



# Calculating Reid Vapour Pressure in the *Environmental Protection (Petrol) Regulations 1999*

## Purpose

This fact sheet provides information on Reid Vapour Pressure (RVP) and the need to manage RVP levels in petrol during summer months to protect Perth's air quality.

This fact sheet also provides guidance for fuel companies calculating the RVP of petrol during the prescribed period in the *Environmental Protection (Petrol) Regulations 1999* (Petrol Regulations).

## Introduction

The Department of Environment Regulation (DER) is responsible for managing and protecting the state's air quality, with assistance and co-operation from other levels of government, industry and the public.

Under Regulation 11 of the Petrol Regulations, from 15 October to 15 April every year:

- petrol supplied in Perth is to be compliant with the monthly volumetric average RVP of 62 kilopascals (kPa), and must not exceed the RVP limit of 64 kPa; and
- prescribed blended petrol (4-10% ethanol by volume) must not exceed the RVP limit of 71 kPa

RVP levels are to be determined according to the standard test methods in Regulation 19.

The RVP standards reduce evaporative fuel emissions in the summer months, which lead to a reduction in ozone and smog formation.

The information in this fact sheet is of particular use to fuel suppliers and distributors in Western Australia who wish to seek

guidance on how to calculate the RVP of their petrol.

## What is Reid Vapour Pressure?

RVP is a standard indicator of petrol volatility, or how readily a fuel evaporates. RVP is the pressure of vapour accumulated above a sample of fuel in a closed vessel at 37.8°C. The RVP is largely determined by the butane content, which has an RVP of about 350kPa. Butane content is partly a function of the nature of the crude oil, but occurs mostly as a result of the refining process.

A large percentage of motor vehicle and fuel related volatile organic compounds (**VOC**) emissions is through evaporation.

The RVP of petrol is a major determinant of the level of VOCs released direct to the atmosphere through evaporation of fuel. Reducing RVP levels in fuel will lead to a reduction in the amount of VOCs released into the atmosphere.



Fuel Delivery Vehicle ( DER)

Some VOCs released through evaporation are photo-chemically reactive, and react in the atmosphere to form ozone, which is the main constituent of photochemical smog. Ozone can irritate the eyes, damage the lungs and aggravates respiratory problems in susceptible people.

## Rationale for Calculation of RVP

Regulation 11 of the Petrol Regulations outlines the RVP standards and the calculation rationale for petrol supplied in Perth area during the prescribed period on and after 15 October 2016.

- (1) This regulation applies on and after 15 October 2016.
- (2) A fuel supplier commits an offence if —
  - (a) the fuel supplier supplies or uses petrol at a place in the Perth area during summer; and
  - (b) the Reid Vapour Pressure of the petrol supplied or use is —
    - (i) for petrol (other than prescribed blended petrol) — more than 64 kPa; or
    - (ii) for prescribed blended petrol — more than 71 kPa.
- (3) A fuel supplier commits an offence if —
  - (a) the fuel supplier supplies or uses petrol (other than prescribed blended petrol) at a place in the Perth area during a month in summer; and
  - (b) the monthly volumetric average Reid Vapour Pressure of the petrol in the month during which the petrol is supplied or used, calculated under subregulation (4), is more than 62 kPa.

(4) For the purposes of subregulation (3)(b), the monthly volumetric average Reid Vapour Pressure of petrol in a particular month is to be calculated as follows —

- (a) a sample is to be taken from each batch of the petrol supplied or used during the month by the fuel supplier;
- (b) the Reid Vapour Pressure of each sample taken is to be ascertained using the same standard test method prescribed by regulation 19;
- (c) the Reid Vapour Pressure of each sample taken is to be multiplied by a fraction that is equal to the volume of petrol in the batch from which the sample was taken divided by the total volume of petrol supplied or used in the relevant month;
- (d) the figures calculated under paragraph (c) for each sample of petrol are to be added together.

(5) For the purposes of subregulations (3) and (4) —

- (a) if petrol is supplied or used during the period that begins at the start of 15 October and ends at the end of 31 October in any year — a reference in those subregulations to a month is taken to be a reference to that period; and
- (b) if petrol is supplied or used during the period that begins at the start of 1 April and ends at the end of 15 April in any year — a reference in those subregulations to a month is taken to be a reference to that period.



Fuel Price Board (DER, 2015)

## Calculation of monthly volumetric average RVP

The following information is guidance for fuel companies calculating the RVP of petrol during the prescribed period in the Petrol Regulations.

For each fuel type there will be an associated total outgoing volume per day ( $V_D$ ).

$V_D$  may comprise of one or several outgoing volumes of one particular fuel type denoted as  $V_1, V_2, V_3 \dots$  and so on, where  $V_1 + V_2 + V_3 + \dots = V_D$

Each of these separate quantities of a single fuel type ( $V_1, V_2, V_3 \dots$ ) will also have an associated RVP such that  $RVP_1$  is the RVP of  $V_1$ ,  $RVP_2$  is the RVP of  $V_2$ ,  $RVP_3$  is the RVP of  $V_3$  etc.

The daily average RVP for a particular fuel type ( $RVP_{DAY}$ ) is calculated as follows:

$$RVP_{DAY} = RVP_1 \times \frac{V_1}{V_D} + RVP_2 \times \frac{V_2}{V_D} + RVP_3 \times \frac{V_3}{V_D} \dots \quad (1)$$

$RVP_{DAY}$  and  $V_D$  will be determined once per day for each fuel type.

A **monthly average RVP** ( $RVP_{month}$ ) for each fuel type supplied will then be calculated every day by summing the average RVP for a particular fuel type supplied on that day ( $RVP_{DAY}$ ) multiplied by that day's supplied volume ( $V_D$ ) divided by the total volume of that fuel type supplied since and including the first day of that calendar month ( $V_{month}$ ).

$$RVP_{month} = \sum_{n=1}^D \left( RVP_{DAY_n} \times \frac{V_{D_n}}{V_{month}} \right) \quad (2)$$

where D represents the current day number of the month.



Bulk Fuel Terminal (DER, 2015)

The issue of 'hot-tanking' may arise where a particular storage volume of a single fuel type is being distributed while that same storage volume is simultaneously being supplied with additional fuel of the same type.

In this situation, the reportable RVP of that total volume of fuel supplied from that storage volume during the period when 'hot-tanking' is in effect will be the maximum of:

- a) the RVP determined for that storage volume just prior to the 'hot-tanking'; and
- b) the RVP determined for that storage volume at the completion of 'hot-tanking'.

Each time the volume of fuel supplied via 'hot-tanking' equals the fuel capacity of that storage volume, then an additional RVP determination will be made for the fuel within that storage volume. The maximum of these additional RVP values and those determined in a) and b) above, together with the total amount of fuel supplied via 'hot-tanking' will be used as one of the terms in the right hand side of equation (1) for the purpose of calculating  $RVP_{DAY}$



Vehicles on road (DER, 2015)

## More information

For advice on calculating RVP, or any other related air quality matters, please contact DER on +61 8 6467 5000, or [email the Department](#).

This document is available in alternative formats and other languages on request.

## Related documents

Additional publications about air quality are available online on DER's website, or by contacting the Department on +61 8 6467 5000

## Legislation

This document is provided for guidance only. It should not be relied upon to address every aspect of the relevant legislation. The full text of the ***Environmental Protection (Petrol) Regulations 1999*** is available electronically from the [State Law Publisher website](#).

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## Legal advice

The information provided to you by DER in relation to this matter does not constitute legal advice. Due to the range of legal issues potentially involved in this matter, DER recommends that you obtain independent legal advice.

Information current at August 2016