Nuro Arizona Law Enforcement Protocol

for Fully Autonomous Vehicles

October 26, 2018

Purpose of Document

To prepare local Law Enforcement for the Nuro R1 vehicle traveling on public roadways and in response to the request from the Arizona Department of Public Safety and Arizona Department of Transportation for a Law Enforcement Protocol for Fully Autonomous Vehicles with no operator present, Nuro is providing the following information:

- How to communicate with a fleet support specialist who is available during the times the vehicle is in operation;
- How to safely remove the vehicle from the roadway;
- How to recognize whether the vehicle is in autonomous mode and steps to safely tow the vehicle;
- A description of the cities where the vehicle will be in operation;
- Any additional information the manufacturer deems necessary regarding hazardous conditions or public safety risks associated with the operation of the autonomous vehicle.

This document may be updated, as needed, prior to and during ongoing vehicle testing and operations. If updated, we will promptly provide law enforcement with an updated copy. If you or your organization has questions or would like to provide feedback based on this document, please contact Nuro at **azlawenforcement@nuro.ai**.

About Nuro and our vehicle, Nuro R1

Our mission is to accelerate the benefits of robotics for everyday life. Our vehicle is a fully autonomous, on-road vehicle designed to transport goods — quickly, safely, and affordably. With no driver or passengers to worry about, our vehicle has been engineered from the ground up to keep what's outside even safer than what's inside.

As a company, Nuro operates and tests a few different vehicle types/designs in multiple States, and maintains compliance with all local Autonomous Vehicle regulations. Our vehicle, R1, has no space for human occupants and no driver present inside the vehicle. Nuro R1 complies with all applicable Federal Motor Vehicle Safety Standards.

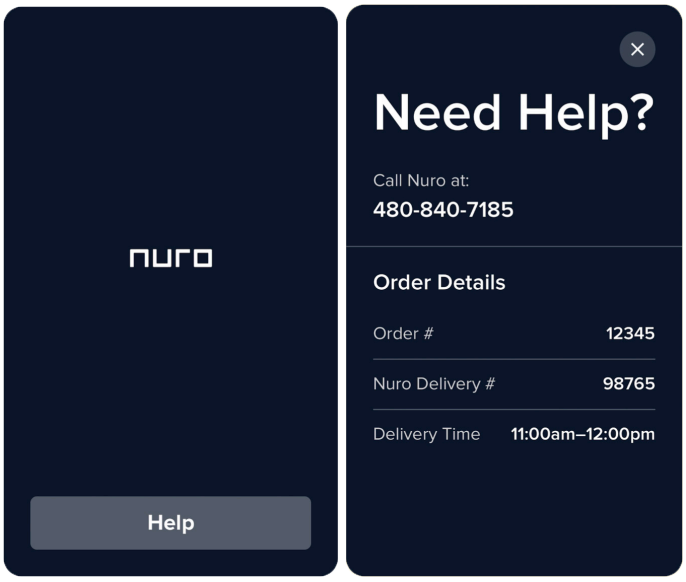
Vehicle ownership information

Owner Name: Nuro, Inc.
Owner Driver License or EIN: [redacted]
Business Location: P.O. Box 2575, Scottsdale, AZ 85252
Contact Information: (480) 840-7185 or feedback@nuro.ai

1) How to communicate with a fleet support specialist who is available during the times the vehicle is in operation

Nuro supports our fleet with Nuro Operations Specialists. Because the R1 vehicle is entirely unmanned, there is no human available in the vehicle to directly communicate with police, fire, and other first responders. Nuro Operations Specialists will be available 24/7 through a dedicated law enforcement hotline. This phone number will be provided directly to state and local agencies in the designated vehicle operating areas. Nuro Operations Specialists monitor the location of the vehicle, understand its status, and can, if necessary, obtain remote control of the unmanned vehicle. In addition, emergency personnel can contact any support number listed online to connect to the appropriate operator to provide assistance.

Law Enforcement or customers can also obtain the support phone number by pressing the "Help" button on the vehicle's side-panel screen.



Typically, a Safety Chase Vehicle will be in convoy, following closely behind the Nuro R1. This Chase Vehicle will function and appear like a normal passenger vehicle, but will be specially equipped to monitor, evaluate, and serve as a backup control platform for R1. Trained operators seated in the Chase Vehicle will be actively monitoring R1's behaviors, including potential Law Enforcement interactions. In the event that Law Enforcement needs to communicate with a Nuro Operations Specialist while the vehicle is in operation, the operators in the Chase Vehicle will also be available to assist them.

Relevant documentation for all Nuro vehicles can be provided electronically to Law Enforcement upon request to the Nuro Operations Specialist in communication with the requesting individual. In addition, when present, the Nuro Operations Specialist in the Safety Chase Vehicle actively in convoy with the Nuro Unmanned Vehicle on public roads will have the relevant documentation for the vehicle to provide Law Enforcement or other parties upon request.

2) How to safely remove the vehicle from the roadway

If law enforcement wishes to direct the Nuro vehicle to pull to the side of the road while in operation, the most efficient method is to pull over the Safety Chase Vehicle, when present, in the same manner as any other vehicle on the road. The operators in the Safety Chase Vehicle will pull over the Nuro Unmanned Vehicle in convoy.

The Nuro Operations Specialists available on the 24/7 Law Enforcement hotline are also able to remotely disable the Nuro vehicle and safely remove it from the roadway.

3) How to recognize whether the vehicle is in autonomous mode and steps to safely tow the vehicle

Law enforcement can contact the 24/7 hotline if they need to understand whether any particular vehicle is in autonomous mode. When a Nuro autonomous vehicle is pulled over by the Safety Chase Vehicle operators or a remote operator at law enforcement's direction, it will always be taken out of autonomous mode. The vehicle will not resume autonomous operations until it is activated by a Nuro Operation Specialist who has gone through a complete checklist that includes verbal confirmation from any Law Enforcement present that it can resume operation.

A stopped Nuro vehicle does not necessarily mean the vehicle is inoperable; it may have detected an obstacle that requires it to stop for safety reasons. If that obstacle resolves itself, the vehicle may resume normal operations and start moving.

If the vehicle is unable to move, a Nuro Operations Specialist is automatically and immediately notified and appropriate action is taken. A Nuro Operation Specialist is available to arrange for vehicle towing when needed. The Chase Vehicle, in convoy, is also equipped with a tow hook that can be attached to assist with towing operations. Towing personnel should be made aware that the vehicle has an electric battery pack housed within the chassis and use appropriate precautions. Please refer to section 5 in this document for battery safety precautions.

4) A description of the cities where the vehicle will be in operation

The primary operational area of the Nuro R1 Unmanned Vehicle is the 85257 zip code in southern Scottsdale, Arizona. The vehicle may occasionally be in the immediately adjacent area, which includes portions of Scottsdale, Tempe, and Phoenix, as well as public roads in the Salt River Pima-Maricopa Indian Community.

The vehicle is designed to travel autonomously within the Nuro Mapped Area and autonomous operation is not enabled outside of that area. The Nuro Mapped Area is a specific geographic area where Nuro vehicles specially equipped with sensors have collected necessary data to ensure safe autonomous vehicle driving. The route an Unmanned R1 vehicle travels has also been successfully driven by a manned autonomous vehicle with a safety driver. Specific information on the most up-to-date operating area can be obtained by contacting Nuro at **feedback@nuro.ai**.

5) Any additional information the manufacturer deems necessary regarding hazardous conditions or public safety risks associated with the operation of the autonomous vehicle

Traction Battery (Main Battery)

The Nuro R1 has a 14.1kWh 48V lithium-ion battery pack located near the bottom of the vehicle. It consists of eight separate modules. The maximum voltage anywhere in the vehicle is less than 60VDC.

The Nuro R1 vehicle Low Voltage system has considerably less voltage then a standard electric passenger vehicle High Voltage system however precautions should still be taken when handling a damaged vehicle.

Image: Location of the traction battery (red rectangle)

It is recommend that the vehicle never be lifted from the battery area as it may puncture the battery and cause injury. If lifting is required, use the designated areas to do so.

If Nuro R1 is submerged in water, the vehicle should be removed using the same precautions, including Personal Protective Equipment. Once the vehicle is removed from the water, contact a Nuro Operations Specialist, who will arrange for Nuro to promptly retrieve the vehicle.

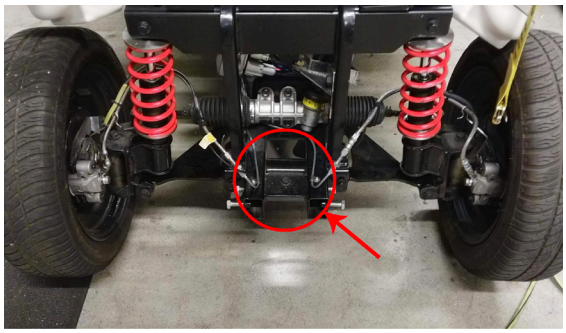


Image: Front - Single jack centered between wheels

In the event of a fire, please follow the guidelines below:

1. For small fires, use only sand, dry chemical carbon dioxide, nitrogen, halon, or regular foam to extinguish. Continuously apply solution until fire is extinguished.
2. Large fires should only be extinguished by trained firefighters with copious quantities of water spray until the fire is extinguished. The amount of water could be up to 2,000 gallons to put out a fire. If water is not immediately available, fire extinguishing agents such as carbon dioxide or foam, may be used to put out the fire until water is available.
3. Personal Protective Equipment should be used even after fire and smoke have subdued.

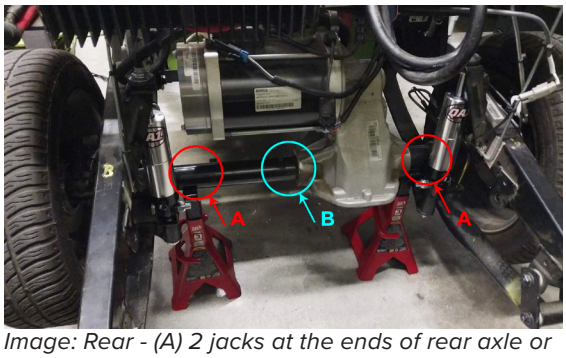


Image: Rear - (A) 2 jacks at the ends of rear axle or (B) single jack centered on rear axle

4. Do not use small quantities of water. If water spray is used, it must be continually applied until fire is extinguished.

Lithium ion batteries contain a flammable liquid electrolyte that may vent, ignite, and produce sparks when subjected to high temperatures or when damaged or abused.

The interaction of water or water vapor with the battery electrolyte may result in the generation of hydrogen and hydrogen fluoride (HF) gas. Contact with the battery electrolyte may be irritating to the skin, eyes, and mucous membranes.

First responders should use the appropriate Personal Protective Equipment, including a self-contained breathing apparatus (SCBA) and take appropriate measures to protect civilians downwind.

The Safety Chase Vehicle carries a fire extinguisher and other equipment to assist in dealing with fire related issues.

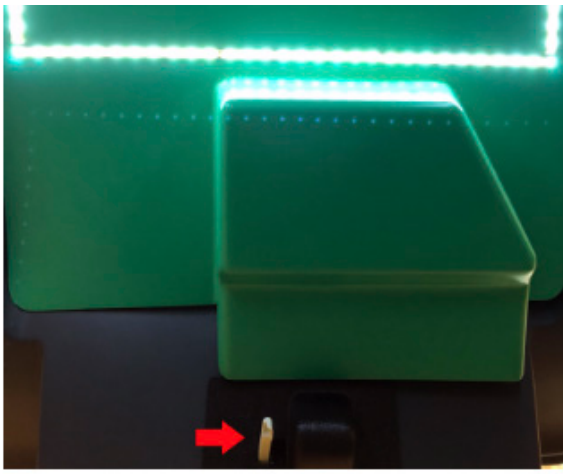
Refer to the Valence U27-24XP battery documentation for additional safety information: **https://lithiumwerks.com/wp-content/uploads/2017/02/Valence-SDS-20161221.pdf**

Backup Batteries

The Nuro R1 has two 18Ah, 12V sealed lead-acid backup batteries located near the base of the vehicle. The emergency response requirements for these batteries are similar to standard passenger vehicles.

Doors

Each of the Nuro R1 cargo doors have a manual opening apparatus on the inside. To manually open from the inside, push the lever located at the bottom center of the door to the right.



Conclusion

Nuro's mission is to accelerate the benefits of robotics for everyday life. We measure our success by how many people's lives are substantially improved by our products. That's why we created the first fully self-driving, on-road vehicle designed to transport goods — quickly, safely, and affordably. With the help of robotics, we can significantly improve people's day-to-day lives, transform local commerce, and make our roads safer.

We seek to work with groups and organizations also driven by this mission. Nuro is open to conducting demonstrations of the R1 vehicle with law enforcement officials and engaging in dialogue about the handling of potential emergency situations.

Additional information on Nuro's approach to safety can be found within Nuro's Safety Self-Assessment report (**www.nuro.ai/safety**), submitted to the National Highway Traffic Safety Administration in September of 2018.