README

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rEHS package

```
library(tidyr)
library(readr)
```

The **rEHS** package includes a set of tools for practical Environmental, Health and Safety management. Download the package from:

```
library(devtools)
# and install_github("dwnadler/rEHS")
```

and open it in R:

```
library(rEHS)
```

Calculate new concentration after a time interval

concentration(contaminant.generation.rate, flow.rate.cfm, timeframe, volume.cf)

contaminant.generation.rate: the rate of contaminant released in cubic feet per minute (cfm)

flow.rate.cfm: the rate of air flow in cubic feet per minute (cfm)

timeframe: the number of minutes (min) it takes to reach the new concentration

volume.cf: the volume of the room in cubic feet (cf)

```
concentration(1.4, 2500, 11, 75000)
```

```
## [1] "Concentration: 171.90 ppm"
```

where: contaminant generation is 1.4 cfm, air flow is 2500 cfm, 11 minutes is the time interval, and room is 75,000 cubic feet

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Calculate DART rate

dart(dart.incidents, total.hours.worked)

dart.incidents:* number of dart-related incidents as defined above

total.labor.hours total number of hours employees worked in a reporting period

```
dart(2, 28000)
```

```
## [1] "DART: 14.29"
```

where: for every 100 employees, 14.29 incidents resulted in lost or restricted days or job transfer due to work related injuries or illnesses

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Sound level at various distances

db(dB0, distance.original, distance.new)

dB0: the original sound measurement (dB)

distance.original: the original distance where noise measurement was taken

distance.new: the second distance to calculate the sound level reading

```
dB.distance(92, 4, 10)
```

```
## [1] "Noise level in db at distance 10.00 is 84.04"
```

where: sound level is 92 dB at 4 feet from a source. At 10 feet from source, sound level is measured as 84.04 dB

Calculate OSHA incident rate

incident.rate(recordable.cases, total.hours.worked)

recordable.cases: all work related deaths, illnesses, and injuries which result in a loss of consciousness, restriction of work or motion, permanent transfer to another job within the company, or that require some type of medical treatment or first-aid.

total.hours.worked: total number of hours employees worked in a reporting period

```
incident.rate(17, 1500000)
```

```
## [1] "Incident rate: 2.27"
```

where: there are 17 recordable cases from 1.5 million hours, and for every 100 employees, 2.27 have been involved in a recordable injury or illness

---

Conversion of mg/m^3 to ppm

mgm3.to.ppm(mg.per.cubic.meter, molecular.weight)

mg.per.cubic.meter: milligrams per cubic meter

molecular.weight: molecular weight

```
mgm3.to.ppm(10 ,78)
```

```
## [1] "ppm: 3.13"
```

where: concentration of acyrlamide is 10 mg/m^3 and molecular weight of acrylamide is 78 grams/mol

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Conversion of ppm to mg/m^3

ppm.to.mgm3(ppm, molecular.weight)

ppm: concentration of molecule in parts per million

```
ppm.to.mgm3(3.13 ,78)
```

[1] "mg/m3: 9.99"

where: concentration of acyrlamide is 3.13 mg/m^3 and molecular weight of acrylamide is 78 grams/mol

---

Calculating the minimum air sampling volume

min.air.volume(limit.of.quantification.mg, contaminant.target.concentration.mgm3)

limit.of.quantification.mg: the smallest amount or the lowest concentration of a substance that is possible to be determined by means of a given analytical procedure with the established accuracy, precision, and uncertainty

contaminant.target.concentration.mgm3: an estimate of the airborne concentrations of the contaminant being tested in mg/m^3

```
min.air.volume(0.0027, 500)
```

[1] "Minimum air volume required: 0.0054 liters"

where: a 0.0027 mg/m3 limit of quantification (concentration) exists for acetone and we are interested in a target concentration of 500 mg/m^3

Comparing an incident rate to an industry incident rate

my.ir.comparison(my.ir, my.naics.code)

my.ir: input your OSHA-recordable incident rate

my.naics.code: input your industry's NAICS number

```
my.ir.comparison(2.7, 3115)
```

```
## # A tibble: 1 x 3
##   Industry                 NAICS    IR
##   <chr>                    <dbl> <dbl>
## 1 Dairy product manufacturing  3115   4.3
```

```
##      IR
## [1,] TRUE
```

where: incident rate = 2.7 and industry is dairy product manufacturing (NAICS 3115)

TRUE output translates to your incident rate as being lower than the industry incident rate.

Calculate air flow

q.cfm(air.velocity.fpm, area.sf)

air.velocity.fpm: velocity of air in feet per minute

area.sf: cross-sectional area of air vent

```
q.cfm(5, 2)
```

[1] "Air flow rate: 10.00 fpm"

where: where air velocity is 5 fpm and vent cross-sectional area is 2 sf

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Recommended Weight Limit and Lifting Index

rwl(horizontal.dist, vertical.dist, distance, angle, seconds.between.lifts, grasp, object.weight)

horizontal.dist: horizontal location of the object relative to the body (cm)

vertical.dist: vertical location of the object relative to the floor (cm)

distance: distance the object is moved vertically (cm)

angle:the asymmetric angle is the amount (in degrees) of trunk and shoulder rotation required by the lifting task. Angle must be input as 90, 60, 45, 30, or 0

seconds.between.lifts: time between lifts in seconds (s). Time must be entered as 300, 60, 30, 15, 10, or 6

grasp: quality of the workers grip on the object (1 = good, 2 = fair, 3 = poor)

object.weight: weight of the object in kilograms (kg)

```
rwl(45, 25, 40, 0, 15, 1, 20)
```

```
## [1] "Weight limit: 3.75 and lifting index: 5.33"
```

a worker is 45 cm from an object horizontally, object is 25 cm above the floor and must be lifted 40 cm up.

The worker is positioned 0 degrees relative to the 20 kg object and has a good (1) grip.

variable LI (lifting index) is created (5.328).

variable weight.limit is created (3.75).

LI interpretations:

- <=1: very low risk
- 1.01 - 1.50: low risk
- 1.51 - 2.00: moderate risk
- 2.01 - 3.00: high risk
- > 3.01: very high risk

weight.limit interpretation:

the acceptable maximum weight (kg) that is safe under the horizontal, vertical, and distance data input in the rwl() function, including the angle, seconds between lifts, and grasp.

Calculating the severity rate

severity.rate(total.days.lost, total.recordable.incidents)

total.days.lost: total number of work days lost due to injury and illness. number of days lost do not need to be consecutive

total.recordable.incidents: total number of recordable incidents that happened in a reporting period

```
severity.rate(5, 2)
```

```
## [1] "Severity rate: 2.50"
```

5 work days were lost from 2 recordable incidents
the average recordable incident resulted in 2.5 lost days

Permissible noise exposure

T(dB)

dB: number of decibels of noise

```
T(88)
```

[1] "Permissible exposure time: 10.556063 hours"

where: the exposure is 88 decibels

Calculating the time interval in minutes for new concentration of contaminant

time.interval(volume.cf, flow.rate.cfm, contaminant.generation.rate.cfm, concentration.ppm)

volume.cf: volume of room or enclosure (cubic feet)

flow.rate.cfm: flow rate of the air (cfm)

contaminant.generation.rate.cfm: rate of generation of contaminant (cfm)

concentration.ppm: concentration of the contaminant to predict (ppm)

```
time.interval(75000, 2500, 1.4, 175)
```

[1] "Time interval is 11.24 minutes for 175.0 ppm"

where: room volume is 75,000 cubic feet air flow rate is 2500 cfm contaminant is generated at 1.4 cfm

---

Calculating air velocity in feet per minute

velocity.fpm(velocity.pressure.as.h2o)

velocity.pressure.as.h2o: pressure in the direction of flow necessary to caus the air at rest to flow at a given velocity

```
velocity.fpm(.20)
```

[1] "Velocity is 1791.09 fpm"

where: there is a velocity pressure of 0.2 inches

Wind chill

wind.chill(temp.fahr, wind.speed.mph)

temp.fahr: degrees in Fahrenheit (must be below 70)

wind.speed.mph: measured wind speed in miles per hour (mph)

```
wind.chill(40, 15)
```

[1] "Wind chill is 31.84 F when wind speed is 15.0 and air temperature is 40.0 F"