

Guidance for Farmers in Nitrate Vulnerable Zones

Standard values, manure sampling protocol and glossary

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The guidance in this series of leaflets is designed to help farmers be compliant with The Nitrate Pollution Prevention Regulations 2008 (SI2349 September 2008). The guidance has been produced in association with the Environment Agency, who is responsible for assessing farmers' compliance with these Regulations.

This Leaflet contains standard values, taken from the Nitrate Pollution Prevention Regulations 2008, and other information that you will need to use to comply with the NVZ rules. This information is presented in the following four Sections:

Section 1 – Standard values needed to calculate your manure storage capacity requirements and compliance with the livestock manure N farm limit

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1. Standard values needed to calculate your manure storage capacity requirements and compliance with the livestock manure N farm limit

The standard values in Tables 1 – 4 are calculated from the daily values given in Schedule 1 of the Regulations. You must use these values to calculate:

- your required manure storage capacity (see Leaflet 4), and
- your compliance with the livestock manure N farm limit (see Leaflet 5).

In the case of permanently housed pigs and poultry, you may use alternative approaches (i.e. ENCASH or sampling and analysis) to derive alternatives to the “Total N produced by livestock” figures in Tables 2 and 3 below.

The Tables also provide figures for the number of animals per hectare that will supply the livestock manure N farm limit of 170 kg N/ha/yr. These figures are to be used as a guide only and to provide a rough indication of how close your farm is to the limit given the number of livestock on your farm.

The figures provided in Tables 2 and 3 are based on an assumed level of occupancy by livestock. If the occupancy on your farm is different to the occupancy values shown in the tables, you should adjust the values of total N produced and volume of excreta using the following equation:

$$\text{Actual total N produced/excreta} = \text{Standard value (from table)} \times \frac{\text{Actual occupancy}}{\text{Standard occupancy}}$$

Table 1: Nitrogen and excreta production from cattle

Cattle	Total N produced¹ by cattle (kg/year)	Volume of excreta per animal (m³/month)	Animal number per ha to comply with maximum N loading (170 kg/ha N per year)
1 calf (all categories) up to 3 months	8	0.21	21.2
1 dairy cow from 3 months and less than 13 months	35	0.60	4.9
1 dairy cow from 13 months up to first calf	61	1.20	2.8
1 dairy cow after first calf (over 9000 litres milk yield)	115	1.92	1.5
1 dairy cow after first calf (6000 to 9000 litres milk yield)	101	1.59	1.7
1 dairy cow after first calf (up to 6000 litres milk yield)	77	1.26	2.2
1 beef cow or steer (castrated male) from 3 months and less than 13 months	33	0.60	5.1
1 beef cow or steer from 13 months and less than 25 months	50	0.78	3.4
1 female or steer for slaughter 25 months and over	50	0.96	3.4
1 female for breeding 25 months and over weighing up to 500 kg	61	0.96	2.8
1 female for breeding 25 months and over weighing over 500 kg	83	1.35	2.0
1 non-breeding bull 3 months and over	54	0.78	3.1
1 bull for breeding from 3 to 25 months	50	0.78	3.4
1 bull for breeding 25 months and over	48	0.78	3.5

¹ Includes an allowance for N losses from livestock housing and manure storage.

Table 2: Nitrogen and excreta production from pigs

Pigs	Occupancy (%)	Total N produced by pigs ¹ (kg/year)	Volume of excreta per pig (m ³ /month)	Animal places per ha to comply with maximum N loading (170 kg/ha N per year)
1 weaner place, 7 to 13 kg	71	1.0	0.03	170
1 weaner place, 13 to 31 kg	82	4.2	0.05	40.5
1 grower place, 31 to 66 kg (dry fed)	88	7.7	0.10	22.1
1 grower place, 31 to 66 kg (liquid fed)	88	7.7	0.18	22.1
1 finisher place, 66 kg and over (dry fed)	86	10.6	0.13	16.0
1 finisher place, 66 kg and over (liquid fed)	86	10.6	0.26	16.0
1 maiden gilt place, 66 kg and over	80	11.1	0.13	15.3
1 sow place, 66 kg and over, with litter, up to 7 kg, fed on diet supplement with synthetic amino acids	100	16.0	0.33	10.6
1 sow place, 66 kg and over, with litter, up to 7 kg, fed on diet without synthetic amino acids (low protein diet)	100	18.0	0.33	9.4
1 breeding boar from 66 kg to 150 kg	100	12.0	0.15	14.2
1 breeding boar, 150 kg and over	100	17.5	0.26	9.7

Table 3: Nitrogen and excreta production from poultry

Poultry	Occupancy (%)	Total N produced by birds ² (kg/year)	Weight of excreta by birds (tonnes/month)	Animal places per ha to comply with maximum N loading (170 kg/ha N per year)
1000 replacement layer pullet places, up to 17 weeks	89	210	1.2	800
1000 laying hens in cages, 17 weeks and over	97	400	3.6	420
1000 laying hen places, free range ¹ , 17 weeks and over	97	530	2.9	320
1000 broiler places	85	330	1.8	510
1000 replacement broiler breeder pullet places, up to 25 weeks	92	290	1.2	590
1000 broiler breeder places, 25 weeks and over	95	700	3.6	240
1000 turkey places (male)	90	1,230	4.8	140
1000 turkey places (female)	88	910	3.6	190
1000 duck places	83	750	12.0	230
1 ostrich	100	1.4	N/A	121

1 N produced in excreta is per pig place and includes an allowance for N losses from livestock housing and manure storage.

2 N produced in excreta is per poultry place and includes an allowance for N losses from livestock housing and manure storage.

Table 4: Nitrogen and excreta production from sheep, goats, deer and horses

Livestock type	Total N produced by 1 livestock type ² (kg/year)	Volume of excreta per livestock type (m ³ /month)	Animal number per ha to comply with maximum N loading (170 kg/ha N per year)
1 lamb, 6 to 9 months	2.0	0.05	85.0
1 lamb, 9 months and over, to first lambing, first tugging or slaughter	1.4	0.05	121.4
1 sheep, less than 60kg, after lambing or tugging. For ewes this includes one or more suckled lambs up to 6 months	7.6	0.12	22.4
1 sheep, over 60kg, after lambing or tugging. For ewes this includes one or more suckled lambs up to 6 months	11.9	0.12	14.3
1 goat	15.0	0.1	11.3
1 deer for breeding	15.2	0.15	11.2
1 deer, other	12.0	0.11	14.2
1 horse	21.0	0.74	8.1

² Includes an allowance for N losses from livestock housing and manure storage.

2. Information relating to crop nitrogen requirement

Part 4 of the Regulations establishes a limit on the amount of nitrogen (from manufactured nitrogen fertiliser and crop available nitrogen from livestock manures) that can be applied to specified crops (see Leaflet 7). The N max limits for the specified crops are provided in Table 5 below, together with a range of permitted adjustments to the limits.

Part 6 of the Regulations establishes a closed period for manufactured nitrogen fertiliser, although applications are permitted to some crops which have a crop nitrogen requirement during this closed period (see Leaflet 9). These crops are listed in Table 6 together with their maximum permissible application rates.

Table 5: The N max limits

Crop	N max limit (kg N/ha) (note a)	Standard crop yield (t/ha)
Wheat, autumn or early winter sown	220 (notes b, c, d)	8.0
Wheat, spring sown	180 (notes c, d)	7.0
Barley, winter	180 (notes b, c)	6.5
Barley, spring	150 (note c)	5.5
Oilseed rape, winter	250 (notes e)	3.5
Sugar beet	120	n/a
Potatoes	270	n/a
Forage maize	150	n/a
Field beans	0	n/a
Peas	0	n/a
Grass	330 (note f)	n/a

Notes:

- (a) An additional 80 kg N/ha is permitted to all crops grown in fields where the previous or current crop received an application of straw for mulching or paper sludge.
- (b) An additional 20 kg N/ha is permitted on fields with a shallow soil type (not shallow soils over sandstone).
- (c) An additional 20 kg N/ha is permitted for every tonne that the expected yield exceeds the standard yield.
- (d) An additional 40 kg N/ha is permitted to milling wheat varieties.
- (e) This consists of a maximum autumn application of 30 kg N/ha (allowed as an exemption to the closed period for manufactured nitrogen fertiliser) and a maximum spring application of 220 kg N/ha. The spring application can be increased by up to 30 kg N/ha for every half tonne that the expected yield exceeds the standard yield.
- (f) An additional 40 kg N/ha is permitted to grass that is cut at least 3 times in a year. From 1st January 2012, the N max rate for grass drops to 300 kg N/ha.

Table 6: Crops to which manufactured nitrogen fertiliser may be applied during the closed spreading period

Crop	Maximum nitrogen rate (kg/ha)
Oilseed rape, winter (note a)	30
Asparagus	50
Brassica (note b)	100
Bulb onions	40
Over-wintered salad onions	40
Parsley	40
Grass (notes a, c)	80

Notes:

- (a) Nitrogen must not be applied to these crops after 31 October.
- (b) An additional 50 kg N/ha may be applied every four weeks during the closed spreading period up to the date of harvest.
- (c) A maximum of 40 kg N/ha may be applied at any one time.

3. Standard values and information needed to determine the nitrogen content of organic manures

The following rules require that you know the 'total' and/or 'crop available' nitrogen contents of organic manures:

- The livestock manure N farm limit (see Leaflet 5)
- The organic manure N field limit (see Leaflet 8)
- The N max limit (see Leaflet 7)

You can use either the standard values provided in Table 7 or manure sampling and analysis (see the 'Protocol') to determine the total nitrogen content of organic manures. Table 8 must be used when calculating 'crop available N' from any livestock manure applications when assessing your compliance with the N max limit.

Table 7 also provides a figure for the maximum application rate that would supply the maximum amount of total N permitted under the organic manure N field limit (i.e. 250 kg N/ha/yr). To note: these figures are provided for guidance only and you should determine a suitable application rate for your specific circumstances.

Table 7: The total N content of organic manures and maximum application rates to supply 250 kg N/ha of total nitrogen

Manure type	Total N content kg/m ³ or kg/t	The maximum application rate to supply 250 kg N/ha	
		Metric Units	Imperial Units
Solid manure			
Cattle farmyard manure	6.0	42 tonnes/ha	17 tons/acre
Pig farmyard manure	7.0	36 tonnes/ha	14.5 tons/acre
Sheep farmyard manure	6.0	42 tonnes/ha	17 tons/acre
Duck farmyard manure	6.5	38 tonnes/ha	15 tons/acre
Poultry layer manure	16	16 tonnes/ha	6.5 tons/acre
Poultry broiler litter	30	8 tonnes/ha	3.2 tons/acre
Turkey litter	30	8 tonnes/ha	3.2 tons/acre
Slurry			
Dairy cattle	3.0	83 m ³ / ha	7,400 gallons/acre
Beef cattle	2.0	125 m ³ / ha	11,200 gallons/acre
Pigs	4.0	63 m ³ / ha	5,600 gallons/acre
Separated manures			
Separated cattle slurry, liquid fraction, strainer box	1.5	167 m ³ / ha	14,900 gallons/acre
Separated cattle slurry, liquid fraction, weeping-wall	2.0	125 m ³ / ha	11,200 gallons/acre
Separated cattle slurry, liquid fraction, mechanically separated	3.0	83 m ³ / ha	7,400 gallons/acre
Separated cattle slurry, solid fraction	4.0	63 m ³ / ha	5,600 gallons/acre
Separated pig slurry, liquid fraction	3.6	70 m ³ / ha	6,300 gallons/acre
Separated pig slurry, solid fraction	5.0	50 m ³ / ha	4,500 gallons/acre

Table 8: The percentage of the total nitrogen content of livestock manures that is available for crop uptake

Manure type	Crop available N (% of total N applied) until 1st January 2012	Crop available N (% of total N applied) from 1st January 2012
Cattle slurry	20	35
Pig slurry	25	45
Poultry manure	20	30
Other livestock manures	10	10

Protocol: The standard methodology for sampling slurry and solid manure for analysis

For slurry

At least five sub-samples, each of 2 litres, must be taken.

- The sub-sample must be taken from a slurry vessel, and;
 - if reasonably practicable, the slurry must be thoroughly mixed before the sub-samples are taken, and
 - each sub-sample must be taken from a different location.
- But if a tanker used for spreading is fitted with a suitable valve, the sub-samples may be taken while spreading, and each sub-sample must be taken at intervals during the spreading.
- The sub-samples must be poured into a larger container, stirred thoroughly and a 2 litre sample must be taken from that container and poured into a smaller clean container to provide the sample for analysis.

For solid manures

The samples must be taken from a manure heap.

- At least ten sub-samples of 1kg each must be taken, each from a different location in a heap.
- Each sub-sample must be taken at least 0.5 metres from the surface of the heap.
- If sub-samples are being collected to calculate compliance with the whole farm limit for pigs and poultry, four samples for analysis must be taken in a calendar year (one taken in each quarter) from manure heaps not more than 12 months old.
- The sub-samples must be placed on a clean, dry tray or sheet.
- Any lumps must be broken up and the sub-samples must be thoroughly mixed.
- A representative sample of at least 2kg must then be sent for analysis.

4. Glossary of terms used in this Guidance

All other soils	means all soils which are not sandy or shallow.
Crop	any vegetation which is grown for agricultural profit or benefit, including grains, vegetables and fruit, grass and forage, horticulture and bulbs grown in open fields. It does not include protected crops grown under glass or crops under poly-tunnels.
Crop available nitrogen	the total nitrogen content of organic manure that is available for crop uptake in the growing season in which it is spread on land.
Dirty water	lightly contaminated run-off from lightly fouled concrete yards or from the dairy/parlour that is collected separately from slurry. It does not include liquids from weeping-wall stores, strainer boxes, slurry separators or silage effluent which are rich in nitrogen and regarded as slurries.
Farm	an area or areas of land and its buildings, which is used for the growing of crops or rearing of livestock, and includes livestock units and any outlying fields all of which form part of an individual farm business.
Farmyard manure (FYM)	livestock excreta that is mixed with straw bedding material, that can be stacked in a freestanding heap without slumping. See also 'temporary field heap'.
Grassland	land on which the vegetation consists predominantly of grass species.
High readily available N content	more than 30 per cent of the total N content of the organic manure is present in molecular forms that can be immediately taken up by the plant, or is released in the year in which it is applied to land. Examples include cattle and pig slurry, most poultry manure, and liquid digested sludge.
Incorporation	a technique that achieves some mixing between the organic manure and the soil.
Land drain	a permanent drain installed below the surface of the ground that is effective in removing surplus water away from field soils. It does not include sealed, impermeable pipes.
Livestock	Means any animal (including poultry) in Schedule 1 of the Nitrate Pollution Prevention Regulations 2008, and includes pigs, cattle, sheep, goats, deer, horses and poultry.
Livestock manure N farm limit	a limit to the average loading of the total amount of nitrogen (N) in livestock manure across the area of a holding.
Low readily available N content	less than 30 per cent of the total N content of the organic manure is present in molecular forms that can be immediately taken up by the plant, or is released in the year in which it is applied to land. Examples include straw based cattle and pig manure.

<i>Low run-off risk land</i>	land that has an average slope less than 3 degrees, does not have land drains (other than a sealed impermeable pipe), and is at least 50 metres from a watercourse or conduit leading to a watercourse.
<i>Manufactured nitrogen fertiliser</i>	any nitrogen fertiliser (other than organic manure) which is manufactured by an industrial process.
<i>Manure N availability</i>	the percentage of the total nitrogen content of organic manure that is available for crop uptake in the growing season in which it is spread on land.
<i>Nitrogen fertiliser</i>	any substance containing one or more nitrogen compounds or nitrogen compounds used on land to enhance growth of vegetation and includes organic manures (see Figure 2 of Leaflet 2).
<i>Nitrate vulnerable zone (NVZ)</i>	an area of land designated in accordance with Regulation 7 of the Regulations.
<i>Organic manure</i>	any nitrogen fertiliser derived from animal, human or plant sources, including livestock manure.
<i>Organic manure N field limit</i>	an annual upper limit of 250kg/ha for nitrogen from all livestock manures and all other organic materials applied to each field. It does not include manures deposited by grazing animals.
<i>Organic producer</i>	a producer with all the land on a holding that is listed on a valid certificate of organic registration issued by an Organic Inspection Body approved by the Advisory Committee on organic Standards.
<i>Other nitrogen-containing materials</i>	any substance containing nitrogen that is neither a manufactured nitrogen fertiliser nor an organic manure e.g. dredgings.
<i>Poultry litter</i>	a mixture of bedding material and poultry excreta which is sufficiently dry to be stored in a stack without slumping.
<i>Poultry manure</i>	excreta produced by poultry, including bedding material that is mixed with the excreta, but excluding duck manure with a readily available N content of 30 per cent or less.
<i>Readily available nitrogen</i>	the amount of nitrogen in organic manure that is present in molecular forms that can be immediately taken up by plants.
<i>Sandy soil</i>	soil over sandstone, and any other soil where – (a) in the layer up to 40 cm deep, there are – (i) more than 50 per cent by weight of sand-sized particles (particles from 0.06 to 2 mm diameter), and (ii) less than 18 per cent by weight of clay-sized particles (particles less than 0.02 mm diameter), and (iii) less than 5 per cent by weight of organic carbon, and

- (b)** in the layer from 40 to 80 cm depth, there are –
- (i) more than 70 per cent by weight of sand-sized particles (particles from 0.06 to 2 mm diameter), and
 - (ii) less than 15 percent by weight of clay-sized particles (particles less than 0.02 mm diameter), and
 - (iii) less than 5 per cent by weight of organic carbon.

Shallow soil

soil which is less than 40 cm deep.

Slurry

excreta produced by livestock (other than poultry) while in a yard or building, (including any bedding, rainwater and washings mixed with it), that has a consistency that allows it to be pumped or discharged by gravity. The liquid fraction of separated slurry is also defined as slurry.

Soil nitrogen supply (SNS)

the amount of nitrogen (kg N/ha) in the soil that becomes available for uptake by the crop in the growing season, taking account of nitrogen losses.

Solid livestock manure

includes poultry manures (litter-based manures e.g. from broilers; and neat excreta e.g. from caged laying hens) and stackable farmyard manure (FYM) e.g. straw-based cattle and pig manure and any stackable separated fibre from the mechanical separation of slurry. See also 'temporary field heap'.

Solid manure

organic manure which can be stacked in a freestanding heap without slumping. See also 'temporary field heap'.

Spreading

includes application to the surface of the land, injection into the land or mixing with the surface layers of the land but does not include the direct deposition of excreta on to the land by animals.

Spring sown crop

any crop which is sown after 1 January and before 31 July in any year.

Standard values

values for use within mandatory calculations.

Surface water

includes coastal waters, estuaries, canals, lakes, ponds, rivers, streams and ditches which contain free water and also temporarily dry ditches and blind ditches.

Temporary field heap

Farmyard manure or solid manure that does not give rise to free drainage of liquid from within the stacked material which is stored temporarily for up to 12 months on a field site.

Tillage land

land that is not being used for grass production and is sown with a crop.

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