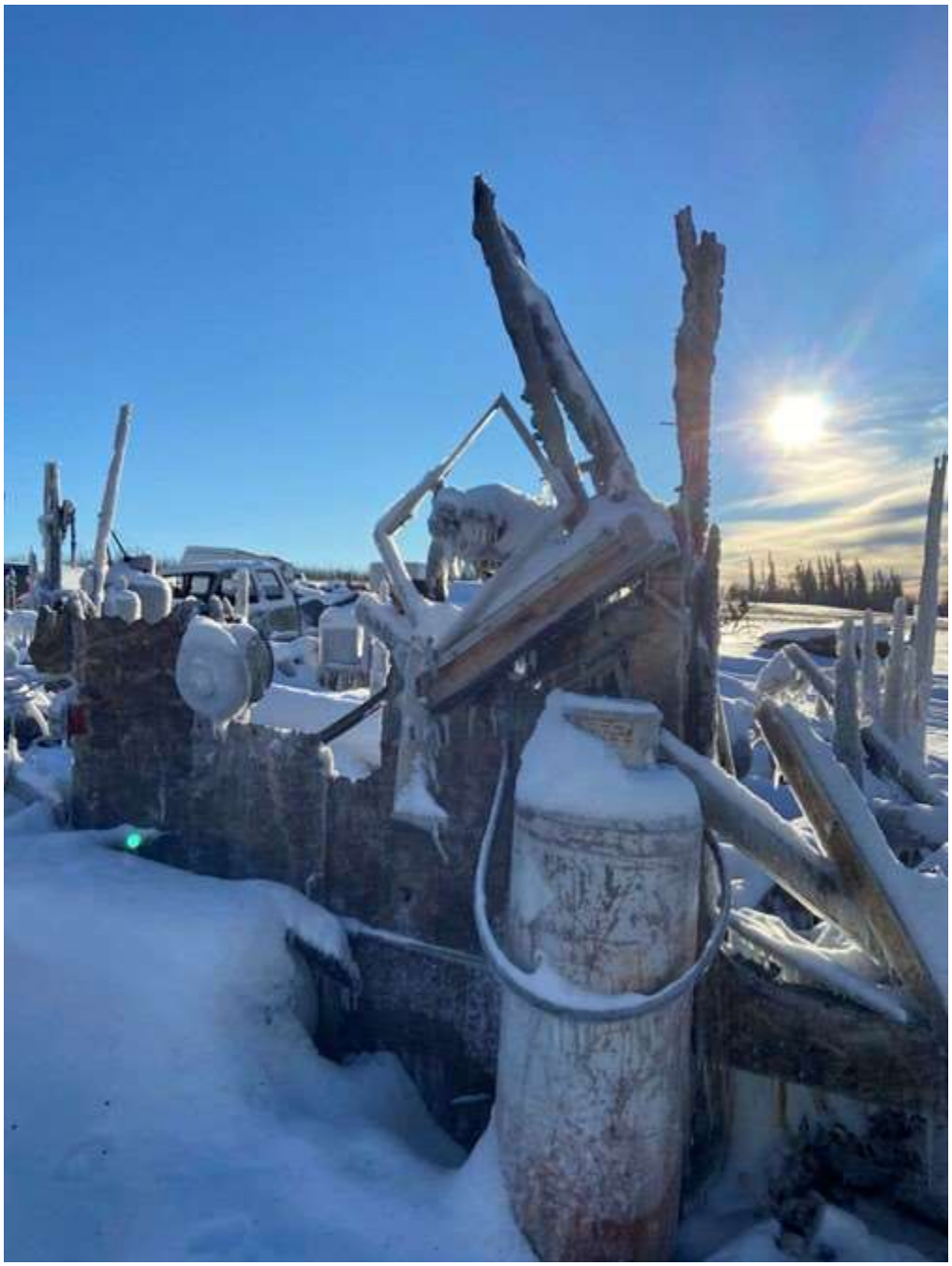

Photo 3 – 100-pound propane cylinder outside the residence connected to an RV style appliance.

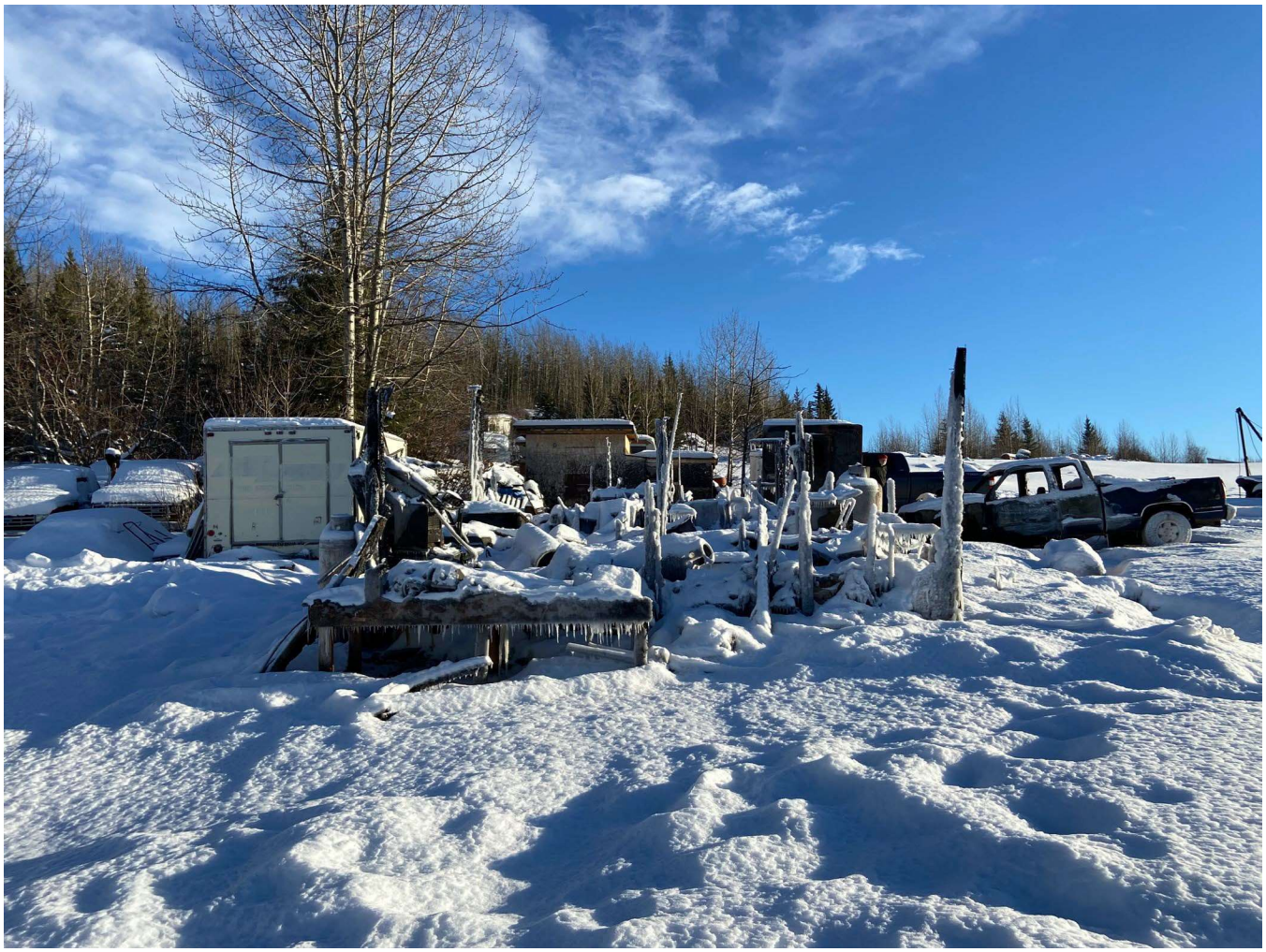

Photo 4 – The residence damaged by explosion and fire.

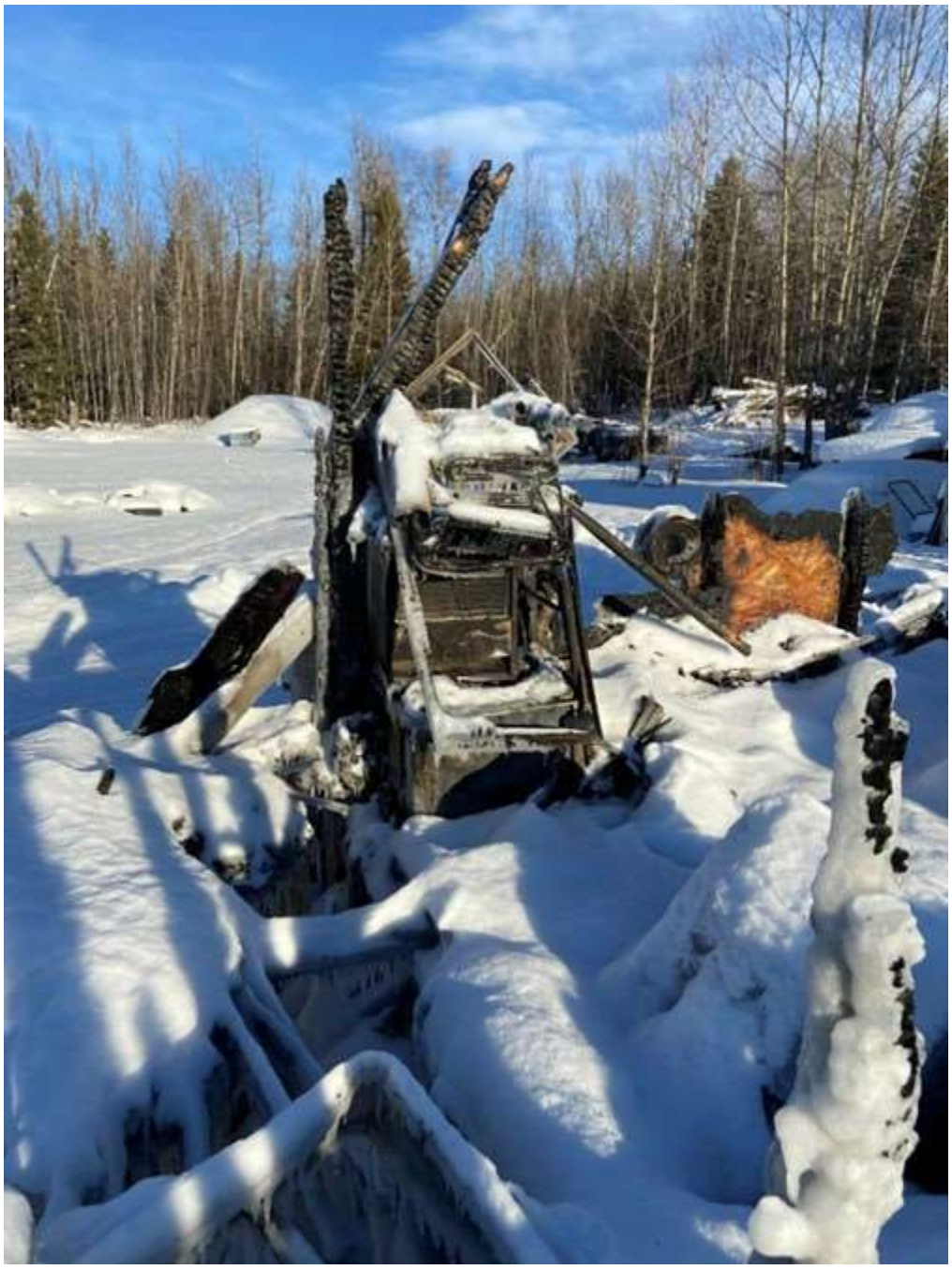

Photo 5 – RV style furnace and refrigerator

Photo 6 – Multiple propane cylinders and tanks on the outside of the residence.

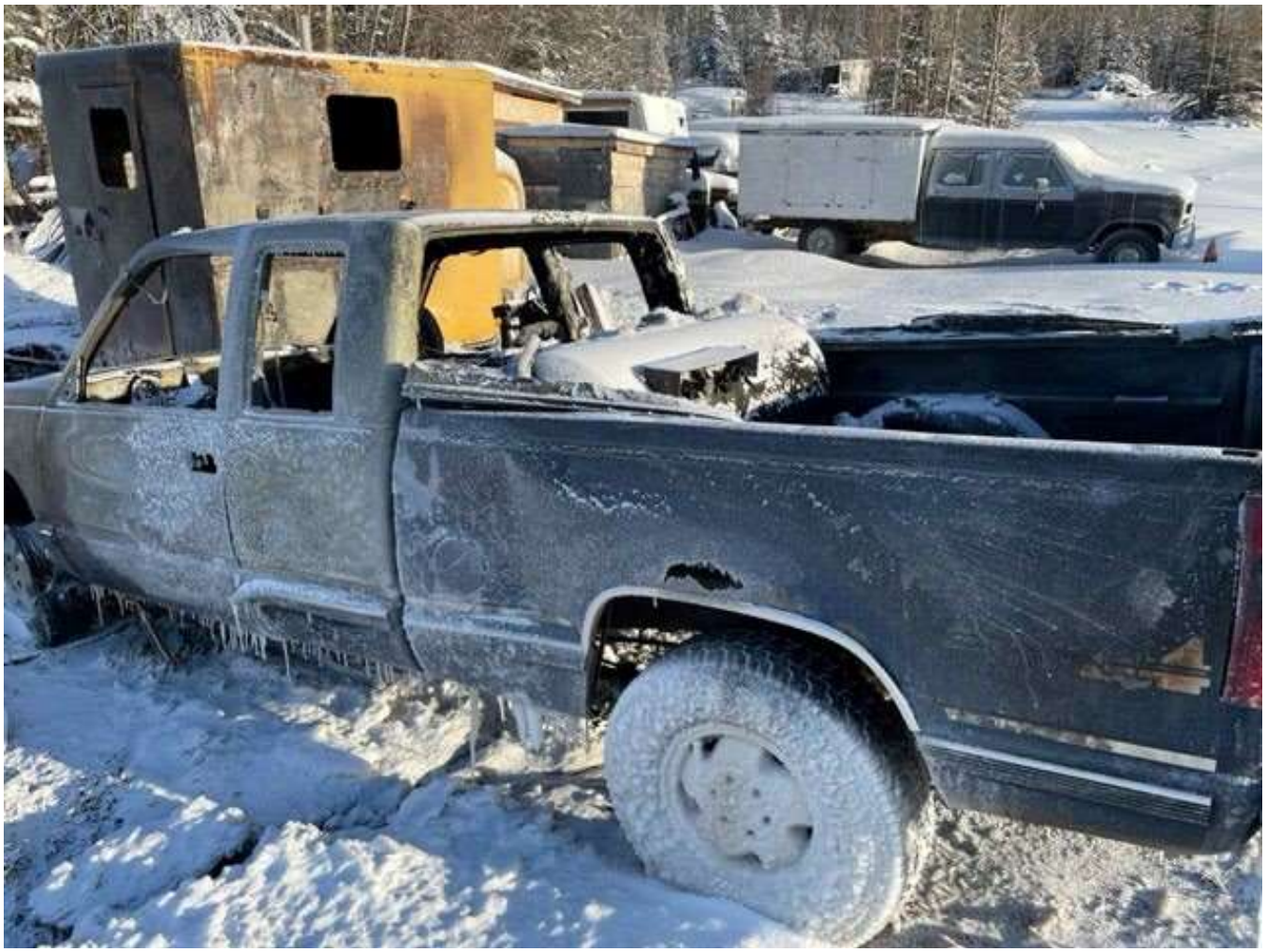

Photo 7 – Propane fueled vehicle damaged by explosion and fire.