



UK Centre for  
Ecology & Hydrology

# SCAIL-Agriculture: User guide

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# 1 Introduction

Simple Calculation of Atmospheric Impact Limits from Agriculture Sources (SCAIL-Agriculture) is a screening tool for assessing the impact from agriculture sources on semi-natural areas like SSSIs and SACs, and human health receptors. The model provides an estimate of the amount of ammonia, nitrogen and acidity deposited on a habitat from the agriculture source as well as particulate PM<sub>10</sub> concentrations from livestock housing for human health receptors. These values can then be used to assess whether impact limits for human health or habitats are exceeded or not.

The SCAIL-Agriculture user guide provides information critical loads and the model, as well as providing a walk-through of the system itself. You will be shown how to complete a query using the web form and how to interpret the results.

## 1.1 Legislative background

Industrial Emissions Directive - Intensive agriculture is covered under the Environmental Permitting Regulations (in England and Wales); Pollution Prevention and Control (Scotland) Regulations 2012; Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 ('The Regulations'); and, Environmental Protection Agency (Industrial Emissions) (Licensing) Regulations Republic of Ireland) 2013 for the rearing of poultry and pigs. There are three main activities that are included in the regulations, for installations with more than: i) 40,000 places for poultry, including ducks and turkeys; ii) 2,000 places for production pigs (over 30 kilogrammes); or iii) 750 places for sows. For the three situations above, there is also a requirement to look at the different emission sources of NH<sub>3</sub> that are occurring within these types of installation - namely emissions from housing, storage and land spreading. On an environmental permit application form, and on the SCAIL web site, you will be asked to fill out all the sources involved in your farming operation that contribute to NH<sub>3</sub> emissions. Further detailed information on IED can be found on the APIS IED Directive page.

The following links will direct the user to the relevant guidance specific to the agency regulating the installation.

- England: <http://www.environment-agency.gov.uk/business/sectors/40069.aspx>;
- Wales: <http://naturalresourceswales.gov.uk/apply-buy-report/apply-buy-grid/installations/intensivefarming/>;
- Scotland: [http://www.sepa.org.uk/air/process\\_industry\\_regulation/pollution\\_prevention\\_control/intensive\\_agriculture.aspx](http://www.sepa.org.uk/air/process_industry_regulation/pollution_prevention_control/intensive_agriculture.aspx);
- Northern Ireland: [http://www.doeni.gov.uk/niea/pollutionhome/ippc/ippc\\_farmregs/application\\_forms\\_and\\_guidance.htm](http://www.doeni.gov.uk/niea/pollutionhome/ippc/ippc_farmregs/application_forms_and_guidance.htm);
- Ireland: <http://www.epa.ie/pubs/forms/lic/ipc/#d.en.46362>

If there is the potential for deposition to have an impact on a site with a conservation designation [e.g. Special Area of Conservation (SAC) or in the UK an Area/Site of Special Scientific Interest (ASSI/SSSI)] then this potential impact needs to be considered.

**PM<sub>10</sub> legislation** - Air quality regulation within the EU is based upon the Ambient Air Quality Directive (2008/50/EC) and Directive 2004/107/EC, which set limits for concentrations of pollutants in outdoor air. These are promulgated in national legislation. Air quality is a devolved matter, though the UK government leads on international and European legislation. Administrations in Scotland,

Wales and Northern Ireland are responsible for their own air quality policy and legislation. The Air Quality (Standards) Regulations 2010 transpose into English law the requirements of Directives 2008/50/EC and 2004/107/EC on ambient air quality. Equivalent regulations have been made by the devolved administrations in Scotland, Wales and Northern Ireland. The equivalent in the Republic of Ireland is the Air Quality Standards Regulations 2011.

**Odours** - The Environmental Permitting Regulations require the control of pollution including odour. In addition, action on odours can be taken under Section 80 of The Environmental Protection Act 1990 in cases where a statutory nuisance is found to exist. Whether or not odour constitutes a statutory nuisance depends on several factors, including:

- severity
- duration
- frequency and
- whether it interferes with the "average" person's reasonable enjoyment of their property.

In other words, an unpleasant odour in someone's garden in the winter that does not enter their house would not constitute a statutory nuisance as the "average" person would not be expected to spend significant periods of time in their garden during cold weather. However, during warmer weather they are more likely to be in the garden and therefore the same odour would be more likely to constitute a statutory nuisance. A Public Inquiry at Newbiggin-on-Sea established that the 98th percentile of hourly concentrations provided a suitable surrogate for determining an odour nuisance. Typically concentrations above between 1 and 5 Odour Units per cubic meter of air when evaluated as the 98th percentile of hourly values would be determined to result in odour pollution. [Horizontal Guidance from the Environment Agency](#) for England, Wales, Scotland and Northern Ireland and the Odour Impact Assessment Guidance for EPA Licensed Sites for the Republic of Ireland provides further details on the assessment of odour issues for regulatory purposes.

Further, guidance can be found at: <https://www.scottishairquality.co.uk> | <https://www.sepa.org.uk> | <https://www.apis.ac.uk> | <https://www.environment-agency.gov.uk> | <https://naturalresourceswales.gov.uk> | <https://www.epa.ie> | <https://www.doeni.gov.uk>.

## 1.2 Emission sources and impacts

**Ammonia (NH<sub>3</sub>)** and impacts - Ammonia (NH<sub>3</sub>) in the atmosphere results primarily from the decomposition and volatilisation of animal wastes. As such it is in principle a natural trace gas. However, as agricultural livestock numbers have dramatically increased, together with increases in nitrogen fertilization, NH<sub>3</sub> emissions have increased accordingly (Sutton et al. 19931 ). Emissions of ammonia lead to the deposition of nitrogen to vegetative surfaces through processes of wet and dry deposition.

**Nitrogen (N) deposition** - describes the input of reactive nitrogen from the atmosphere to the biosphere both as gases, dry deposition and in precipitation as wet deposition. Enhanced reactive nitrogen deposition is a consequence of global emissions of oxidised nitrogen (NO, HNO<sub>3</sub> and NO<sub>2</sub> – often referred to as NO<sub>x</sub>) from fossil fuel combustion, and reduced N (NH<sub>x</sub>) from agricultural sources. Excess nitrogen deposition to terrestrial plants can lead to eutrophication effects, and communities most at risk are those rich in mosses and lichens, and where species richness is comprised of slow growing species. Competition from invasive species, often grasses, poses a threat for many plant communities but the type of species invading will depend on the proximity of a seed source (arable, farmed land). Nitrogen deposition can also increase the risk of damage from drought (summer and winter) and frost.

Ecosystem impacts – see APIS Overview [Nitrogen Deposition](#)

**Acid deposition** – represents the mix of air pollutants that deposit from the atmosphere leading to acidification of soils and freshwaters. It mainly consists of pollutants emitted by the combustion of fossil fuels (e.g. power generation). The removal of these pollutants from the atmosphere is in the form of wet deposition in rainfall, cloud-water or occult deposition, mist and dew, but also includes dry deposited acidifying gases. Rainfall that is acidic, possesses elevated H<sup>+</sup> ion concentrations, and has been commonly known as ‘acid rain’.

Ecosystem impacts – see APIS Overview [Acid Deposition](#)

**Particulate matter, PM<sub>10</sub>** - Particulate pollution is composed of particles that are small enough to remain suspended in the air. Particulate matter pollution consists of very small particles floating in the air, which can include smoke, soot, dust, salts, acids, metals, and semi-volatile liquids. Particulate matter also forms when gases emitted from industrial and combustion sources, and motor vehicles undergo chemical reactions in the atmosphere. Particulate pollution also can include materials that can be highly toxic. Exposure to such particles can affect both the lungs and heart.

Human Health Impacts: PM<sub>10</sub> refers to particulate matter less than 10 microns in diameter, about one seventh the thickness of a human hair. Major sources of PM<sub>10</sub> include motor vehicles; wood burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning, industrial sources, windblown dust from open lands; and atmospheric chemical and photochemical reactions. Suspended particulates produce haze and reduce visibility.

**Odour** - Odour is the smell that we are able to detect from substances, carried by air into our nostrils. The ability of odours to be carried long distances in the air means that odours have the ability to affect a large number of people. The degree to which people are affected will however depend on the sensitivity of their sense of smell and their tolerance of the odour in question. Odour problems are typically associated with the following:

- fumes from boilers, etc.
- smoke from bonfires or chimneys
- accumulations of waste (e.g. dog faeces, food items, etc.)
- odour arising from the manner in which animals are kept and
- odour from industrial, trade or business premises Occasionally, pollutants have an accompanying odour, e.g. hydrogen sulphide or ammonia.

## 1.3 Critical Loads/Levels and Air Quality Limits

Critical Loads/levels are the threshold level for the deposition or concentration of a pollutant above which harmful indirect effects may occur on a habitat or species, according to current knowledge. Additional deposition above the Critical Load/Level is termed Critical Load/Level Exceedance. For combustion processes we are primarily interested in SO<sub>2</sub> and NO<sub>x</sub> emissions which lead to sulphur and nitrogen being deposited onto vegetation which may be harmful. Deposition is always quoted in kg of sulphur or nitrogen per hectare per year (kg S/ha/yr and kg N/ha/yr respectively). If 15 kg of nitrogen were deposited to a sensitive bog ecosystem every year, where the bog has a critical load of 5-10 kg N/ha/yr over time the integrity of the bog would decrease. Critical loads have been set to protect the vegetation but symptoms may not be visible for up to 10 to 20 years.

Further information on [critical loads and levels](#).

SCAIL Agriculture also assesses human health receptors using the National Air Quality Objectives. In SCAIL we provide the user the option to test against PM<sub>10</sub>. Details of the air quality limit values can be found in the following [UK AIR web pages](#) and [document](#).

## 1.4 Meteorology

The SCAIL-Agriculture screening model uses an approach that uses data from nearby meteorological stations. The Typical Meteorological Year approach is used to derive meteorological data to best represent the long-term dataset based on the similarity of the annual wind direction distribution to the long-term average (five year). Similarity of long-term wind direction distributions of nearby stations has been used to reduce the number of meteorological stations used. The 109 stations included in the model for the UK are shown in Figure 1 below with a full table in Appendix 1.

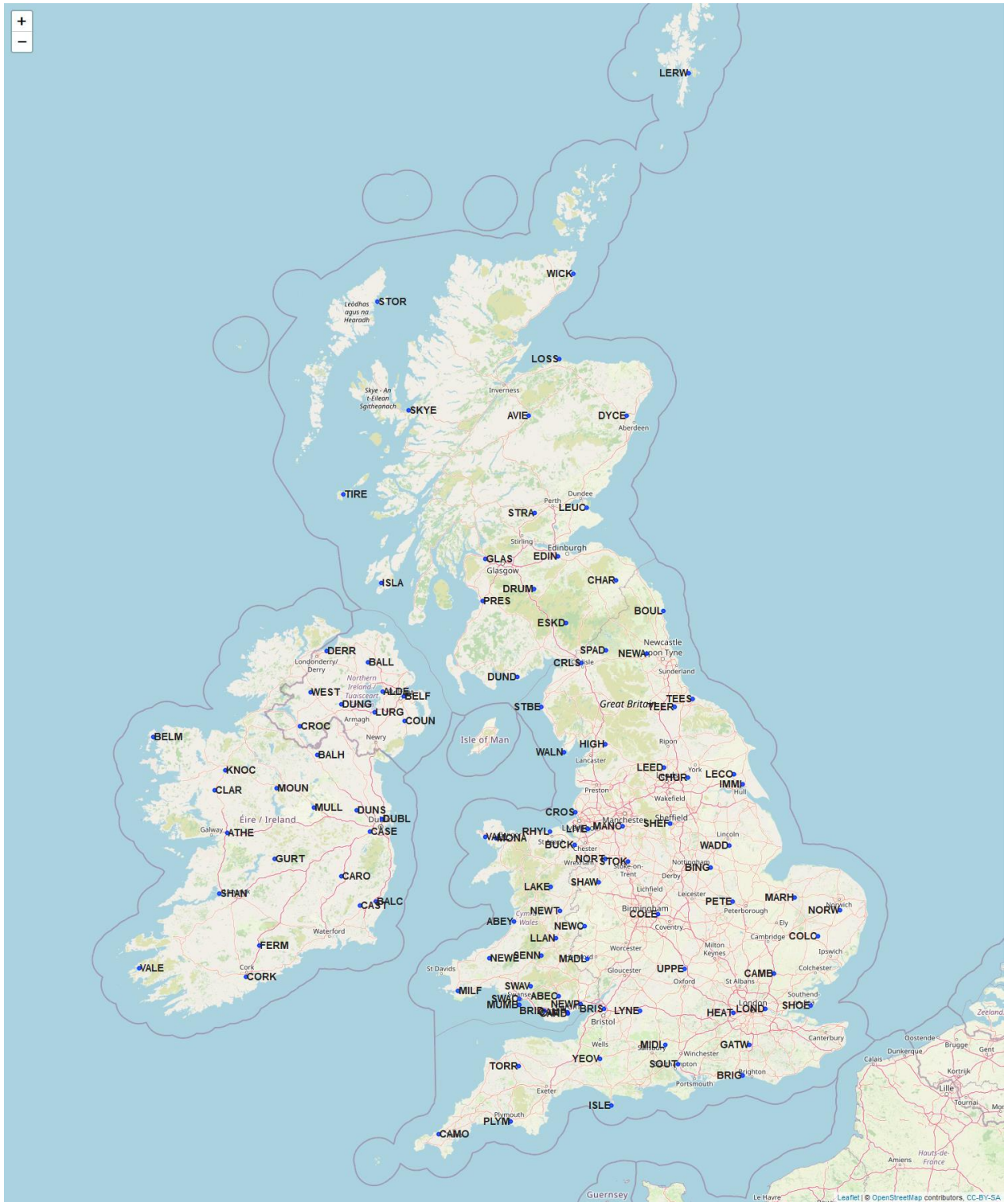


Figure 1: 109 Meteorological Station used in SCAIL-Agriculture

## 1.5 The SCAIL-Agriculture Web System

This section provides a brief walk-through of the system and will guide you through the form filling exercise and interpretation of the results.

SCAIL-Agriculture decision flow chart Figure 2 shows the flow diagram of the SCAIL agriculture tool and the decisions that may be taken in carrying out an environmental assessment. Since the tool compares a number of metrics for habitats or human health, obtaining no exceedance on all limits may be difficult. Where environmental standards are already exceeded by the background or the new installation results in an exceedance you should consult the relevant regulatory guidance for further action. In addition, for emissions of ammonia where a sensitive receptor is located within 250 metres of the installation the following guidance must be followed:

- *For intensive farming sites that are regulated under the Environmental Permitting Regulations (EPR) in England and Wales (PPC permitted sites in Scotland, IED in Northern Ireland) and with distances to the nearest sensitive receptor of less than 250m, applicants must go straight to undertaking detailed modelling.*
- *For non-EPR (PPC / IED) sites with distances to the nearest sensitive receptor between 100-250m, SCAIL can be used and then advice must be sought from the regulator for clarification on whether detailed modelling is required.*
- *For sites with distances to the nearest sensitive receptor of less than 100m, detailed modelling will be required.*



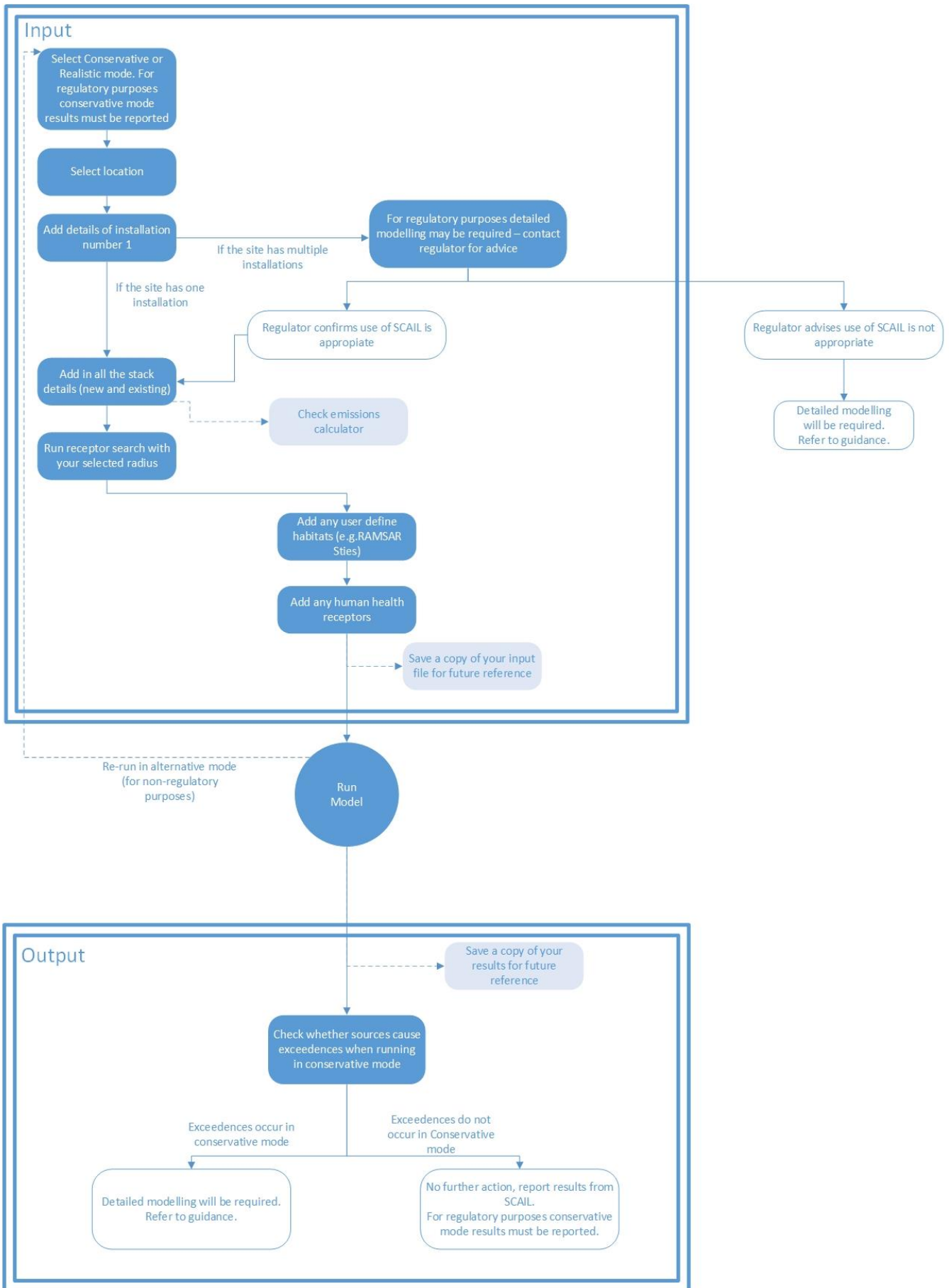


Figure 2: SCAIL Agriculture flow chart

## 2.2 Filling out the Form

Throughout the SCAIL-Agriculture web system the user is provided with guidance notes by using the information icon ( ? ). By clicking the mouse on the icon (see Figure 4) text is displayed in the grey box on the right of the form giving guidance on the relevant input field.



Figure 4: How to use the guidance info tool

### 2.2.1 Entering Input Data

All the information needed to run the model is entered on the web form. However, if you have saved input data from a previous run, this can be loaded by clicking on the **Load Input Data** button at the top-right of the form. This will bring up a window where the input file can be selected and loaded (Figure 5). This will populate the form with the saved input data, ready to edit or run.

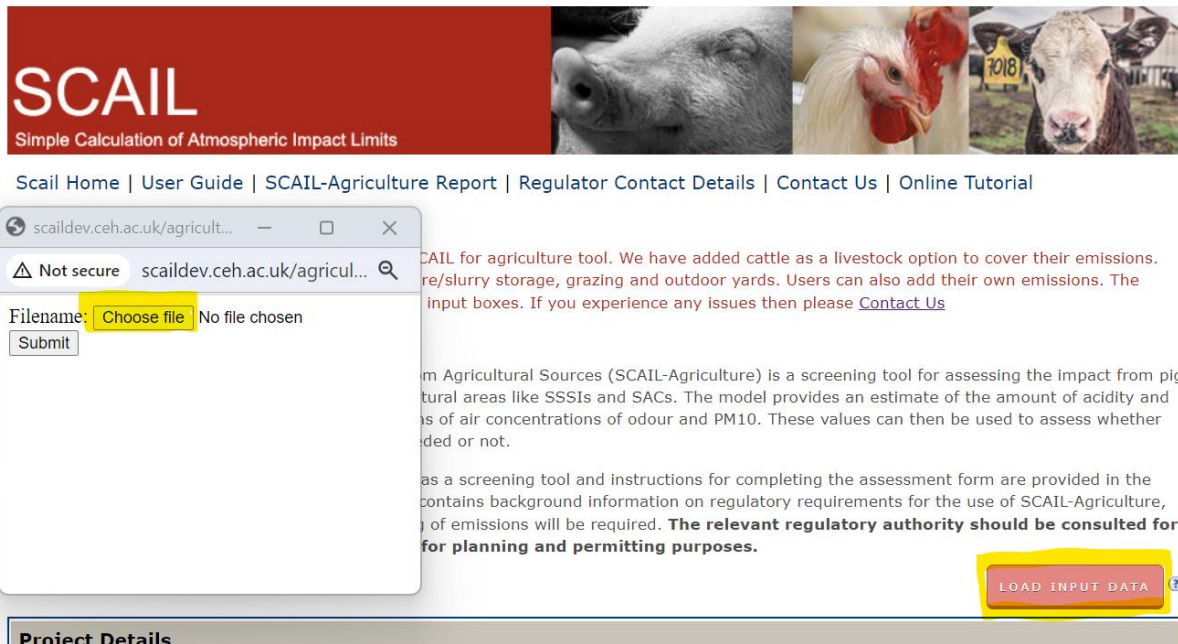


Figure 5: Specifying file for loading input data

## 2.2.2 Project Details & Run Modes

In the **Project Notes** box you can enter details on the sources to be modelled and the type of run being carried out, e.g. 'hybrid' or 'conservative'. This information is copied onto the output screen and also to any output files saved (Figure 6).

Figure 6: Initial project setup

For the Project Run Mode, either **Hybrid** or **Conservative** (or **Realistic** mode) can be chosen (Figure 6).

Where **SCAIL-Agriculture** results are to be reported to the relevant regulatory authority, results must be produced using the **Hybrid** or **Conservative** run mode.

## Run Modes

SCAIL-Agriculture can be used in either mode as a guide for non-regulatory purposes such as exploratory investigations for planning, pre-application or research.

### Conservative Mode:

In Conservative mode the source to receptor bearing will rotate the habitat site so that it is in the prevailing wind direction for the meteorological file being used and hence receive the highest amount of pollutant concentration and deposition. The 'Conservative Mode' assumption can help to ensure that the effects of local wind fields are captured. However, the method works best for situations where there are either single sources or sources are closely grouped, and care needs to be taken with sources that are widely spaced apart. For this reason, **the use of SCAIL-Agriculture is not suitable for regulatory screening of sites with multiple installations or dispersed sources, and the relevant Regulatory Authority should be contacted for advice.**

The prevailing wind direction at each of the meteorological sites is listed in Table A1.1, 'Wind Direction (degrees)'.

The following examples illustrate the use of the 'Conservative Mode' option. The left hand and centre figures illustrate that the rotation of the receptor locations into the prevailing wind direction works well when Installation and sources (e.g. livestock sheds) are located close to a source. The source midpoint is determined by the location of Installation as defined by the user. The methodology does not work well when sources are distant from Installation as shown in the far right-hand figure.

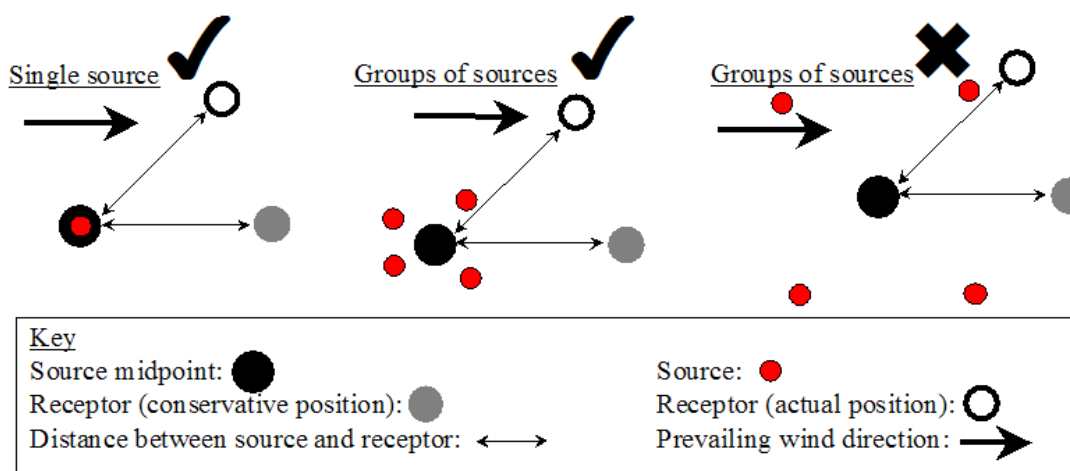


Figure 7: Conservative mode together with use of running SCAIL Agriculture with single source, grouped sources and multiple 'dispersed' sources.

### Hybrid Mode:

In the conservative mode, the bearing between the source and receptor is 'rotated' till a new bearing is aligned to the prevalent wind direction (for the nearest met station). This results in a worst case scenario, in terms of pollutant concentrations, at the receptor. Sometimes, this method is seen as too conservative and an alternative **Hybrid mode** is available to users. With the new update, the Hybrid mode will return the maximum concentration from the predictions among the arc points from  $\pm 40^\circ$  to  $\pm 10^\circ$  and the receptor. For each receptor, including the protected sites in the "search radius" function of SCAIL, there will be 9 calculations at  $10^\circ$  apart (Figure 7). A maximum concentration value from those calculations will be presented to the user.

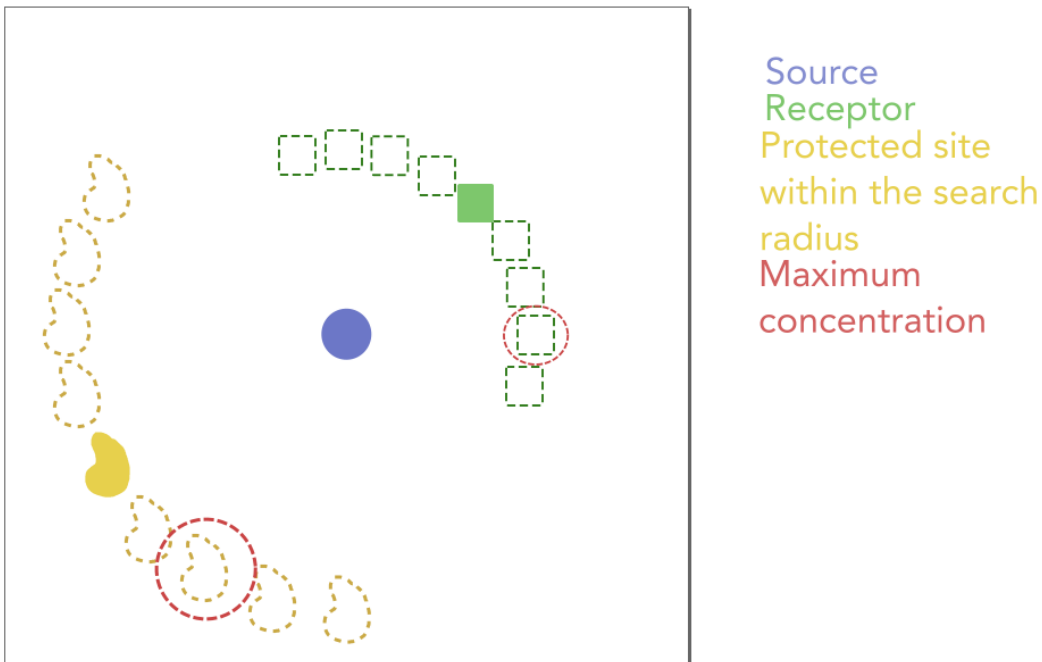


Figure 8: SCAIL Agriculture in Hybrid mode showing source and receptor and the four 10 degree bearings either site of the receptor location. The maximum concentration is presented to the user in the results page.

#### Realistic Mode:

Realistic mode will use the actual position of the receptor site and the bearing to the source.

Where SCAIL-Agriculture is not being used for regulatory purposes, in situations where a large number of sources are being modelled across a wide geographical area, the modeller should use the actual source position as applied through the “realistic met” option.

Details of the meteorological sites included in SCAIL-Agriculture can be seen in Appendix 1.

### 2.2.3 Installation Details

An Installation is the facility or group of sources for which the assessment of releases is required. More than one Installation can be specified if the assessment is for a number of releases from different locations or if you want to see detailed output from a particular Source in isolation from the other Sources being modelling. **The use of SCAIL-Agriculture is not suitable for regulatory screening of sites with multiple installations or dispersed sources (as per Figure 6).** For dispersed sources please run them separately and add up the concentrations/deposition for each receptor. **If in doubt the relevant Regulatory Authority must be contacted for advice.**

Click on the down arrow next to the Installation to add another Installation, otherwise select the Installation identifier for which you are about to enter details (the default is 1 for the first Installation). If other Installations have been added, more than 1 identifier will be present (Figure 9). To delete an Installation, select the Installation then click on the cross next to the Installation selection box.

Figure 9: Specifying an installation

Add the installation location in the 'Installation Location' box, this can be done in two ways;

- Enter the grid reference of your installation (See Figure 7)
  - If your grid reference is in the landranger format i.e. NY587803 please select the “landranger” option and add your grid reference in the box.
  - If your grid reference is in the x,y format i.e. 358784,580380 please select the “x,y” option and add your grid reference in the box. Note that there should be no spaces after the coma.

You can verify your location by clicking in “**choose/verify location**” to make sure the red location marker is in the correct place. Close the Map box when finished.

- Choose a location in the map - if you don't have a grid reference you can leave the “Installation Location” box empty and click in the “**choose/verify location**” button. Another window with a map will show (see Figure 8). Navigate through the map (use the zoom + and - buttons) and look for your installation location. When you locate your installation, click on the map to add a marker where your installation is located. Click the “OK” button in the grey box in the map and the new location co-ordinates will be transferred to the **Installation Location** box.

The new location co-ordinates are transferred back to the **Installation Location** box. Click OK to close the map window when finished.

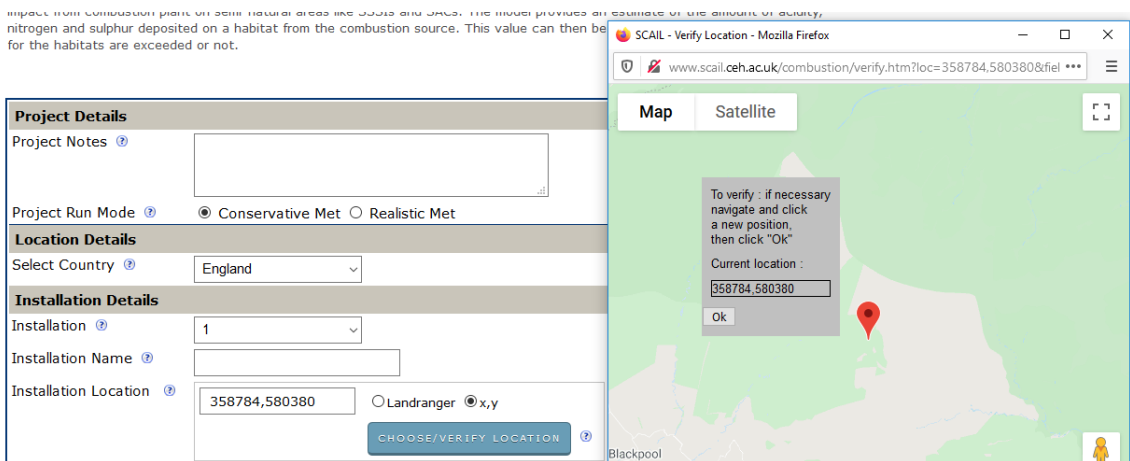


Figure 10: Verifying the location details after adding the location in the box



nitrogen and sulphur deposited on a habitat from the combustion source. This value can then be used to assess whether impact limits for the habitats are exceeded or not.

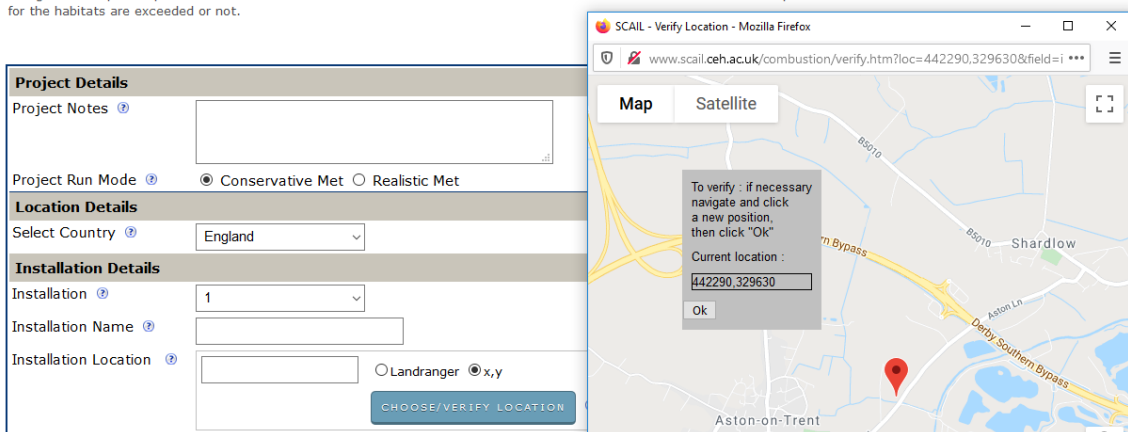


Figure 11: Choosing the location details by clicking on the map. Click 'OK' to confirm your location.

## 2.2.4 Source Details

Each Installation is made up of a number of discrete Sources representing component contributions on the farm from which pollutants are emitted. It should be noted that SCAIL-Agriculture groups all the contributing sources in an Installation and therefore you will not be able to tell how much contribution to the total concentration or deposition a particular source made. Where you require details of the specific contributions then simply create a separate Installation and put the source you want to specifically identify into this Installation (Installations can overlap each other).

The Source details section allows the specification of each Source at an Installation. Enter the details for each Source. If you want to use multiple Sources, fill in the details for one Source, then select **Add Source** from the **Source** drop-down and fill in the details for the additional Source. Sources can be removed using the red delete button (Figure 12). Up to 20 sources can be added.

For each Source, enter a Source name and a location. This process is identical to the specification of Installation location (see Installation details). Enter the relevant co-ordinates, then click on Verify location to open the map window allowing the source location to be confirmed or moved by clicking at a new location and clicking **“OK”** to confirm the new location (Figure 10: Verifying the location details after adding the location in the box).

If your application is for a new Installation or Source, select **'New'**. If you are including an existing Sources, select **'Existing'** (see Figure 9).

### User Options

Select Pig or Poultry depending on the livestock type you are assessing. At this point you are now ready to enter the data that will be used to calculate the emissions coming from the various agricultural Sources. SCAIL uses the same emission factors found in the IED application. There are three menus associated with Source type (Figure 12). Most of the time you will need to select all 3.

- The first select list shows the three main types of agricultural Sources: 1. Housing 2. Litter / Manure Storage 3. Land Spreading
- The second select menu will depend on what is selected in the first menu, but it will contain livestock types, storage or land spreading operations.
- Finally the third select menu gives further detail. The two input boxes are for inputting the number of livestock or area of housing or volume of slurry spread on fields.

For example, in Figure 8 the user has selected "Housing", "Layers" and "Cages deep pit". There are 16000 layers in the housing unit which has an area of 3475 m<sup>2</sup>. It should be noted that SCAIL-Agriculture includes buildings as cuboids. If housing is selected, you are prompted to specify the building height and select if the building is naturally ventilated. If the building is not naturally ventilated (i.e. it is ventilated by mechanical fans) then specify the location of the ventilation fans as either "Roof" or "Side of Building" using the "Fan Location" drop down. If you do not know the location of the ventilation fans or if there is a roughly even split between fans mounted on the roof and walls of the building then you should select "Side of Building". When "Roof" mounted fans are selected then you should specify the number of fans, the diameter of a typical exhaust and airflow of a typical fan (Figure 12). If any of information required for including "Roof" mounted fans is unknown then use the "Side of Building" option. Guidelines on the ventilation rates for typical livestock types can be found in Table 2-D of the SCAIL-Agriculture report.

**Source Details**

Source [?](#) 1

Source [?](#)  Pig  Poultry  Cattle  User defined emissions

New or Existing Source [?](#) New

Source Name [?](#) Shed 1

Source Location [?](#) Provides a link to GoogleMaps to check the location.  
 442290,329630  Landranger  x,y  
 [?](#)

Source Type [?](#) Housing

Type [?](#) Layers

Details [?](#) Cage with deep pit

Livestock Number [?](#) 16000

Housing Floor Area [?](#) 3475 m<sup>2</sup>

Naturally Vented

Building Height 5 m

Fan Location [?](#) Roof

No. of Fans (optional) [?](#) 3

Fan Diameter [?](#) 0.8 m

Fan Flowrate [?](#) 3.84 m<sup>3</sup>/s

Figure 12: Specifying Source details

If **housing** is selected, you are prompted to specify the building height and select if the building is naturally ventilated. If the building is not naturally ventilated (i.e. it is ventilated by mechanical fans) then specify the location of the ventilation fans as either "Roof" or "Side of Building" using the "Fan Location" drop down. If you do not know the location of the ventilation fans or if there is a roughly even split between fans mounted on the roof and walls of the building then you should select "Side of Building". When "Roof" mounted fans are selected then you should specify the number of fans, the diameter of a typical exhaust and airflow of a typical fan (Figure 13). If any of information required for including "Roof" mounted fans is unknown then use the "Side of Building" option. Guidelines on the ventilation rates for typical livestock types can be found in Table 2-D of the SCAIL-Agriculture report.



Figure 13: Specifying options for housing

Finally specify the Livestock number and the footprint area of the animal housing and the type of animal housed in the building (see Figure 14 for types available). As a guide, the animal welfare regulations (The Welfare of Farmed Animals (England) Regulations 2007) recommends minimum floor areas that must be provided for livestock.

Figure 14: Specifying animal types for housing – showing ‘Layers’ and ‘Sows’ as examples

The last input stage is to specify the housing regime for the animal (Figure 15), then click on the “Get Emission Values” button to populate the values from the database defaults according to the options selected and input values. User-specified values can be added and comments on the Source entered. Where any manual modification is made to the emission rates then suitable comments should be included to provide a record of any assumptions made.

Figure 15: Specify housing regime (right hand side)

For **manure storage**, enter the mass of manure and area of storage, then select the storage type (Figure 16). Now click on the “Get Emission Values” button and the emissions of ammonia, PM<sub>10</sub> and odour will be populated with values from the database defaults according to the options selected and input values. These values can be replaced by user-defined values if required, and a comment added about the values used.

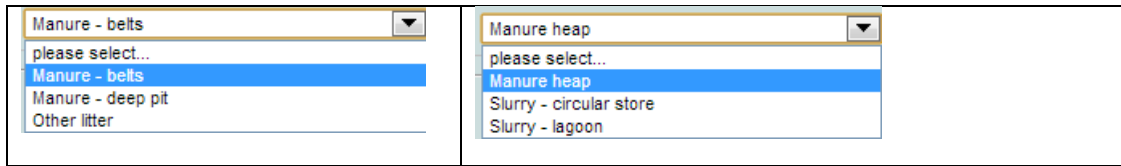


Figure 16: Specifying Litter/Manure storage parameters

Similarly, if **land spreading** is selected, enter the mass of manure to be spread, and the area over which it is spread and the number of applications per year. Select the type of application (Figure 17), the type of poultry where relevant (Figure 18), then Press the “Get Emission Values” button and the emissions of ammonia, PM<sub>10</sub> and odour will be populated with values from the database according to selections made. Again, user-specified values can be added and comments on the Source entered.

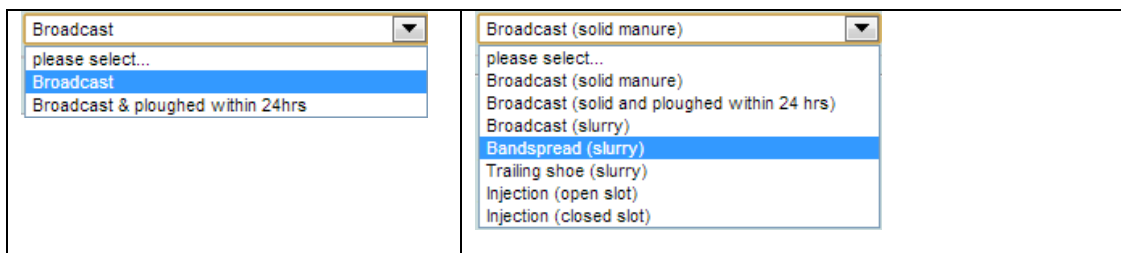


Figure 17: Specifying Land spreading parameters

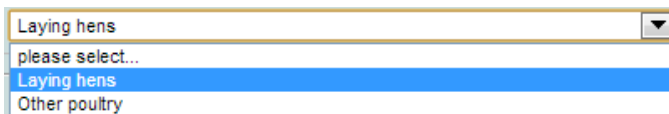


Figure 18: Specifying poultry type for land spreading selection

Complete the entry of all details for all Sources required

**TIP for modelling types of Sources not included in the tool**

SCAIL-Agriculture provides a flexible platform for modelling a multitude of Sources. The inclusion of Pig, Poultry and Cattle within the tool relates to the automated look-up of emissions data although the users of the tool are able to overwrite these values with their own emission calculations (suitable commentary should be added) using the ‘**User defined emissions**’ option. Likewise modelling of emissions from on-farm anaerobic digestion units could apply the point source modelling approximations to treat a range of types of emissions.

### 2.2.5 Entering designated site details

Enter the radius over which you would like an automated search of designated sites, then click on the “Run receptor search” button. It should be noted that this search will be centred on the location that was specified for Installation number 1. This searches on-line databases for designated sites within the specified radius from the Installation and produces a list of all sensitive designated sites found (Figure 19). This list shows the site name, the distance to the Installation and the designated sites. There is a default radius search but you can set your own radius – 5 to 10 km is about right.

Plant Capacity  Megawatt  Sulphurous  non-Sulphurous

**Designated Site details:**

Search Radius  km RUN RECEPTOR SEARCH ?

No. of Designated Sites 11 found VERIFY RECEPTOR LOCATIONS ?

Site No.	Name	Distance(km)	Designation	Country	Easting	Northing
1	Donington Park	2.325	SSSI	England	441776	327362
2	Boulton Moor	4.528	SSSI	England	438162	331491
3	Lockington Marshes	6.051	SSSI	England	448251	330669
4	Breedon Hill	6.382	SSSI	England	440533	323494
5	Pasture & Asplin Woods	7.649	SSSI	England	442940	322009
6	Breedon Cloud Wood & Quarry	7.853	SSSI	England	441558	321811
7	Dimmsdale	8.067	SSSI	England	437967	322818
8	Calke Park	8.211	SSSI	England	437126	323245
9	Ticknall Quarries	8.261	SSSI	England	436324	323915
10	Attenborough Gravel Pits	9.423	SSSI	England	450834	333601
11	Oakley Wood	9.482	SSSI	England	448245	322251

Figure 19: Receptor details within a specified distance of an Installation

Clicking on the Verify Receptor Locations button produces a map showing the Installation and identified receptor locations (Figure 20). Further information on the specific habits is provided by hovering the mouse over the blue “Receptors” pins; these show the closest edge of the identified habitats. The red “Receptor” pin shows the location of the first Installation that was added.

**Designated Site details:**

Search Radius  km RUN RECEPTOR SEARCH ?

No. of Designated Sites 14 found VERIFY RECEPTOR LOCATIONS ?

Site No.	Name	Distance(km)	Designation
1	Ellery Sike	1.868	SSSI
2	Kielder Mires	3.446	SSSI
3	Border Mires, Kielder - Butterburn	3.447	SAC
4	Oakshaw Ford	3.803	SSSI
5	Whitberry Burn	4.715	SSSI
6	Birky Cleugh	4.961	SSSI
7	Lyne Woods	5.175	SSSI
8	Caudbeck Flow	5.566	SSSI
9	Mollen Woods	6.421	SSSI
10	Kershope Bridge	6.952	SSSI
11	Kershope Bridge	6.952	SSSI
12	Spadeadam Mires	7.67	SSSI
13	Bolton Fell Moss	9.464	SAC
14	Bolton Fell Moss	9.761	SSSI

User specified site

Site Name

Site Location

Figure 20: Confirming Designated sites in relation to an Installation

## 2.2.6 User-specified Habitats

There is also the facility to add User-specified sites. This can be used where new sites may have arisen, for example, or where other semi-natural areas need assessing. Click on Add site, then enter a name and location for the site. You should also select the habitat type within the Receptor site (Figure 21).

User specified site: 1 ✖ Add site

Site Name: North Pennine Moors

Site Location: 400035,500035 ○ Landranger ○ x,y VERIFY LOCATION ?

Habitat within site: please select... CHECK BACKGROUND LEVELS ?

**Human Health Receptor**

Receptor: PM<sub>10</sub> percentile Annual Average ?

Receptor Name: Landranger ○ x,y VERIFY LOCATION ?

Receptor Location: CHECK BACKGROUND PM10 LEVELS ?

SAVE INPUT DATA CLEAR CALCULATE

Habitat Type List:

- please select...
- please select...
- Acid grassland
- Bogs
- Broadleaved, Mixed and Yew Woodland
- Calcareous grassland
- Coastal and Floodplain Grazing Marsh
- Coastal saltmarsh
- Coniferous woodland
- Dunes, Shingle & Machair
- Dwarf Shrub Heath
- Fen, Marsh and Swamp
- Hedgerows
- Inland Rock & Scree

Figure 21: Specifying habitat type for a user defined receptor

Confirm the site location using the map, then at this stage you can use the **Check Background Levels** button to check the background concentration and deposition levels for each pollutant at the habitat grid reference entered and then compare these levels with the Critical Load/Level of the selected Habitat Type (Figure 22). This information will open in a new window. More User-specified sites can be added in the same way and individual sites can be deleted by selecting the site, then pressing the red delete button next to the Add site button.

SCAIL Combustion - Background Levels - Mozilla Firefox

www.scaill.ceh.ac.uk/cgi-bin/combustion/background\_check.pl?habitat=

### Background Levels and Critical Loads

Region: England  
Gridreference: 400035,500035  
Habitat: Bogs

Concentrations/Depositions and Critical Loads	Conc NH3 (µg/m3)	N Dep. kg N/ha/yr	Acid Dep. kEq H+/ha/yr
Background concentration to habitat	0.73		
Background deposition to habitat		18.62	1.66
Critical Load / Level	1-3	5 - 15	0.75 [MaxN:0.75   MinN:0.32   MaxS:0.43]

**Concentrations/Depositions and Critical Loads**

	Conc NH3 (µg/m3)	N Dep. kg N/ha/yr	Acid Dep. kEq H+/ha/yr
Background concentration to habitat	0.6		
Background deposition to habitat		12.5	1.01
Critical Load / Level	1-3	5 - 15	1.0 • MaxN:1.0 • MaxS:0.79 • MinN:0.22

RUN RECEPTOR SEARCH ?  
VERIFY RECEPTOR LOCATIONS ?  
CHECK BACKGROUND LEVELS ?

Figure 22: Background levels at User-specified habitat sites.

## 2.2.7 Entering Human Receptor details

### Entering Human Receptor details:

There is also the facility to add User-specified Human Receptor sites. These are used to assess concentrations of PM<sub>10</sub> and odour. There are a number of statistics that are relevant for PM<sub>10</sub> exposure hence SCAIL Agriculture allows the user to specify either the 90<sup>th</sup> percentile, 98<sup>th</sup> percentile or annual average statistic, these are selected using the “PM<sub>10</sub> percentile” drop-down shown in Figure 19.

The method is very similar to the addition of user-specified habitat sites as described in the previous section. Click on **Add receptor**, then enter a name and location for the Receptor. Confirm the site location using the map, then at this stage you can use the **Check Background PM<sub>10</sub> Levels** button to check the background PM<sub>10</sub> concentration at the location read from APIS (**Error! Reference source not found.**). As before, more Human Receptor sites can be added in the same way and individual receptors can be deleted by selecting the receptor, then pressing the red delete button next to the **Add receptor** button. It should be noted that background concentrations for odour are not required in the assessment.

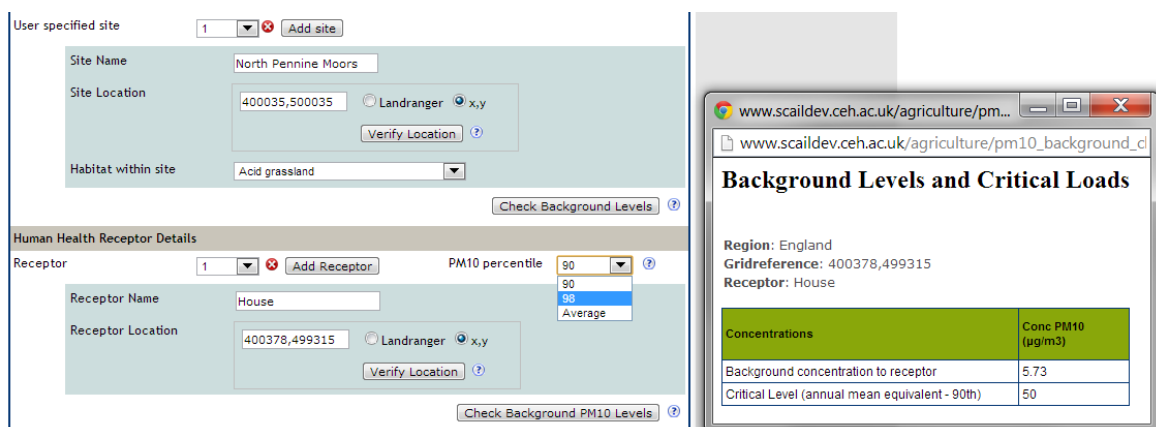


Figure 23: Checking PM<sub>10</sub> background at specified receptors and selecting the output statistic for PM<sub>10</sub> assessments.

## 2.2.8 Saving the input file

Use the **Save input data** button to save all the information entered on the form for this project (Figure 24 and Figure 25). This will enable the same scenario to be run again or modified without having to enter all the information again. A user-specified file can be saved (Figure 24) although this depends on the internet browser that you are using. This file should be renamed if you want to save multiple runs in the same folder. If you forget to save the input data at this stage, it can be saved from the results page after the model has run.

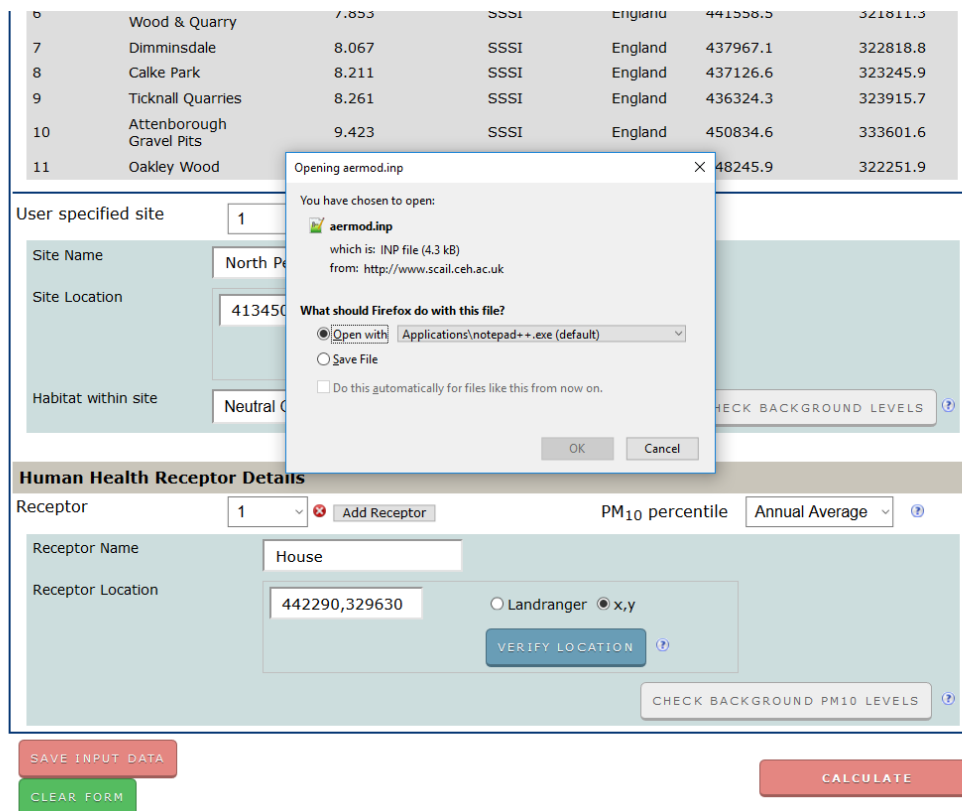


Figure 24: Specifying file name for saving input data (options depend on the browser that you are using).

### 2.2.9 Clearing the Form

If you want to clear the form, deleting all the Sources that have been set up, click on the **Clear Form** button (Figure 25). If the input data is required later, make sure you have saved the data first using the **Save Input Data** button.

### 2.2.10 Running the model

Before running the assessment tool you can add any additional information about the Assessment in the notes box. Save the input file if you wish to re-use the input data. Once you are happy that all the information has been correctly entered on the form, click the **Calculate** button to run the assessment (Figure 25).

11	Oakley Wood	9,482	SSSI	England	448245.9	322251.9
----	-------------	-------	------	---------	----------	----------

User specified site: 1

Site Name: North Penine Moors

Site Location: 413450,327251  Landranger  x,y

Habitat within site: Neutral Grassland

---

**Human Health Receptor Details**

Receptor: 1  PM<sub>10</sub> percentile: Annual Average

Receptor Name: House

Receptor Location: 442290,329630  Landranger  x,y

Figure 25: Buttons to run the model, Save the input data or clear the form or Calculate to run the model

A holding screen is displayed while the calculations are being undertaken (Figure 26).

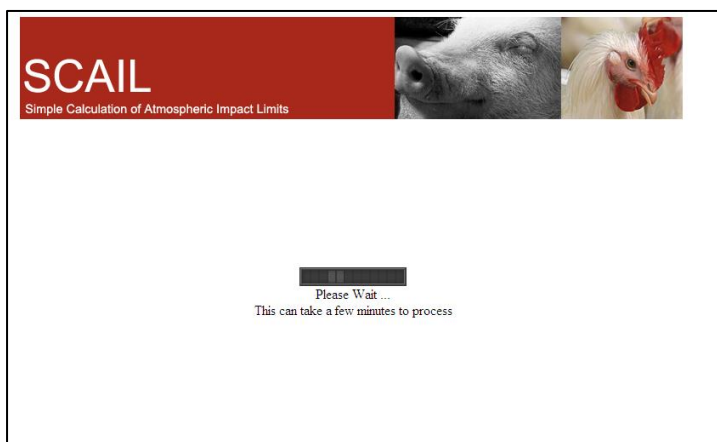


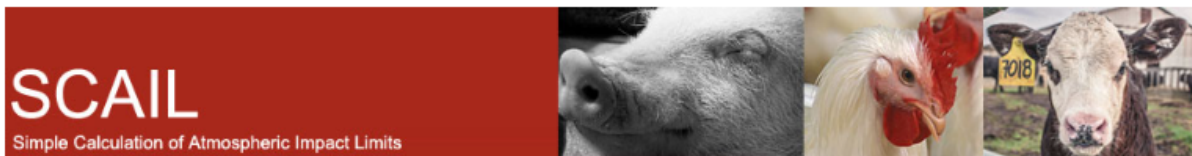
Figure 26: Holding screen while calculation is on-going

## 2.3 Interpreting the Results

Once the assessment has run, you will be presented with the results page. To display the results for different receptor site click the box in top left of the Results form (Figure 27). Help text can be accessed by clicking on the information icon ( ? ). Text relating to the application appears in the “Content Specific Help Text” box at the top of the screen as shown in Figure 18.

The output screen is split into:

- Site Information – information on the selected site (name, location, distance from Installation No. 1 etc.) as well as generic information on the model run (met. site, run mode and the PM<sub>10</sub> percentile that was applied).
- Installation Information – emissions, concentrations and deposition values subdivided by each Installation included in the assessment. This includes information on the total number of Sources included in each Installation and the number of Sources that were flagged as being “New” Staks.
- Total Deposition/ Concentrations and Exceedances – concentrations and deposition values totalled for all Installations included in the assessment. These can include information on the relevant Environmental Assessment Level or Critical Load/Level based on the pollutant and receptor type being modelled.



## Results

[Scail Home](#) | [User Guide](#) | [SCAIL-Agriculture Report](#) | [SEPA/EA/NIEA/EPA Contact Details](#) | [Online Tutorial](#)

Content Specific Help Text

Site Information: Kilby-Foxton Canal (SSSI) [dropdown menu]

Region: Kilby-Foxton Canal (SSSI) and  
 Site Name: Saddington Reservoir (SSSI) Foxton Canal  
 Site Code: Great Bowden Borrowpit (SSSI)  
 Leighfield Forest (SSSI)

Designation Status: SSSI  
 Distance from Installation (m): 3015  
 Receptor Type: Habitat  
 Grid Reference: 466212.1,294905.6  
 Met Site: COLE  
 Run Mode: Conservative  
 PM<sub>10</sub> Percentile: Average

Installation Information

No.	Name	No. of sources	No. of new sources	PM <sub>10</sub> (t/a)	NH <sub>3</sub> (t/a)	Odour (kOu/a)	Conc NH <sub>3</sub> (µg/m <sup>3</sup> )	Dep N (kg/ha/yr)	Dep Acid (kEq H+/ha/yr)	Conc PM <sub>10</sub> (µg/m <sup>3</sup> )	Conc Odour (Ou/m <sup>3</sup> )
1	East Farm	1	1	-	0.56	-	0.02	0.08	0.005	-	-

Total Depositions/Concentrations and Exceedances

Concentrations/Depositions and Critical Loads/Levels	NH <sub>3</sub> (µg/m <sup>3</sup> )	N Dep. (kg N/ha/yr)	Acid Dep. (kEq H+/ha/yr)	PM <sub>10</sub> (µg/m <sup>3</sup> )	Odour (Ou/m <sup>3</sup> )


Figure 27: Selecting different receptor sites to display

Results are displayed for NH<sub>3</sub>, Nitrogen deposition and acid deposition for habitats and PM<sub>10</sub> for human health receptors (Figure 28). A breakdown of the total concentration and deposition to the habitat is given together with the background concentration/deposition, based on the grid reference supplied for the habitat. An exceedance (total value – environmental standard) is then calculated and displayed as both a percentage and an absolute value.



The relevant regulatory authority should be contacted for advice regarding as to whether further detailed modelling will be required if one or more of the following threshold levels are met or exceeded (based on results produced using the Conservative Met run mode):

For more information on how to interpret the results please consult the relevant regulatory Guidance Document for the country that the assessment is being conducted.



**SCAIL**  
Simple Calculation of Atmospheric Impact Limits

### Results

Scail Home | User Guide | SCAIL-Agriculture Report | SEPA/EA/NIEA/EPA Contact Details | Online Tutorial

Content Specific Help Text

Site Information: Kilby-Foxton Canal (SSSI)

Region: England  
 Site Name: Kilby-Foxton Canal  
 Site Code: 2772  
 Designation Status: SSSI  
 Distance from Installation (m): 3015  
 Receptor Type: Habitat  
 Grid Reference: 466212.1,294905.6  
 Met Site: COLE  
 Run Mode: Conservative  
 PM<sub>10</sub> Percentile: Average

Installation Information

No.	Name	No. of sources	No. of new sources	PM <sub>10</sub> (t/a)	NH <sub>3</sub> (t/a)	Odour (kOUE)	Conc NH <sub>3</sub> (µg/m <sup>3</sup> )	Dep N (kg/ha/yr)	Dep Acid (kEq H+/ha/yr)	Conc PM <sub>10</sub> (µg/m <sup>3</sup> )	Conc Odour (OU/m <sup>3</sup> )
1	East Farm	1	1	-	0.56	-	0.02	0.08	0.005	-	-

Total Depositions/Concentrations and Exceedances

Concentrations/Depositions and Critical Loads/Levels	NH <sub>3</sub> (µg/m <sup>3</sup> )	N Dep. (kg N/ha/yr)	Acid Dep. (kEq H+/ha/yr)	PM <sub>10</sub> (µg/m <sup>3</sup> )	Odour (OU/m <sup>3</sup> )
Process Contribution (PC) at receptor edge	0.01557	0.08	0.005	-	-
Background concentration at receptor edge	2.90	26.18	2.03 (N:1.67)(S:0.16)	-	-
<b>Predicted Environmental Concentration/Deposition (PEC)</b>	2.92	26.26	2.03	-	-
Environmental Assessment Level or Critical Load / Level	Lower: 1 Upper: 3	Standing open water not inc oligotrophic types	Standing open water not inc oligotrophic types	-	-
ALTERNATIVE CRITICAL LOAD INFO					
USE OWN THRESHOLDS?					
% of relevant standard PC	Lower: 2% Upper: 1%	n/a	n/a	-	-
% of relevant standard PEC	Lower: 292% Upper: 97%	n/a	n/a	-	-
<b>EXCEEDANCE</b>	Lower: 1.92	n/a	n/a	-	-

Figure 28: results page (displayed Critical Load values are examples only)

### 2.3.1 Options after running the model

At the bottom of the results page are several options (Figure 29). The **Save Results** button will save the output data in CSV (comma separated variables) format, which can be opened in Microsoft Excel.

The **Save Inputs** button can be used to save the input data for this model run if it was not saved on the input form before running the model.

You can return to the Input Page by clicking on the **Back Page** button at the bottom of the page.

**If you use your browser's Back button to go back to the input page, you may lose the input data you filled out on the form.**

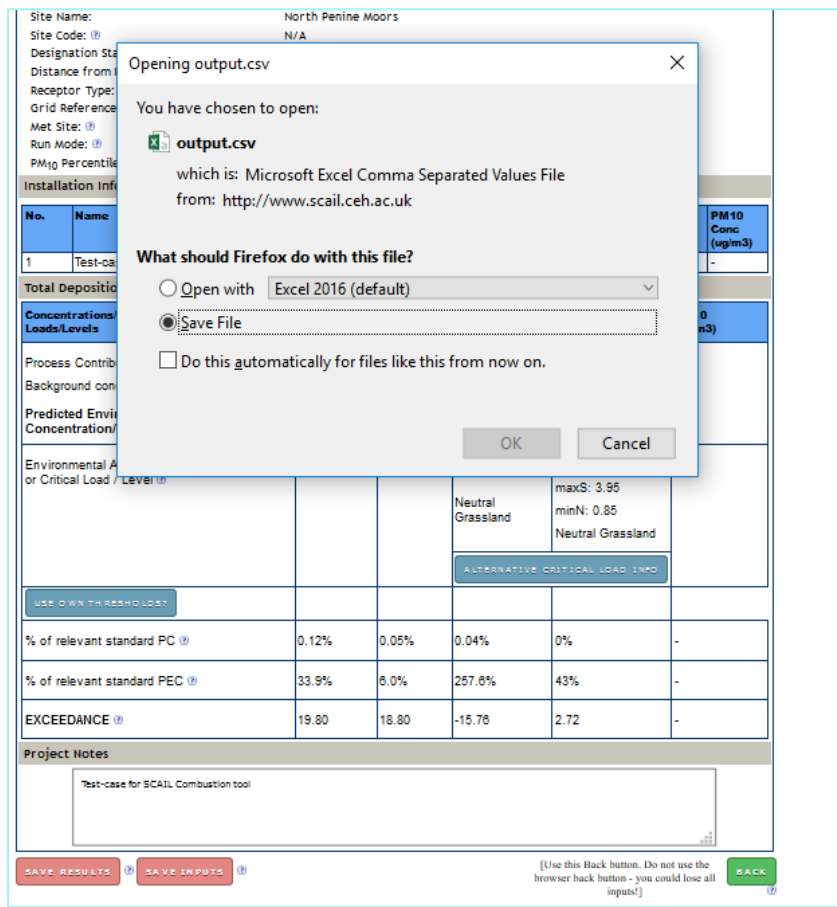


Figure 29: Foot of page showing Save Results as an .csv file, Save Inputs and Back buttons

## Appendix 1 : Typical Meteorological Year Wind Roses

**Table A1.1: Details of meteorological sites included in SCAIL-Agriculture**

Station	Station Elevation (m)	Wind Direction (degrees)	Name (Short)	Station X Coordinate (m)	Station Y Coordinate (m)
Aviemore	228	210	AVIE	289652	814315
Boulmer	23	250	BOUL	425300	614200
Cardiff Weather Centre	52	230	CARD	318200	176100
Church Fenton	8	270	CHUR	452818	438027
Coleshill	96	200	COLE	421090	286940
Crosby	9	150	CROS	329940	400570
Edinburgh Gogarbank	57	250	EDIN	316100	671400
Eskdalemuir	242	190	ESKD	323500	602600
Glasgow Bishopton	59	210	GLAS	241788	671073
Heathrow	25	210	HEAT	507700	176700
Islay Port Ellen	17	140	ISLA	132900	651300
Isle of Portland	52	250	ISLE	367798	69251
Lerwick	82	170	LERW	445392	1139660
Leuchars	10	260	LEUC	346800	720900
Lossiemouth	6	250	LOSS	321249	869822
Lyneham	145	210	LYNE	400629	178255
Mumbles Head	32	270	MUMB	262700	187000
Plymouth	50	90	PLYM	249219	52714
Skye Lusa	18	210	SKYE	170593	824888
Spadeadam No.2	285	250	SPAD	364700	573000
Stornoway Airport	15	190	STOR	146443	933104

Valley	10	210	VALL	230885	375849
Dyce	62	170	DYCE	387810	812800
Prestwick RNAS	10	250	PRES	236902	627653
Tiree	10	190	TIRE	99900	744600
Wick	30	150	WICK	336490	952230
Bristol Filton	59	250	BRIS	360057	180491
Camborne	87	230	CAMO	164123	40307
Gatwick Charlwood	67	230	GATW	527047	140598
Marham Kent	21	220	MARH	573608	308938
Newcastle Albemarle	142	270	NEWA	407700	569500
Peterborough Wittering	73	250	PETE	504288	302621
Shoeburyness	2	230	SHOE	596079	187772
Walney Island	15	310	WALN	319209	465529
Abercynon	80	320	ABEC	308350	195270
Aberystwyth	50	190	ABEY	259800	281270
Bridgend	20	280	BRID	292214	179019
Buckley	140	240	BUCK	329113	364738
Cardiff Bute Park	10	270	CAMP	317684	177235
Lake Vyrnwy	300	230	LAKE	301541	318810
Llandrinod Wells	210	210	LLAN	306000	261500
Milford Haven	50	250	MILF	193600	205000
Mona	62	210	MONA	242137	374057
Newcastle Emlyn	30	100	NEWE	230770	240830
Newport	10	250	NEWP	333165	186070
Newtown	110	260	NEWT	311673	291730

Rhyl	5	160	RHYL	302373	379405
Sennybridge No.2	307	240	SENN	289406	241777
Swansea	150	240	SWAC	263200	193900
Swansea Valley	60	230	SWAV	276200	207900
Immingham / Humber Estuary	2	210	IMMI	512393	431263
Leeds / Bradford (not Bingley)	210	270	LEED	426501	448082
Manchester City Centre	69	190	MANC	381494	384371
Liverpool John Lennon Airport	22	280	LIVE	343790	381965
Southampton (Solent)	11	230	SOUT	445001	116734
Brighton / Eastbourne	2	230	BRIG	520373	105397
London Weather Centre	32	230	LOND	544114	182251
Cambridge / Stansted Airport	101	220	CAMB	553215	222553
Sheffield	267	280	SHEF	434033	387260
St Bees Head	125	170	STBE	295654	514798
Stoke-on-Trent	118	330	STOK	387349	346027
Teesside	26	220	TEES	456874	521933
Aldergrove Int. Airport	63	220	ALDE	127638	538057
Belfast harbour no2	4	210	BELF	149713	531340
Dungannon / Omagh	152	270	DUNG	82885	527376
Lurgan	19	190	LURG	117627	516265
Crocknacrieve / Thomastown	62	160	CROC	36427	507111

West Tyrone	118	130	WEST	50840	542360
County Down	4	280	COUN	149322	505376
Derry airport	20	220	DERR	70916	584426
Ballymena / Ballymoney 2	64	180	BALL	113637	569865
Charterhall	112	220	CHAR	376031	646239
Drumalbin	245	210	DRUM	290853	638412
Dundrennan	113	70	DUND	271089	547194
Strathallan	35	230	STRA	293300	716186
Carlisle	33	250	CRLS	339136	560271
Tees-side	34	190	TEER	437758	513656
High Bentham / Kirkby Lonsdale	81	120	HIGH	363600	473699
Leconfield	7	270	LECO	503008	442321
Northwich	65	230	NORT	362400	348799
Waddington	68	230	WADD	499151	364342
Bingham / Grantham	27	220	BING	479000	339999
Shawbury RAF	72	250	SHAW	355058	322738
Norwich Weather Centre	41	230	NORW	624700	296799
Newcastle On Clun	120	180	NEWC	338930	273939
Madley	78	190	MADL	341697	237600
Upper Heyford RAF	126	210	UPPE	451559	226404
Close to Colchester	66	240	COLC	600700	266499
Middle Wallop	90	220	MIDL	430306	139118
Yeovil	20	210	YEOV	354998	123196

Nr Great Torrington and Burrington	197	210	TORR	260650	116809
Belmullet	9	220	BELM	-121393	510967
Casement	91	220	CASE	104385	387928
Cork	155	230	CORK	-46478	236429
Dublin	71	250	DUBL	118380	400712
Knock	201	210	KNOC	-47461	467110
Mullingar	101	220	MULL	44861	417894
Shannon	15	120	SHAN	-67279	332843
Valentia	24	270	VALE	-165987	258840
Athenry	40	260	ATHE	-51946	398415
Ballyhaise	78	220	BALH	52621	474765
Carlow Oakpark	78	170	CARO	69273	340616
Claremorris	68	210	CLAR	-61176	446597
Dunsany	83	250	DUNS	91193	412238
Fermoy Moore park	46	290	FERM	-28151	270257
Gurteen	75	200	GURT	-2623	365536
Mount Dillon	39	200	MOUN	5699	442238
Ballycanew	32	230	BALC	106285	310207
Castledockerell	5	210	CAST	88409	306854



INVESTORS  
IN PEOPLE



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