

ENVIRONMENTAL PROTECTION AGENCY

BATNEEC GUIDANCE NOTE

Class 7.1

***MANUFACTURE OF VEGETABLE &
ANIMAL OILS AND FATS***

(DRAFT 3)

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1. INTRODUCTION

This Guidance Note is one of a series issued by the Environmental Protection Agency and is designed to provide guidance to those applying for integrated pollution control licences under the EPA Act. It should also be read in conjunction with *Application Guidance Notes*, available under separate cover.

It should be noted at the outset, that noise is not included within the scope of this work and guidance on this parameter has been issued separately.

This Guidance Note is comprised of seven main sections and an appendix. Following this introduction, Section 2 contains a general note on the interpretation of BATNEEC. The industrial activity covered by the terms of this note is given in Section 3. In Section 4, the technologies to control emissions are tabulated and in Section 5 the specific emission limit values (ELVs) are given. Section 6 contains comments on compliance monitoring requirements, while the principal references are given in Section 7.

The Appendix gives the main sources of emissions, and the principal releases from such sources.

All applicants for Integrated Pollution Control licences, in the sector covered by this note, should carefully examine the information laid down in this Guidance Note, and should use this information to assist in the making of a satisfactory application for an Integrated Pollution Control licence to the Agency. It should be clearly understood that achieving the emission limit values does not, by itself, meet the overall requirements in relation to I.P.C. In addition to meeting such values the applicant will also be required to demonstrate that waste minimisation is a priority objective and to put in place particular abatement measures to reduce overall mass emissions and pollutant load where this is necessary to protect the ambient environment.

The technologies and the associated emission limit values (ELVs) identified in this Guidance Note are, at the time of writing, regarded as representing BATNEEC for new activities. BATNEEC is not a static quality and will change as technologies, environmental factors and costs alter with the passage of time. The Agency may amend or update the guidance contained in this note should such amendments seem appropriate. The information contained in this Guidance Note is intended to be used only as a tool to assist in determining the BATNEEC for an operation in this sector and should not be taken to be a definitive authority on the BATNEEC for this sector. This Note should not be considered as a legal document.

2. INTERPRETATION OF BATNEEC

BATNEEC means '*the best available technology not entailing excessive costs*'. The technology in question should be **Best** at preventing pollution and **Available** in the sense that it is procurable by any person. **Technology** itself is taken as the techniques and the use of the techniques, including training and maintenance etc.

NEEC addresses the balance between environmental benefit and financial expense.

The objective of the Best Available Technology Not Entailing Excessive Costs (BATNEEC) Guidelines is to provide a list of technologies that will be used by the EPA to determine BATNEEC for a scheduled activity. The BATNEEC identified in this guideline is used as a basis for setting emission limit values. This BATNEEC Guidance Note addresses the technology of the manufacture of oils and fats only. It is intended to update these Guidelines as required in order to incorporate technology advances as they occur.

In the identification of BATNEEC, emphasis is placed on pollution prevention techniques, including cleaner technologies and waste minimisation, rather than end-of-pipe treatment.

Technologies identified in the BATNEEC guidelines are considered to be the current best practice for the purposes of setting emission limit values. These technologies are representative of a wide range of currently employed technologies appropriate to particular circumstances. The entire range would not necessarily be appropriate in specific cases. The specific choice depends on a wide range of circumstances but the crucial factor is that the selected regime achieves BATNEEC. In applying BATNEEC, Environmental Quality Objectives (EQO's) must be respected where set. Measures such as in-plant changes, raw material substitution, process recycling and improved material handling and storage practices, may also be employed to effect reductions in emissions. As well as providing for the installation of equipment, and the operation of procedures for the reduction of possible emissions, BATNEEC will also necessitate the adoption of an on-going programme of environmental management and control, which will focus on continuing improvements aimed at prevention, elimination and/or progressive reduction of emissions.

As described in the EPA Act of 1992, BATNEEC will be used to prevent, eliminate or where that is not practicable, limit, abate, or reduce an emission from an activity which is listed in the first schedule of the Act. The use of BATNEEC is construed in the Act to mean the provision and proper maintenance, operation, use and supervision of facilities which are the most suitable for the purposes.

In determining BATNEEC for an activity, regard shall be had to :

- the current state of technical knowledge;
- the requirements of environmental protection;

- the application of measures for these purposes, which do not entail excessive costs, having regard to the risk of significant environmental pollution which, in the opinion of the agency exists.

For existing facilities, additional regard shall be had to :

- the nature, extent and effect of the emission concerned;
- the nature and age of the existing facilities connected with the activity and the period during which the facilities are likely to be used or to continue in operation, and
- the costs which would be incurred in improving or replacing these existing facilities in relation to the economic situation of activities of the class concerned.

The technologies and the associated emission limit values (ELV's) identified in this Guidance Note are regarded as representing BATNEEC. It is generally envisaged that these emission limit values will gradually be extended to existing facilities, however the specific licence requirements and associated time frames will be identified when the licence is processed. Additional and more stringent requirements may be specified on a site-specific basis.

Where an operator of an existing facility predicts that it will be difficult to meet the emission limit value within the specified time-frame, he will be required to satisfy the Agency as to the reasons why the requirements cannot be met. All applicants will be required to submit an environmental management plan which will give consideration to the following, in order of priority;

- waste reduction/source elimination;
- waste recovery;
- Proposed and alternative treatment technologies and predicted performance data;
- Proposed and alternative waste disposal options.

This management plan must propose a revised time-frame for the achievement of emission limit values as set out in this Guidance Note.

The BATNEEC Guidelines are not the sole basis on which license emission limit values are to be set, since information from other sources will also be considered; including site-specific environmental and technical data, plant financial data and other relevant information.

3. SECTOR COVERED BY THIS GUIDANCE NOTE

This Guidance Note covers SECTOR 7.1 of the activities specified in the First Schedule to the EPA Act 1992. These are:

7.1. The manufacture of vegetable and animal oils and fats where the capacity for processing raw materials exceeds 40 tonnes per day.

Note: *The production of animal oils and fats is covered in the notes on **Rendering** and on **Fish Meal and Fish Oil**. This note addresses the extraction of vegetable oils and fats and the refining of both vegetable and animal oils and fats to produce purer products.*

4. CONTROL TECHNOLOGIES

4.1 INTRODUCTION

As explained in Section 2, this Guidance Note identifies BATNEEC but obviously does so in the absence of site-specific information. Accordingly it represents the requirements expected of any new activity covered by the Note, but does not exclude additional requirements which may form part of the granting of a licence for a specific site.

The approach to be used in selecting BATNEEC is based on the following hierarchy:

- Process design / redesign changes to **prevent** emissions and **eliminate** wastes that might pose environmental problems.
- **Substitution** of materials (e.g. low sulphur fuel) by environmentally less harmful ones.
- Demonstration of waste **minimisation** by means of process control, inventory control and end-of-pipe technologies etc.

The existing or possible measures for reducing and controlling emissions are described in this section. These range from relatively simple containment measures to sophisticated recovery and "end-of-pipe" technologies and include:

- (i) Load minimisation
- (ii) Containment
- (iii) Recovery/recycle
- (iv) Emission reduction
- (v) Waste treatment and disposal

The technical feasibility of the measures listed below has been demonstrated by various sources. Used singly or in combination, the measures represent BATNEEC solutions when implemented in the appropriate circumstances. The circumstances depend on plant scale, materials used, nature of the products made, number of different products produced, etc. A summary of the treatments for various emissions is given at the end of the section.

Note that where flammable/explosive vapours or dusts are handled, safety procedures (acceptable to HSA) should be adopted and nothing in this note should be construed as advice to the contrary.

4.2 TECHNOLOGIES FOR LOAD MINIMISATION

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Inventory control.
- Optimisation of water usage.
- Dry equipment cleaning and dry vacuum systems, where feasible.
- Separation of cooling water, storm water and process effluents of different origin in order to permit appropriate treatment options.
- Enclosed delivery and offloading points for dusty materials with extraction to bag filter.

4.3 CONTAINMENT OF EMISSIONS:

No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Enclosure of materials (excl. bulk liquids), storage, handling, processing and transfer within a suitable building.
- Closed storage and transfer systems for milled material, raw materials etc.
- Bunding of tanks.
- Overground pipelines and transfer lines.
- Overfilling protection on bulk storage tanks.
- Prevention of rain ingress, wind entrainment etc. for stored materials.
- Heat recovery to be used where practicable.
- Local extract systems as appropriate e.g. drier unloading; mill; separators etc.
- Condensers on all appropriate process equipment e.g. evaporators etc.
- Minimisation of tank filling losses by e.g. vapour return systems.
- Low loss vacuum pumps (e.g. dry vacuum pumps; once through oil pumps)

4.4 TECHNOLOGIES FOR RECOVERY AND RECYCLE:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Solvent recovery plant.
- Reuse in another facility.
- Reuse of collected dusts.
- Recovery of residues from extraction/refining, alkali saponification and deodorisation distillation condensate.

4.5 TECHNOLOGIES FOR TREATING EMISSIONS TO AIR:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

(Symbols refer to Table 4.1)

- Condensation (T1).
- Cyclones (T2).
- Filtration (fabric filters normally adequate) (T3).
- Biofilters (T4).
- Incineration (Incinerator emissions are the subject of a separate note) (T5).
- Wet scrubbers (T6).

4.6 TECHNOLOGIES FOR TREATING WATER EMISSIONS

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

(Symbols refer to Table 4.2).

4.6.1 Primary Treatment

- pH Correction/neutralisation (F1).
- Coagulation/flocculation/precipitation (F2).
- Sedimentation/filtration/floatation (F3).
- Centrifugation (F4).

4.6.2 Secondary Treatment

- Biofilters (F5).
- Anaerobic treatment (F6).
- Activated sludge/aeration lagoons (F7).
- Extended aeration (F8).
- Nitrification/denitrification (F9).

4.6.3 Tertiary Treatment

- Filtration/coagulation/precipitation (F10).

4.7 TECHNOLOGIES FOR THE TREATMENT AND DISPOSAL OF WASTES:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

4.7.1 Sludge Treatment

- Gravity thickening.
- Dissolved air floatation.
- Filtration.
- Centrifugation.
- Sludge digestion.
- Drying.

4.7.2 Disposal

- Engineered landfill of wastes.
- Landspreading of wastes (as fertiliser).
- Reuse in downstream processing.
- Incineration (Incinerator emissions are subject to a separate note).

**Table 4.1 - Summary of Technologies for Treating Emissions to Air
(Symbols refer to section 4.5)**

| Emission Type | Technology |
|------------------------------|-------------------|
| Dust | T2, T3 |
| Odours | T1, T4, T5, T6 |
| Acids | T6 |
| Organics (include. solvents) | T5, T4 |
| Hydrogen | - |

**Table 4.2 - Summary of Technologies for Treating Water Emissions
(Symbols refer to section 4.6)**

| Emission Type | Technology |
|----------------------|------------------------|
| Organics | F2, F3, F5, F6, F7, F8 |
| Oils/Fats/Grease | F2, F3 |
| Acids/Alkalis | F1 |
| Phosphates | F10 |
| Ammonia/Nitrates | F9, F6, F7, F8 |

5. EMISSION LIMIT VALUES

5.1 REFERENCE CONDITIONS

The reference conditions for concentrations of substances in emissions to air from contained sources are:

For non-combustion gases:

Temperature 273 °K; Pressure 101.3 kPa; no correction for water vapour content.

For combustion gases:

Temperature 273°K; Pressure 101.3 kPa; dry gas; oxygen content 3% for liquid and gaseous fuels and 6% for solid fuels.

These units and reference conditions may not be suitable for continuous monitoring methods and may, by agreement with the Agency, be converted, for day to day control purposes, into values more suitable for the available instrumentation.

5.2 INTERPRETATION OF COMPLIANCE

Unless otherwise detailed in the licence, the following interpretation of compliance with limit values should apply:

5.2.1 Emissions to Air

For **continuously monitored** emissions, the following will be required for compliance with measurements based on 30 minute mean values (unless otherwise stated):

- (i) 97% of all 30 minute mean measurements shall be below 1.2 times the emission limit.
- (ii) No 30 minute mean measurement shall exceed 2.0 times the emission limit.
- (iii) All daily mean values shall be less than the emission limit.

Where **periodic monitoring** is used to check compliance, all samples should meet the consent conditions.

The **mass emission** of hexane or other solvents should be determined by a mass balance to derive total hexane or solvent loss using seed (or fat or oil) throughput data and hexane or solvent purchase and recovery records. A detailed inventory of hexane or solvent purchase and seed (or fat or oil) throughput should be kept.

5.2.2 Emissions to waters

The limit values for discharges to water are based on 24 hour flow proportional composite samples unless otherwise specified.

5.3 EMISSIONS TO AIR

Emission Limit Values representing BATNEEC are given in Table 5.1 below.

Table 5.1 - Emission Limit Values for Emissions to Air

| Emission | Limit Value |
|--|---|
| Particulates | 50 mg/m ³ |
| Hexane (solvent extraction) | |
| - Rapeseed and maize germ | 2.0 kg/t of seed processed |
| - Other seeds | 1.5 kg/t of seed processed |
| VOC (solvent fractionation and refining processes excl. degumming) | 1.5 kg/t of fat or oil subject to fractionation |
| VOC (degumming) | 4 kg/t of fat or oil subject to degumming |

5.4 Releases to Water

Effluent should be minimised by recovery of materials wherever practicable. The use of lower quality water may be possible for some parts of the process rather than fresh water.

All releases to waters are subject to a licence from the Agency. However any discharge to sewer will require the consent of the sanitary authority. BATNEEC to minimise the release of substances will generally include minimisation at source and either specific treatment of contaminated waste streams to remove particular substances or co-treatment of combined effluent streams or both. The Emission Limit Values for effluent discharges to waters are set out in Table 5.2.

Table 5.2 - Emission Limit Values for Discharges to Water*

| Constituent Group or Parameter | Limit Value | Notes |
|---|-----------------------------------|--------------|
| pH | 6 - 9 | 4 |
| BOD | >90% removal or 35 mg/l | 1,4 |
| Toxic Units | 5 | 2,4 |
| Total Nitrogen (as N)** | >80% Removal or 15 mg/l | 4,5 |
| Total Phosphorus (as P)** | >80% Removal or 2 mg/l | 4,5 |
| Ammonia (mg/l as N) | 10 | 4 |
| Oils, Fats and Grease (mg/l) | 25 | 4 |
| Fish Tainting | No Tainting | 3,4 |
| Mineral Oil (Interceptor) (mg/l) | 20 | 4 |
| Mineral Oil (Biological Treatment) | 1 | 4 |

* All values refer to daily averages, except where otherwise stated to the contrary, and except for pH which refers to continuous values. Limit values apply to effluent prior to dilution by uncontaminated streams e.g. stormwater, cooling water, etc.

** Only applicable to waters subject to eutrophication. One or both limits may apply depending on the sensitivity of the receiving waters.

Notes for Table 5.2:

1. The daily raw waste load for BOD is defined as the average daily mass arising for treatment over any three month period.

Calculations of the removal rates for BOD should be based on the differences between the waste loads arising for disposal and those discharges to the receiving waters. The amounts removed by treatment (chemical, physical, biological) may be included in the calculation.

2. The toxicity of the effluent shall be determined on an appropriate aquatic species. The number of Toxicity Units (TU) = $100/96 \text{ hr LC50}$ in percentage vol/vol. so that higher TU values reflect greater levels of toxicity.
3. No substances shall be discharged in a manner which, or at a concentration which, following initial dilution causes tainting of fish or shellfish, interferes with normal patterns of fish migration or which accumulates in sediments or biological tissues to the detriment of fish, wildlife or their predators.
4. Consent conditions for these parameters for discharge to municipal treatment plants can be established with the Licensing Authority, and different values may apply.
5. Reduction in relation to influent load. Total nitrogen means the sum total of Kjeldahl-Nitrogen plus nitrate-nitrogen plus nitrite-nitrogen.

6. COMPLIANCE MONITORING

The methods proposed for monitoring the emissions from these sectors are set out below.

6.1 EMISSIONS TO AIR

1. Continuous particulate emission monitoring when airflow exceeds 300 m³/min.
2. Periodic monitoring for other parameters as per licence.
3. Records of weekly hexane and other solvent purchases and of seed and fat or oil throughputs should be forwarded to the licence authority weekly, together with company estimates of the mass emissions of hexane and other solvents.

6.2 WASTE WATER DISCHARGES:

1. Establish existing conditions prior to start-up, of key emission constituents, and salient flora and fauna.
2. Daily monitoring of flow and volume, continuous monitoring of pH. Monitoring of other relevant parameters as deemed by the Agency taking account of the nature, magnitude and variability of the emission, and the reliability of the control technologies.
3. Monitoring of influent and effluent from the waste water treatment plant to establish % BOD reduction and early warning of any difficulties in waste water treatment plant, or unusual loads.
4. Periodic fish tainting and toxicity tests where appropriate taking account of the nature, magnitude and variability of the emission, and the reliability of the control technologies.
5. Periodic biodegradability checks where appropriate on effluents to municipal waste treatment plants, both prior to start-up and thereafter.

6.3 SOLID WASTE MONITORING:

1. The recording in a register of the types, quantities, date and manner of disposal of all wastes.
2. Leachate testing of sludges and other material as appropriate being sent for landfilling.
3. Annual waste minimisation report showing efforts made to reduce specific consumption together with material balance and fate of all waste materials.

7. PRINCIPAL REFERENCES

7.1 U.K. DEPARTMENT OF THE ENVIRONMENT

- 7.1.1 Secretary of State's Guidance PG6/25(91)
(Vegetable oil extraction and fat and oil refining processes)

APPENDIX 1

MAIN EMISSIONS

1 INTRODUCTION:

In this section, the major sources of emissions to air and water are identified, as are the principal sources of waste from the sector. It should be borne in mind that the identified list of sources is not all encompassing, nor will every plant falling within an individual sector have every one of the emissions which are associated with the sector as a whole.

Emissions are considered under the following headings: fugitive and unscheduled emissions, and specific process emissions. Some of the latter are considered to have little potential environmental significance and these are designated as minor (m). (However, obviously there could be specific plants where this designation of minor may not be correct. Such emissions must then be examined on a one-off basis).

2 SOURCES OF EMISSION TO AIR FROM: (SYMBOLS REFER TO TABLE A1)

2.1 Fugitive and Unscheduled Emissions:

- Stripping of odorous compounds from waste water treatment plants (WWTP) resulting in releases to air and/or odour problems.
- Storage tank vents.
- Vapour losses during storage, filling and emptying of bulk solvent tanks and drums (including hose decoupling).
- Bursting discs and relief valve discharges.
- Leakages from flanges, pumps, seals, valve glands etc.
- Building losses (windows, doors etc.)

2.2 Process Emissions

- Drier emissions (m).
- Screening(S1).
- Conditioning (S2).
- Size reduction/kernel cracking (S1).
- Extraction plant (S3).
- Solvent recovery (S3).
- Refining plant (S4).
- Solvent losses from wet product/cake handling/transportation (S3).
- Distillation vents (S3).
- Vacuum pump discharges (m).
- Hydrogenation vents (S5).

3. SOURCES OF EMISSIONS TO WATER FROM: (SYMBOLS REFER TO TABLE A2)

3.1 Spills and Diffuse Sources etc.

- Contaminated stormwaters
- Storage tank leaks
- Pipework leaks.
- Spillages.
- Bund Drains.
- Leakages from flanges, pumps, seals, valve glands etc.

3.2 Process Emissions

- Condensate (evaporation) (E1)
- Boiler blowdown (m)
- Contaminated water arising from cleaning of plant (E2).
- Steam stripping (E2).
- Laboratory effluent (m).
- Product washings (E4).
- Storage area/tanks/skips/haulage vehicles etc. washdown (E1 and E2).
- Cooling Water (m).
- Spent acids/alkalis (E3).

4. SOURCES OF WASTE (SYMBOLS REFER TO TABLE A3)

- Sludges from WWTP (W1).
- Contaminated drums, equipment, packaging and protective clothing (W2)
- Process by-products (W3).
- Still bottom residues (W4).
- Dust from abatement plant (W5).
- Spent solvent (W6).
- Spent adsorbents (W7).
- Spent catalysts (W8).

Table A1 - Summary of Sources and Emissions to Air
 (Symbols refer to section 2 of Appendix)

| Source | Emissions |
|--------|---------------------------------|
| S1 | Dust |
| S2 | Dust Odours |
| S3 | Odours Solvent (e.g. hexane) |
| S4 | Odours Solvent Acids |
| S5 | Hydrogen Odours |

Table A2 - Summary of Sources and Emissions to Water
 (Symbols ref to section 3 of Appendix)

| Sources | Emissions |
|---------|--|
| E1 | Trace solvent Trace Oils/Fats/Grease |
| E2 | Organics (BOD) Inorganics Oils/Fats/Grease |
| E3 | Acids/alkalis |
| E4 | Acids/alkalis Product (oils/fats/grease) Phosphates Sulphates |

Table A3 - Summary of Other Releases
(Symbols refer to section 4 in Appendix)

| Source | Emission |
|---------------|--|
| W1 | Organics (BOD) Inorganics Oils/Fats/Grease |
| W2 | Process and Treatment Plant Chemicals |
| W3 | Alkali saponification residues Raw material residues after extraction and refining Deodorisation distillation condensate |
| W4 | Polymeric residues Oils/Fats/Grease Solvent Traces of raw materials |
| W5 | Raw material Grit Raw material residues |
| W6 | e.g. hexane |
| W7 | Fuller's earth, clays, activated carbon |
| W8 | e.g. Nickel |