行政院所屬各機關因公出國人員出國報告書

（出國類別：考　察　　）

考察固定污染源揮發性有機物(VOC)空氣污染管制及收費制度出國報告書

服務機關：行政院環境保護署
出國人　職　　稱：技　正　薦任技士
　　　　姓　　名：王美文　鍾敏慧

出國地點：德國、瑞士及英國
出國期間：九十二年九月七日至九月十八日
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摘　要

本考察計畫為九十二年九月七日至十八日，赴德國、瑞士及英國等揮發性有機物管理制度較為完整國家，考察其管制策略、法規及收費制度，共計拜訪德國之巴伐利亞州區域發展及環境事務部、環境保護局、瑞士政府環境部、英國環境部、環境保護局與 Bristol 市議會等單位。

德國方面，VOC 排放之主要來源為溶劑使用，1990 年至 2000 年明顯減少近一半 VOC 排放量，並已研訂 2010 年之管制目標，另該國遵循歐盟 1999 年溶劑排放公約規定，於 2001 年 8 月訂定聯邦相關法令，並據以落實管制 VOC 排放。

瑞士方面，為歐洲第一個對揮發性有機物徵收污染稅之國家，其徵收對象為進品或國內製造 VOC 者，藉由業者提報 VOC 結算表單，進行減免及退稅作業，而所收稅款係透過全民健康保險平均分配予每一位國民，以達最大成本效益。

英國方面，對於空氣品質之改善，除訂定臭氧之目標外，更訂定苯及 1,3-丁二烯之目標，另亦遵循歐盟溶劑排放公約規定，於 2002 年 3 月訂定相關法令，由環境保護局及地方政府負責執行。

由本次考察結果可知，歐盟溶劑排放公約之管制內容具有彈性及管制之有效性，德國及英國均據以落實於其國內之法令，而瑞士具有創新性之 VOC 污染稅收費制度，均值得作為我國揮發性有機物管制及規劃收費制度之學習及參考。

目　錄

壹、前言

依近幾年空氣品質監測結果顯示，臭氧為造成空氣品質不良之主要污染物，而針對臭氧前趨物之揮發性有機物，已列為本署重點管制工作，並亟需參考國外先進國家之管制經驗，以有效減少揮發性有機物之排放，爰此，本署本（九十二）年度空氣污染防制基金預算編列經費，考察歐美對於揮發性有機空氣污染物之管制及收費制度。

鑑於歐盟已陸續訂定歐洲各國揮發性有機空氣污染物減量目標，並於一九九九年訂定使用有機溶劑製程作業之揮發性有機物排放限制規定，歐洲各國已配合積極進行相關管制措施，擬派員至歐洲考察，作為我國研訂管制策略及執行管制工作之借鏡。

本次出國考察期間為九十二年九月七日至十八日，赴德國、瑞士及英國之揮發性有機物管理制度較為完整國家，考察其管制策略、法規及收費制度等，瞭解其實際執行經驗。

貳、行程表

日期	星期	地點	工作內容
九月七日	日	台北→德國	啟程
九月八日	一	德國慕尼黑	抵達目的地
九月九日	二	德國慕尼黑	拜訪德國巴伐利亞州區域發展及環境事務部
九月十日	三	德國慕尼黑	拜訪德國巴伐利亞州環境保護局
九月十一日	四	德國慕尼黑→瑞士伯恩	路程及整理資料
九月十二日	五	瑞士伯恩	拜訪瑞士政府環境部（SAEFL）
九月十三日	六	瑞士伯恩→英國倫敦	路程及整理資料
九月十四日	日	英國倫敦	蒐集及整理資料
九月十五日	一	英國倫敦	拜訪英國環境部（DEFRA）
九月十六日	二	英國倫敦	拜訪英國環境保護局（EA）及Bristol市議會
九月十七日	三	英國倫敦→台北	返程
九月十八日	四	英國倫敦→台北	抵達台北

參、工作內容

一、德國揮發性有機物管制制度

拜會德國巴伐利亞州區域發展及環境事務部(Bavarian State Ministry for Regional Development and Environmental Affairs) Roland Fischer 博士，以及該州環境保護局(Bavarian Environmental Protection Agency) Richard Schlachta 博士，主要討論內容如下:

（一）德國及巴伐利亞州揮發性有機物排放及減量情形

德國政府對於降低VOC排放量以減緩地表臭氧污染，列為其環境政策上之重要議題，根據德國VOC排放量推估資料，全國VOC排放量自1990年之322萬公噸，降至2000年之160萬公噸，其中63%來自溶劑使用之排放，30%來自能源使用，7%為工業排放；能源使用排放量中，66%係屬交通運輸（包含加油站）之排放。

在巴伐利亞州部分，1996年VOC排放量為413,840公噸，其中交通運輸車輛排放為103,745公噸，約佔25%，自然生態植物之排放量為118,910公噸，約佔28.7%，其他為工業或溶劑使用之排放。至2000年，巴伐利亞州VOC排放量已降至350,400公噸，約減量15.3%。另州政府訂定2010年VOC排放量目標為降至285,550公噸，較1996年減少69%。

（二）德國及巴伐利亞州揮發性有機物管制相關法令

德國VOC管制法規主要係遵循歐盟1999/13/EC（1999年3月11日公布）指令中關於特定工廠及活動使用發性有機物的排放規定，於2001年8月訂定聯邦防制法及相關子法，據以執行。

1.管制對象

當特定行業使用有機溶劑年使用量達一定規模者，始為管制象，但少部分行業如乾洗業不論使用量之多寡，均須受法令之管制。因此，業者可以選擇將其有機溶劑使用量降至一定量以下，即不在管制範圍；倘使用量達管制規模以上者，其廢氣及逸散之排放量則必須符合排放管制限值，並須每年向環保單位申報一次。

2.排放限值

排放限值包括單一標準及總排放量標準，單一標準中包括廢氣濃度標準或逸散量佔溶劑使用比例（%）；總排放量標準包括廢氣排放量加上逸散量之排放標準、每單位產品（產量）排放量或每單位面積（體積）排放標準等。

3.VOC 定義

(1)任一有機物在 193.15°F（19.85°C）時其蒸氣壓為 0.01KPa。

(2)任一有機物在特殊使用條件有類似揮發情形。

4.業者採取策略

業者須每年提報減量計畫（Reduction scheme），可彈性採用不同之方案如下：

(1)選擇使用 VOC 含量較低之替代品。

(2)使用更好之防制方法以彌補逸散排放量。

(3)其他減量方案。

5.質量平衡表

為能夠確實掌握業者 VOC 排放情形，環保單位要求業者在每年提報的資料中須包括質量平衡表（balance sheet），該表列出之項目如下：

(1)INPUT 量：包括溶劑購買量（I/1）及溶劑回收使用量（I/2）。

(2) OUTPUT 量：包括處理後廢氣排放量（O/1）、廢水中的量（O/2）、產品中的量（O/3）、未收集的量（O/4）、被處理破壞的量（O/5）、廢棄物中的量（O/6）、回收的量，此部分還包括回收出售（O/7）、回收貯存（O/8）及回收再使用（I/2）以及其他（O/9）等。環保單位審查時，即可從業者提供之資料進行下列計算：

溶劑使用量 C = I1 - O8

溶劑排放量 E = F（逸散量）+ O1

而逸散量 F 可由下列公式計算

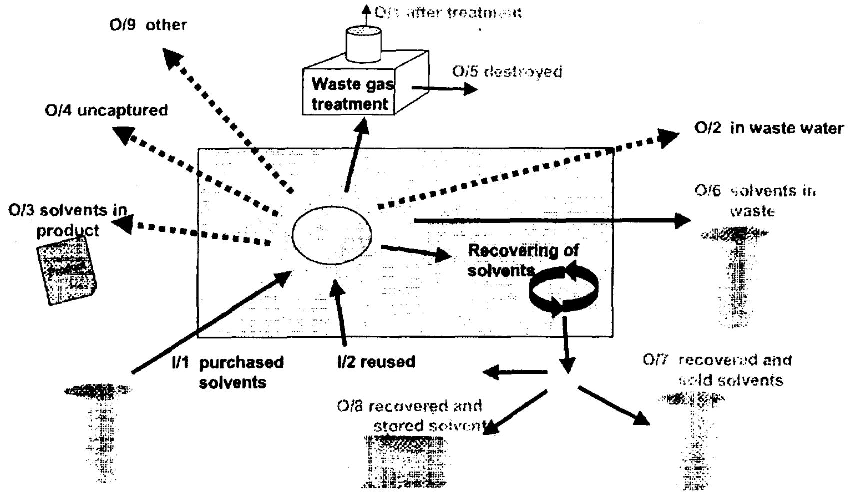
F = I1 - O1 - O5 - O6 - O7 - O8

F = O2 + O3 + O4 + O9

VOC-Reduction In Germany

The Solvent Ordinance (Draft)

Requirements to the operator (picture designed by Ökopol)



International Workshop on Implementation of the VOC-Abatement Techniques in Surface Coating nd Degreasing

藉由此平衡表可以讓業者更了解其溶劑使用及排放情形，有助於研擬減量策略；對環保單位而言，可更有效掌握業者溶劑使用及排放情形，更明確查核其 VOC 排放量。以噴霧塗裝製程為例，藉由質量平衡分析發現，當使用 100 公斤溶劑塗裝時，僅有 25 公斤係使用於

成品，由此可以更進一步分析業者之減量空間及減量成本效益，有效減少 VOC 之排放。

6.業者應執行事項

(1)定期或連續性檢測工廠排放廢氣中 VOC 排放情形。

(2)每年一次或當環保單位要求時，提供資料予環保單位。

(3)證明依照所允諾的溶劑管理計畫來執行各項管制措施。

（三）巴伐利亞州環保組織架構

1.單位層級及權責

(1)區域發展及環境事務部：主要負責環境政策及目標之擬定。

(2)環境保護局：主要提供專家意見及報告，協助地方政府執行政府法規；另每年舉辦說明會，提供技術支援。

(3)地方政府：共七個，負責較複雜（大型）工廠之管制及許可證核發。

(4)鄉鎮及半自治區：共有七十一個鄉鎮及二十五個半自治區，負責工廠之管制、許可證核發及法規執行。

2.許可證核發程序

在德國與台灣一樣，工廠須申請設置及操作許可證，但其核發許可證有幾項特點：

(1)空氣、水及廢棄物的許可證一併審查核發。

(2)許可證審查須有政府官員、專家及民眾之意見，必要時須召開公聽會（Public Hearing），不須召開公聽會之許可證在三個月內審查核發，須召開公聽會的許可證在三個月內審查核發。

(3)許可證須登載所有事項，包括許可排放量、控制設施及監測設備等。

（四）小結

1.德國是歐盟組織之一，因此係依照歐盟的規範來制定 VOC 管制規範；在歐盟第一階段 VOC 管制規範 96/61/EC，已將加油站 VOC 排放列入管制，規定加油站裝卸油品或為民眾車輛加油之加油槍須加裝回收裝置，政府機關亦定期檢測，業者並未反對。

2.此次與德國官員討論之 1999/13/EC 規範是歐盟第一階段 VOC 管制規範，管制對象含括大部分使用溶劑業者。

3.歐洲近年來臭氧問題逐年嚴重，因此減少 VOC 的排放已成環保重要施政，德國已擬定至 2010 年的管制目標，以降低臭氧污染。

二、瑞士揮發性有機物收費制度

於 9 月 12 日拜會瑞士瑞士環境部（Swiss Agency for the Environment, Forests and Landscape ,SAEFL） Christina Hurzeler 女士，主要討論內容如下：

（一）收費背景

瑞士政府對降低 VOC 排放量早已列為環境政策上之重要議題，1995 年 12 月 21 日瑞士聯邦政府修正「聯邦環境保護法」（the Federal Law relating to Protection of the Environment , LPE, BBI.1996 I 233），並於 1997 年 5 月 21 日決定自同（1997）年 7 月 1 日起執行 LPE 法令，對 VOC 稅之徵收條例（1997 年 11 月 12 日訂定）即源自於 LPE 的 Articles 35a 及 35c，而瑞士已自 2000 年 1 月 1 日起徵收「揮發性有機物（VOC）稅」。

（二）徵收揮發性有機物（VOC）稅之目的

VOC 與 NO_X 同為造成地表臭氧濃度升高（summer smog）之原因，近幾年來，瑞士國內地表臭氧濃度經常超過空氣污染防制法（OAPC，Ordinance on Air Pollution Control）所訂定之限值（如附表

一)，2001 年瑞士全國空氣品質監測站網（Swiss National Observation Network for Atmospheric Pollution，NABEL）監測值有 750 小時的測值超過臭氧限值（120µg/m^3），這影響民眾的健康及生活環境，根據 LPE 的 Articles 1 及 11 規定必須改善地表臭氧濃度，相對的就必須減少 VOC 的排放。

瑞士聯邦議會設定 VOC 排放減量目標須削減至 1960 年水準，並分階段實施具經濟誘因的稅收政策。這相對於 1984 年 VOC 最大排放量須減少 55%。但執行第一階段收費，並不足以達到地表臭氧濃度符合環境限值目標，因為要達到符合地表臭氧濃度標準，相對的至少須減少 1984 年 VOC 最大排放量的 70~80%。目前瑞士 2001 年 VOC 排放量約 130,000 公噸，要達到符合地表臭氧濃度標準之目標，VOC 年排放量須降至 80,000 公噸以下。

為提高徵收 VOC 稅之減量效益，瑞士聯邦政府已自 2003 年 1 月 1 日起調整稅率。希望在最短時間內達到 VOC 年排放量降至 80,000 公噸以下之目標。

（三）徵收對象

凡是瑞士進口或在其國內製造的 VOC 皆須繳稅，也就是說，凡在瑞士製造含有 VOC 成分的產品已被徵收 VOC 稅；進口貨物則依其所含 VOC 的量徵收。

基本上，只針對排放至環境中的 VOC 部份徵收，也就是指出口貨物及不會產生排放量者不在被徵收範圍。原則上須課稅之 VOC 物種均列於徵收條例附錄 1 中，不在列表上之 VOC 則不予課稅。

事實上，符合 VOC 定義（蒸氣壓或沸點）的有機物很多，但表中列出屬於日常使用及排放會影響人體健康與環境，或存在風險者。

附錄 2 則列舉徵收對象為含 VOC 之進口貨物，但含量在 3%以

下者排除在外（例如：化妝品），無需繳交 VOC 稅。

（四）收費稅率

VOC 稅之徵收條例中已明定 VOC 稅率以每公斤 3 瑞士法郎為基準並採漸進方式徵收，自 2000 年 1 月 1 日至 2002 年 12 月 31 日先收取 2 瑞士法郎；從 2003 年 1 月 1 日起則調整為每公斤 3 瑞士法郎。同時政府須定期分析收稅對 VOC 排放的影響，根據評估收稅後 VOC 排放量約每年減少 3~5%。

（五）執行單位

在執行方面，SAEFL（Swiss Agency for the Environment, Forests and Landscape）負責稅收分配及檢視課稅效益，聯邦關稅管理局（the Federal Customs Administration）負責稅款之徵收，並決定免稅及退稅事務。

州立空氣污染管理局（The cantons，cantonal air pollution services）支援關稅管理局之稅款徵收工作，負責審核退稅所填具之 VOC 結算表單（VOC balance sheets）及退稅申請，審核結果回報關稅管理局，尤其決定免稅及退稅事宜。州立空氣污染管理局透過執行空氣污染防制法（OAPC，Ordinance on Air Pollution Control）通常相當熟悉申請者的操作情形。

除此之外，由不同利益團體代表組成的專家委員會（commission of experts）負責諮詢及顧問工作，以確保全瑞士政府執行此條例之公平與落實；其成員包括：聯邦政府代表、州管理局代表、工商團體人士等。

（六）稅款徵收申報及減免、退稅

VOC 稅的減免係經由退稅的程序，在 LPE 及 OAPC 中即已考慮

數種減免情況，符合下列情形者可予以退稅：

1.含 VOC 貨物或原物料為出口者。

2.VOC 在處理過程中並未逸散至環境中。

3.VOC 批發（wholesale）者。

依據 LPE 的 Articles 35a Paragraph 4，VOC 排放者如投入額外經費減少 VOC 排放遠低於法規要求者，聯邦議會可以給予減免。

工廠則應提交 VOC 結算表單（VOC balance sheet）。該 VOC 結算表單應包括下列資料：

1.基本數據：有關 VOC 輸入、輸出及貯存數量，貨物中 VOC 含量，回收再利用及逸散量等，工廠必須提供清楚完整的資料。

2.回收 VOC：經由不同處理方法 VOC 可被回收再利用，這部份詳細資料亦相當重要。

3.釋出 VOC 量：工廠對於 VOC 經焚化或轉移的量應確切掌握。所謂釋出 VOC 的量亦包括含在廢棄物中轉送至他處的部份。

4.剩餘排放量

瑞市政府預估，藉由稅的減免工廠 VOC 的排放量會被量化；從工廠排放的 VOC 量將會個別較 OAPC 的許可量至少減少 30~50%。

（七）稅款收入分配

瑞士「聯邦環境保護法」規定，稅款須『平均』分配與每一個人民。瑞士除徵收 VOC 稅之外，也自 1998 年 7 月 1 日起徵收燃料油的「硫」稅，凡含硫量超過 0.1%的燃料油每 1000 公斤須繳 12 瑞士法郎，2001 年約徵收 80 萬瑞士法郎，與所徵收之 VOC 稅一年約一億多瑞士法郎相較比例非常小。

業者提出將所徵收之稅款一部分分配予工廠的建議，已經遭到聯

邦議會的拒絕；據估計，2003 年每個人約可分配 21 瑞士法郎。

在瑞士，健康保險相較其他系統而言是註冊人數最為齊全的一個系統。因此，徵收之稅款透過強制性健康保險平均分配予每一個人。經評估分析，此一方法可達到最大的成本效益；因為，透過強制性健康保險平均分配予每一個人，可減少許多行政費用的支出。

（八）小結

1.瑞士徵收 VOC 稅主要是要減少 VOC 的排放量以減輕瑞士地表臭氧污染問題。根據瑞士政府提供之空氣品質標準，其臭氧標準為每小時 60ppb(每年不得超過 1 次)，較我國的空氣品質標準每小時 120ppb 嚴格。

2.由於 VOC 不易量測及易逸散揮發的特性，造成管制上的困難。因此，瑞士政府採取在製造或進口時徵收稅費的方式，使業者執行 VOC 減量，每年約可減量 3%，聯邦政府並隨時檢視評估徵收之效益。

3.徵收之費用「平均」分配與每一個人民，政府不能將該費用作為徵收或其他 VOC 管制的行政費用，也不能補助或獎勵業者進行 VOC 防制；此與我國徵收空氣污染防制費專款專用於空氣污染防制工作不同。

三、英國揮發性有機物管制制度

（一）英國環境部（Department for Environment Food and Rural Affairs，DEFRA）

於 9 月 15 日由 Trade Partners UK 機構之 Bob Thompson 先生陪同，拜會環境食品及鄉村事務部 Head of Air and Environment Quality Division－Dr. Martin L. Williams，主要討論內容如下：

1.臭氧空氣品質改善目標

(1)主要係參考歐洲委員會（European Commission）於 1999 年 6 月提出之國家最大排放值公約（National Emission Ceiling Directive），訂定歐盟會員國之 NOx、VOC、SOx 及 NH3 等空氣污染物排放之減量目標，另臭氧空氣品質目標為至 2010 年符合 120 μg/m^3，每日連續八小時平均值計算，每年超出該標準之天數為 20 天以內。

(2)英國臭氧空氣品質目標為至 2005 年底前符合 100 μg/m^3，以每日連續八小時平均之最大值計算，每年超出該標準之次數為 10 次以內。由於空氣污染物具有跨區域傳輸之特性，臭氧之前驅物容易從歐洲大陸傳輸至英國，該目標是否能達成，仍有相當之不確定性。

2.揮發性有機物空氣品質改善目標

鑑於苯及 1,3-丁二烯兩項污染物於空氣中普遍存在，且對人體危害較大，爰針對該兩項污染物訂定空氣品質改善目標如下：

(1)苯：以年平均值計算，至 2003 年底達 16.25 μg/m^3（5ppb）；至 2010 年底，England 及 Wales 達 5 μg/m^3，Scotland 及 Northern Ireland 達 3.25 μg/m^3。

(2) 1,3-丁二烯：至 2003 年底達 2.25 μg/m^3（1ppb）。

3.2003 年 8 月臭氧污染事件

於 2003 年 8 月 1 日至 15 日間，英國空氣品質測站測得之臭氧濃度，普遍達高濃度（HIGH concentration：90-180 ppb, 180-360 μg/m^3），最高濃度出現於 8 月 11 日，為 125 ppb（250 μg/m^3）。經分析結果顯示：

(1)該期間氣侯屬持續性之高壓系統，導致長時間之日照，而且盛行

風為東南風，從歐洲大陸帶來大量之臭氧生成前驅物，提供臭氧生成之理想環境。

(2)本次臭氧污染事件係於8月3日至6日間形成，於7日至8日間稍微下降，其後於9日快速達到尖峰，8日至12日逐漸下降。

(3)英格蘭東南部於8月10日夜間出現臭氧不尋常之小尖峰，其中原因相當複雜，可能係其他地區或甚至歐洲大陸於稍早時間形成臭氧後流動之結果。

（二）英國環境保護局（Environment Agency）

於9月16日上午由Trade Partners UK機構之 Bob Thompson先生及Peter Walsh先生陪同，拜會環境保護局John Hescott先生，主要討論因應歐盟劑排放公約之作法，內容如下：

1.為執行歐盟於1999年3月22日訂定之溶劑排放公約（Solvent Emissions Directive，以上簡稱SED，全名為Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations）規定，英國之England及Wales已於2002年3月訂定二項法令（Directions），分別歸屬於環境保護法（Pt I of the Environment Protection Act 1990）及污染預防與控制法（the Pollution Prevention and Control Regulations 2000）之下。

2.政府並訂定執行指南（guidance note），說明該公約之主要內容及環境食品及鄉村事務部提出之執行方式等，以供各界參考使用。該指南之主要內容如下：

(1)SED實施日期

A 新設污染源：需於操作前符合SED規定；倘於2002年3月22日前已取得授權書或許可證者，則需於2002年7月22日

前符合規定。

B 既存污染源(於 2000 年 4 月 1 日前已取得許可證者)：至 2007 年 10 月 31 日完全符合 SED 規定即可；其間製程倘進行變更者，則視為新設污染源。

(2)SED 基本管制內容

該公約管制範圍內之活動，其溶劑使用量達一定程度以上者，需符合下列規定之一：

A 廢氣排放限值及逸散量限值（佔使用量之比例）。

B 總排放限值。

C 執行溶劑減用計畫，進而減少排放量，相當於符合前述總排放限值者。

(3)有機鹵化物、致癌、致突變及生殖毒性物質之管制

SED 對於易造成人體及環境危害之 VOC 物質，訂定更為嚴格之管制規定：

A 屬 R40 風險之有機鹵化物：使用量達 100g/h 以上者，其個別物質之總排放限值為 20mg/m^3。

B 屬 R45、R46、R49、R60 或 R61 風險之致癌、致突變及生殖毒性物質：使用量達 10g/h 以上者，其個別物質之總排放限值為 2mg/m^3。

另既存污染源使用前述危害性高之物質者，應於儘短時間內作規劃及替換該些物質，並應於 2003 年 3 月 22 日前提出替換時間表。

(4)溶劑管制計畫

公私場所需每年編寫及提報溶劑管制計畫，以證明其符合 SED 之規定，此外，選擇符合排放限值者，需檢測其排放情形。

（三）英國 Bristol 市議會（Bristol City Council）

於9月16日下午由Trade Partners UK機構之 Bob Thompson先生及Peter Walsh先生陪同，拜會Bristol市議會Environmental Quality Team David Muir先生，主要討論地方政府對於VOC排放之管制，內容如下：

1.地方政府與環境保護局在污染管制工作之分工

(1)環境保護局：管理範圍屬區域性及全國性，對象為規模較大之製程，數量較少。在Bristol計管制22處之33個製程。

(2)地方政府：管理範圍屬地方性，對象為規模較小之製程，較量較多，而且常需與民眾陳情案件併同處理，有時甚至與健康、安全、食品及住宅等問題相關。在Bristol計管制200個製程。

2.管制VOC之目的

(1)因所有VOC均有形成臭氧之潛勢，在臭氧生成潛勢方面，烯類如o-Xylene、m- Xylene及p- Xylene等為最高，苯環類物質次之，而烷類之生成潛勢最低。

(2)減少空氣中具有致癌性之苯及1,3-丁二烯之物質。

(3)避免造成大氣組成之改變，進而影響氣侯之變遷。

3.Bristol之VOC排放情形

(1)VOC排放之列管對象：

A 環境保護局共管制3個使用有機物質製程及1個氣體製造相關程序。

B Bristol議會共管制2個氣體製造程序、2個儲槽區、4個表面塗裝物品製造程序、47個表面塗裝作業及93個加油站，約佔所有列管製程之70%。

(2)VOC排放之主要來源

A 非甲烷碳氫化合物（NMHC's)：主要來自表面塗裝作業、氣

體製造及道路交通。

B 苯：主要來自儲槽區、加油站及道路交通。

C 1,3-丁二烯：主要來自道路交通。

4.Bristol 空氣品質監測結果

苯及甲苯之監測結果顯示，於 2000 年時由歷年之平均值 15ppb 以上，明顯降至 5ppb 以下，主要為限制汽油中苯含量之結果；至 2001 年由於大量壓取式容器（dispensers）之使用，致濃度回升至 10ppb 以上。

肆、結論

一、德國及英國均相當配合歐盟於 1999 年訂定之溶劑排放公約，於其國家既有之管制架構下，訂定相關法令及推行相關措施，據以落實執行，能善盡身為歐洲大國之責任，值得肯定。

二、對於歐洲各國家空氣污染之管制趨勢，應先掌握歐盟訂定之相關公約內容，以有效瞭解各國家研訂之背景及發展。

三、歐盟於 1999 年訂定之溶劑排放公約，除管制對象含括大部分使用有機溶劑之製程外，管制內容給予業者選擇適用標準之彈性，包括廢氣排放限值、總排放量限值或提報溶劑減用計畫等，且對毒性高之物質加嚴管制標準，並要求業者定期提報溶劑管制計畫等，其管制內容具有彈性及管制之有效性。

四、德國對於 VOC 排放之減量，由 1990 年至 2000 年，明顯減少近一半之排放量，並已研訂 2010 年之管制目標，足見該國管制 VOC 之決心。

五、英國對於空氣品質之改善，除訂定臭氧之目標外，更訂定苯及 1,3-丁二烯之目標，明確保障民眾之健康。

六、瑞士對於揮發性有機物之管制措施，係以收費制度為主，且為歐洲第一個對揮發性有機物徵收污染稅之國家，其徵收對象為進品或國內製造 VOC 者，藉由業者提報 VOC 結算表單，進行減免及退稅作業，而所收稅款係透過全民健康保險平均分配予每一位國民，以達最大成本效益，收費相關制度相當具創新性，值得借鏡。

七、本次考察行程除對實地瞭解拜訪國家之 VOC 空氣污染管制及收費制度外，更感謝接待人員為我們準備之簡報說明及書面資料，明顯感受到他們認真做事之態度，此行各方面收獲良多。

伍、建議

一、因國內正逐步研擬特定行業或製程之揮發性有機物管制標準，可參酌歐盟 1999 年所訂溶劑排放公約之管制對象、管制標準及相關行政管制措施等，作為法規研訂之參考及比較。

二、德國及英國要求業者每年提報質量平衡表（balance sheet），以及瑞士業者於申請 VOC 稅款減免、退稅所提供之資料 VOC 結算表單（VOC balance sheet）等，均為掌握業者整體 VOC 使用及排放情形之有效方式，此做法可以作為國內未來訂定相關管制規範之參考。

三、目前國內係針對 SOx 及 NOx 徵收空氣污染防制費，亦刻正規劃 VOC 之收費制度，另考量土壤污染防制費亦已對 VOC 物質徵收，倘欲整合該二項收費制度，瑞士之 VOC 污染稅制度可提供參考。

四、依據瑞士 VOC 污染稅係為追求最大成本效益之分配，國內空氣污染防制費之使用及分配情形，建議定期進行評估及檢討。

五、空氣品質改善方面，目前國內尚無 VOC 相關之空氣品質標準，

且對於空氣品質 VOC 監測工作亦稍不足，建議可參酌英國之空氣品質改善目標，逐步規劃研訂苯及 1,3-丁二烯等對人體健康影響較大物質之標準，以保障民眾健康。

陸、附件

附件一：1999 年歐盟溶劑排放公約

附件二：2002 年歐盟委員會對溶劑排放公約之修正提案

附件三：德國揮發性有機物管制制度簡報資料

附件四：德國減少表面處理作業 VOC 排放之管制及防制措施

附件五：德國空氣污染管制技術參考手冊

附件六：瑞士揮發性有機物收費制度簡報資料

附件七：英國 2003 年 8 月臭氧污染事件分析報告

附件八：英國對於歐盟溶劑排放公約之執行指南

附件九：英國 Bristol 地方政府對 VOC 排放管制簡報資料

附件一：1999 年歐盟溶劑排放公約

附件一：1999 年歐盟溶劑排放公約

I

(Acts whose publication is obligatory)

COUNCIL DIRECTIVE 1999/13/EC

of 11 March 1999

on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 130s(1) thereof,

Having regard to the proposal from the Commission (1),

Having regard to the opinion of the Economic and Social Committee (2),

Acting in accordance with the procedure laid down in Article 189c of the Treaty (3),

(1) Whereas the European Community action programme on the environment approved by the Council and the representatives of the Governments of the Member States meeting within the Council by resolutions of 22 November 1973 (4), 17 May 1977 (5), 7 February 1983 (6), 19 October 1987 (7) and 1 February 1993 (8) stresses the importance of the prevention and reduction of air pollution;

(2) Whereas in particular the resolution of 19 October 1987 emphasises the importance of Community action to concentrate, *inter alia,* on implementation of appropriate standards in order to ensure a high level of public health and environmental protection;

(3) Whereas the European Community and its Member States are parties to the Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution concerning the control of emissions of volatile organic compounds in order to reduce their transboundary fluxes and the fluxes of the resulting secondary photochemical oxidant products so as to protect human health and the environment from adverse effects;

(4) Whereas pollution due to volatile organic compounds in one Member State often influences the air and water of other Member States; whereas, in accordance with Article 130r of the Treaty, action at Community level is necessary;

(5) Whereas, because of their characteristics, the use of organic solvents in certain activities and installations gives rise to emissions of organic compounds into the air which can be harmful for public health and/or contributes to the local and transboundary formation of photochemical oxidants in the boundary layer of the troposphere which cause damage to natural resources of vital environmental and economic importance and, under certain exposure conditions, has harmful effects on human health;

(6) Whereas the high incidence of high tropospheric ozone concentrations in recent years has triggered

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(1) OJ C 99, 26.3.1997, p. 32.

(2) OJ C 287, 22.9.1997, p. 55.

(3) Opinion of the European Parliament of 14 January 1998 (OJ C 34, 2.2.1998, p. 75), Council Common Position of 16 June 1998 (OJ C 248, 7.8.1998, p. 1) and Decision of the European Parliament of 21 October 1998 (OJ C 341, 9.11.1998, p. 70).

(4) OJ C 112, 20.12.1973, p. 1.

(5) OJ C 139, 13.6.1977, p. 1.

(6) OJ C 46, 17.2.1983, p. 1.

(7) OJ C 328, 7.12.1987, p. 1.

(8) OJ C 138, 1.2.1993, p. 1.

widespread concern regarding the impact on public health and the environment;

(7) Whereas, therefore, preventive action is required to protect public health and the environment against the consequences of particularly harmful emissions from the use of organic solvents and to guarantee citizens the right to a clean and healthy environment;

(8) Whereas emissions of organic compounds can be avoided or reduced in many activities and installations because potentially less harmful substitutes are available or will become available within the coming years; whereas, where appropriate substitutes are not available, other technical measures should be taken to reduce emissions into the environment as much as economically and technically feasible;

(9) Whereas the use of organic solvents and the emissions of organic compounds which have the most serious effects on public health should be reduced as much as technically feasible;

(10) Whereas installations and processes which fall under this Directive should at least be registered if they are not subject to authorisation under Community or national legislation;

(11) Whereas existing installations and activities should, where appropriate, be adapted so that within an appropriate period they meet the requirements established for new installations and activities; whereas that period should be consistent with the timetable for compliance of Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (1);

(12) Whereas the relevant parts of existing installations which undergo substantial change must, as a matter of principle, meet the new installation standards for the substantially changed equipment;

(13) Whereas organic solvents are used by many different types of installations and activities so that, in addition to general requirements, specific requirements should be defined and, at the same time, thresholds for the size of the installations or activities which have to comply with this Directive;

(14) Whereas a high level of environmental protection requires the setting and achievement of emission limits for organic compounds and appropriate operating conditions, in accordance with the principle of best available techniques, for certain installations and activities using organic solvents within the Community;

(15) Whereas in some cases Member States may exempt operators from complying with the emission limit values because other measures, such as the use of low-solvent or solvent-free products or techniques, provide alternative means of achieving equivalent emission reductions;

(16) Whereas emission-limiting measures adopted before the entry into force of this Directive should be taken into account in an appropriate way;

(17) Whereas alternative approaches to reduction may allow the objectives of this Directive to be achieved more effectively than by implementing uniform emission limit values; whereas, therefore, Member States may exempt existing installations from compliance with the emission limits if they implement a national plan, which will, within the timetable for implementation of this Directive, lead to an at least equal reduction in emissions of organic compounds from these activities and installations;

(18) Whereas existing installations falling under Directive 96/61/EC which are covered by a national plan can under no circumstances be exempted from the provisions of that Directive, including Article 9(4) thereof;

(19) Whereas in many cases small and medium-sized, new and existing installations may be allowed to comply with somewhat less stringent requirements to maintain their competitiveness;

(20) Whereas for dry cleaning a zero threshold is appropriate, subject to specified exemptions;

(21) Whereas monitoring of emissions is required, including the application of measurement techniques, to assess the mass concentrations or the quantity of the pollutants whose release into the environment is permitted;

(22) Whereas operators should reduce emissions of organic solvents, including fugitive emissions, and of organic compounds; whereas a solvent management plan is an important tool to verify this; whereas, although guidance may be given, the solvent management plan is not developed to the stage where a Community methodology can be established;

(23) Whereas Member States have to establish a procedure to be followed and measures to be taken where emission limitations are exceeded;

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(1) OJ L 257, 10.10.1996, p. 26.

(24) Whereas the Commission and the Member States should collaborate in order to ensure that information on the implementation of this Directive and on the progress of substitution options is exchanged,

HAS ADOPTED THIS DIRECTIVE:

Article 1

Purpose and scope

The purpose of this Directive is to prevent or reduce the direct and indirect effects of emissions of volatile organic compounds into the environment, mainly into air, and the potential risks to human health, by providing measures and procedures to be implemented for the activities defined in Annex I, in so far as they are operated above the solvent consumption thresholds listed in Annex IIA.

Article 2

Definitions

For the purposes of this Directive:

1. *installation* shall mean a stationary technical unit where one or more activities falling within the scope defined in Article 1 are carried out, and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions;

2. *existing installation* shall mean an installation in operation or, in accordance with legislation existing before the date on which this Directive is brought into effect, an installation which is authorised or registered or, in the view of the competent authority, the subject of a full request for authorisation, provided that the installation is put into operation no later than one year after the date on which this Directive is brought into effect;

3. *small installation* shall mean an installation which falls within the lower threshold band of items 1, 3, 4, 5, 8, 10, 13, 16 or 17 of Annex IIA or for the other activities of Annex IIA which have a solvent consumption of less than 10 tonnes/year;

4. *substantial change*

   — for an installation falling within the scope of Directive 96/61/EC, shall have the definition specified in that Directive,

   — for a small installation, shall mean a change of the nominal capacity leading to an increase of emissions of volatile organic compounds of more than 25 %. Any change that may have, in the opinion of the competent authority, significant negative effects on human health or the environment is also a substantial change,

   — for all other installations, shall mean a change of the nominal capacity leading to an increase of emissions of volatile organic compounds of more than 10 %. Any change that may have, in the opinion of the competent authority, significant negative effects on human health or the environment is also a substantial change;

5. *competent authority* shall mean the authority or authorities or bodies responsible under the legal provisions of the Member States for carrying out the obligations arising from this Directive;

6. *operator* shall mean any natural or legal person who operates or controls the installation or, where this is provided for in national legislation, to whom decisive economic power over the technical functioning of the installation has been delegated;

7. *authorisation* shall mean a written decision by which the competent authority grants permission to operate all or part of an installation;

8. *registration* shall mean a procedure, specified in a legal act, involving at least notification to the competent authority by the operator of the intention to operate an installation or activity falling within the scope of this Directive;

9. *emission* shall mean any discharge of volatile organic compounds from an installation into the environment;

10. *fugitive emissions* shall mean any emissions not in waste gases of volatile organic compounds into air, soil and water as well as, unless otherwise stated in Annex IIA, solvents contained in any products. They include uncaptured emissions released to the outside environment via windows, doors, vents and similar openings;

11. *waste gases* shall mean the final gaseous discharge containing volatile organic compounds or other pollutants, from a stack or abatement equipment into air. The volumetric flow rates shall be expressed in m^3/h at standard conditions;

12. *total emissions* shall mean the sum of fugitive emissions and emissions in waste gases;

13. *emission limit value* shall mean the mass of volatile organic compounds, expressed in terms of certain specific parameters, concentration, percentage and/or level of an emission, calculated at standard conditions, N, which may not be exceeded during one or more periods of time;

14. *substances* shall mean any chemical element and its compounds, as they occur in the natural state or as produced by industry, whether in solid or liquid or gaseous form;

15. *preparation* shall mean mixtures or solutions composed of two or more substances;

16. *organic compound* shall mean any compound containing at least the element carbon and one or more of hydrogen, halogens, oxygen, sulphur, phosphorus, silicon or nitrogen, with the exception of carbon oxides and inorganic carbonates and bicarbonates;

17. *volatile organic compound (VOC)* shall mean any organic compound having at 293,15 K a vapour pressure of 0,01 kPa or more, or having a corresponding volatility under the particular conditions of use. For the purpose of this Directive, the fraction of creosote which exceeds this value of vapour pressure at 293,15 K shall be considered as a VOC;

18. *organic solvent* shall mean any VOC which is used alone or in combination with other agents, and without undergoing a chemical change, to dissolve raw materials, products or waste materials, or is used as a cleaning agent to dissolve contaminants, or as a dissolver, or as a dispersion medium, or as a viscosity adjuster, or as a surface tension adjuster, or a plasticiser, or as a preservative;

19. *halogenated organic solvent* shall mean an organic solvent which contains at least one atom of bromine, chlorine, fluorine or iodine per molecule;

20. *coating* shall mean any preparation, including all the organic solvents or preparations containing organic solvents necessary for its proper application, which is used to provide a decorative, protective or other functional effect on a surface;

21. *adhesive* shall mean any preparation, including all the organic solvents or preparations containing organic solvents necessary for its proper application, which is used to adhere separate parts of a product;

22. *ink* shall mean a preparation, including all the organic solvents or preparations containing organic solvents necessary for its proper application, which is used in a printing activity to impress text or images on to a surface;

23. *varnish* shall mean a transparent coating;

24. *consumption* shall mean the total input of organic solvents into an installation per calendar year, or any other 12-month period, less any VOCs that are recovered for reuse;

25. *input* shall mean the quantity of organic solvents and their quantity in preparations used when carrying out an activity, including the solvents recycled inside and outside the installation, and which are counted every time they are used to carry out the activity;

26. *reuse of organic solvents* shall mean the use of organic solvents recovered from an installation for any technical or commercial purpose and including use as a fuel but excluding the final disposal of such recovered organic solvent as waste;

27. *mass flow* shall mean the quantity of VOCs released, in unit of mass/hour;

28. *nominal capacity* shall mean the maximum mass input of organic solvents by an installation averaged over one day, if the installation is operated under conditions of normal operation at its design output;

29. *normal operation* shall mean all periods of operation of an installation or activity except start-up and shut-down operations and maintenance of equipment;

30. *contained conditions* shall mean conditions under which an installation is operated such that the VOCs released from the activity are collected and discharged in a controlled way either via a stack or abatement equipment and are therefore not entirely fugitive;

31. *standard conditions* shall mean a temperature of 273,15 K and a pressure of 101,3 kPa;

32. *average over 24 hours* shall mean the arithmetic average of all valid readings taken during the 24-hour period of normal operation;

33. *start-up and shut-down operations* shall mean operations whilst bringing an activity, an equipment item or a tank into or out of service or into or out of an idling state. Regularly oscillating activity phases are not to be considered as start-ups and shut-downs.

Article 3

Obligations applying to new installations

Member States shall adopt the necessary measures to ensure that:

1. all new installations comply with Articles 5, 8 and 9;

2. all new installations not covered by Directive 96/61/EC are registered or undergo authorisation before being put into operation.

Article 4

Obligations applying to existing installations

Without prejudice to Directive 96/61/EC, Member States shall adopt the necessary measures to ensure that:

1. existing installations comply with Articles 5, 8 and 9 no later than 31 October 2007;

2. all existing installations must have been registered or authorised by 31 October 2007 at the latest;

3. those installations to be authorised or registered using the reduction scheme of Annex IIB notify this to the competent authorities by 31 October 2005 at the latest;

4. where an installation:

   — undergoes a substantial change, or

   — comes within the scope of this Directive for the first time following a substantial change,

   that part of the installation which undergoes the substantial change shall be treated either as a new installation or as an existing installation, provided that the total emissions of the whole installation do not exceed those that would have resulted had the substantially changed part been treated as a new installation.

Article 5

Requirements

1. Member States shall take the appropriate measures, either by specification in the conditions of the authorisation or by general binding rules to ensure that paragraphs 2 to 12 are complied with.

2. All installations shall comply with:

(a) either the emission limit values in waste gases and the fugitive emission values, or the total emission limit values, and other requirements laid down in Annex IIA;

or

(b) the requirements of the reduction scheme specified in Annex IIB.

3. (a) For fugitive emissions, Member States shall apply fugitive emission values to installations as an emission limit value. However, where it is demonstrated to the satisfaction of the competent authority that for an individual installation this value is not technically and economically feasible, the competent authority can make an exception for such an individual installation provided that significant risks to human health or the environment are not to be expected. For each derogation, the operator must demonstrate to the satisfaction of the competent authority that the best available technique is being used;

(b) activities which cannot be operated under contained conditions may be exempted from the controls of Annex IIA, when this possibility is explicitly mentioned in that Annex. The reduction scheme of Annex IIB is then to be used, unless it is demonstrated to the satisfaction of the competent authority that this option is not technically and economically feasible. In this case, the operator must demonstrate to the satisfaction of the competent authority that the best available technique is being used.

Member States shall report to the Commission on the derogation concerning paragraphs (a) and (b) in accordance with Article 11.

4. For installations not using the reduction scheme, any abatement equipment installed after the date on which this Directive is brought into effect shall meet all the requirements of Annex IIA.

5. Installations where two or more activities are carried out, each of which exceeds the thresholds in Annex IIA shall:

(a) as regards the substances specified in paragraphs 6, 7 and 8, meet the requirements of those paragraphs for each activity individually;

(b) as regards all other substances, either:

   (i) meet the requirements of paragraph 2 for each activity individually; or

   (ii) have total emissions not exceeding those that would have resulted had point (i) been applied.

6. Substances or preparations which, because of their content of VOCs classified as carcinogens, mutagens, or toxic to reproduction under Directive 67/548/EEC (¹), are assigned or need to carry the risk phrases R45, R46, R49, R60, R61, shall be replaced, as far as possible and by taking into account the guidance as mentioned in Article 7(1), by less harmful substances or preparations within the shortest possible time.

7. For discharges of the VOCs referred to in paragraph 6, where the mass flow of the sum of the compounds causing the labelling referred to in that paragraph is greater than, or equal to, 10 g/h, an emission limit value of 2 mg/Nm^3 shall be complied with. The emission limit value refers to the mass sum of the individual compounds.

8. For discharges of halogenated VOCs which are assigned the risk phrase R40, where the mass flow of the sum of the compounds causing the labelling R40 is greater than, or equal to, 100 g/h, an emission limit value of 20 mg/Nm^3 shall be complied with. The emission limit value refers to the mass sum of the individual compounds.

The discharge of VOCs referred to in paragraphs 6 and 8 shall be controlled as emissions from an installation under contained conditions as far as technically and economically feasible to safeguard public health and the environment.

9. Discharges of those VOCs which, after the entry into force of this Directive, are assigned or need to carry one of the risk phrases mentioned in paragraphs 6 and 8, shall have to comply with the emission limit values mentioned in paragraphs 7 and 8 respectively, within the shortest possible time.

10. All appropriate precautions shall be taken to minimise emissions during start-up and shut-down.

11. Existing installations which operate existing abatement equipment and comply with the following emission limit values:

— 50 mg C/Nm^3 in the case of incineration,

— 150 mg C/Nm^3 in the case of any other abatement equipment,

shall be exempt from the waste gases emission limit values in the table in Annex IIA for a period of 12 years after the date referred to in Article 15, provided the total emissions of the whole installation do not exceed those that would have resulted had all the requirements of the table been met.

12. Neither the reduction scheme nor the application of paragraph 11 nor Article 6 exempt installations discharging substances specified in paragraphs 6, 7 and 8 from fulfilling the requirements of those paragraphs.

13. Where a risk assessment is carried out in accordance with Council Regulation (EEC) No 793/93 (²) and Commission Regulation (EC) No 1488/94 (³) or Council Directive 67/548/EEC and Commission Directive 93/67/EEC (⁴) of any of the substances causing the labelling R40, R60 or R61 which are controlled under this Directive, the Commission shall consider the conclusions of the risk assessment and shall take the necessary measures as appropriate.

Article 6

National plans

1. Without prejudice to Directive 96/61/EC, Member States may define and implement national plans for reducing emissions from the activities and industrial installations covered by Article 1, excluding activities 4 and 11 of Annex IIA. None of the other activities may be excluded from the scope of this Directive by means of a national plan. These plans shall result in a reduction of the annual emissions of VOCs from existing installations covered by this Directive by at least the same amount and within the same time frame as would have been achieved by applying the emission limits under Article 5(2) and (3) and Annex II, during the validity period of the national plan. The national plan, if necessary updated, will be resubmitted to the Commission every three years.

A Member State which defines and implements national plans may exempt existing installations from implementation of the emission limit values laid down in Article 5(2) and (3) and Annex II. A national plan may under no circumstances exempt an existing installation from the provisions laid down in Directive 96/61/EC.

2. A national plan shall include a list of the measures taken or to be taken to ensure that the aim specified in paragraph 1 will be achieved, including details of the proposed plan monitoring mechanism. It shall also include binding interim reduction targets against which progress towards the aim can be measured. It shall be compatible with the relevant existing Community legislation,

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(¹) OJ 196, 16.8.1967, p. 1. Directive as last amended by Commission Directive 98/98/EC (OJ L 355, 30.12.1998, p. 1).

(²) OJ L 84, 5.4.1993, p. 1.

(³) OJ L 161, 29.6.1994, p. 3.

(⁴) OJ L 227, 8.9.1993, p. 9.

including the relevant provisions of this Directive, and shall include:

- an identification of the activity or activities to which the plan applies,
- the reduction in emissions to be achieved by those activities which corresponds to that which would have been achieved by applying the emission limits as specified in paragraph 1,
- the number of installations affected by the plan and their total emissions and the total emission of each of the activities.

The plan shall also include a full description of the range of instruments through which its requirements will be achieved, evidence that these instruments will be enforceable and details of the means by which compliance with the plan will be demonstrated.

3. The Member State shall submit the plan to the Commission. The plan must be accompanied by supporting documentation sufficient to verify that the aim of paragraph 1 will be achieved, including any documentation specifically requested by the Commission. Existing installations undergoing a substantial change shall remain within the scope of the national plan, provided that they were part of this plan before undergoing such substantial change.

4. The Member State shall designate a national authority for the collection and evaluation of the information required by paragraph 3 and for the implementation of the national plan.

5. (a) The Commission shall inform the committee referred to in Article 13 of the criteria for assessing national plans, one year after the entry into force of this Directive at the latest.

(b) If the Commission, in considering the plan, the resubmitted plan, or in considering the progress reports submitted by the Member State under Article 11, is not satisfied that the objectives of the plan will be achieved within the prescribed period, it shall inform the Member State and the committee referred to in Article 13 of its opinion and of the reasons for reaching such an opinion. It shall do so within six months of receipt of the plan or report. The Member State shall then notify the Commission and inform the committee, within three months, of the corrective measures it will take in order to ensure that the objectives are achieved.

6. If the Commission decides within six months of the notification of the corrective measures that those measures are insufficient to ensure that the objective of the plan is achieved within the prescribed period, the Member State shall be obliged to satisfy the requirements of Article 5(2) and (3) and Annex II within the period specified in this Directive in the case of existing installations. The Commission shall inform the committee referred to in Article 13 of its decision.

Article 7

Substitution

1. The Commission shall ensure that an exchange of information between Member States and the activities concerned on the use of organic substances and their potential substitutes takes place. It shall consider the questions of:

- fitness for use,
- potential effects on human health and occupational exposure in particular;
- potential effects on the environment, and
- the economic consequences, in particular, the costs and benefits of the options available,

with a view to providing guidance on the use of substances and techniques which have the least potential effects on air, water, soil, ecosystems and human health. Following the exchange of information, the Commission shall publish guidance for each activity.

2. Member States shall ensure that the guidance referred to in paragraph 1 is taken into account during authorisation and during the formulation of general binding rules.

Article 8

Monitoring

1. Member States shall introduce an obligation for the operator of an installation covered by this Directive to supply the competent authority once a year or on request with data that enables the competent authority to verify compliance with this Directive.

2. Member States shall ensure that channels to which abatement equipment is connected, and which at the final point of discharge emit more than an average of 10 kg/h of total organic carbon, are monitored continuously for compliance.

3. In the other cases, Member States shall ensure that either continuous or periodic measurements are carried out. For periodic measurements at least three readings shall be obtained during each measurement exercise.

4. Measurements are not required in the case where end-of-pipe abatement equipment is not needed to comply with this Directive.

5. The Commission shall organise an exchange of information on the use of solvent management plans in Member States based on the data for the implementation of this Directive in the three years following the date referred to in Article 15.

Article 9

Compliance with emission limit values

1. Compliance with the following shall be demonstrated to the satisfaction of the competent authority:

— emission limit values in waste gases, fugitive emission values and total emission limit values,

— the requirements of the reduction scheme under Annex IIB,

— the provisions of Article 5(3).

Guidance is provided in Annex III on solvent management plans serving to demonstrate compliance with these parameters.

Gas volumes may be added to the waste gas for cooling or dilution purposes where technically justified but shall not be considered when determining the mass concentration of the pollutant in the waste gas.

2. Following a substantial change, compliance shall be reverified.

3. In the case of continuous measurements the emission limit values shall be considered to be complied with if:

(a) none of the averages over 24 hours of normal operation exceeds the emission limit values, and

(b) none of the hourly averages exceeds the emission limit values by more than a factor of 1,5.

4. In the case of periodic measurements the emission limit values shall be considered to be complied with if, in one monitoring exercise:

(a) the average of all the readings does not exceed the emission limit values, and

(b) none of the hourly averages exceeds the emission limit value by more than a factor of 1,5.

5. Compliance with the provisions of Article 5(7) and (8) shall be verified on the basis of the sum of the mass concentrations of the individual volatile organic compounds concerned. For all other cases, compliance shall be verified on the basis of the total mass of organic carbon emitted unless otherwise specified in Annex IIA.

Article 10

Non-compliance

Member States shall take appropriate measures to ensure that, if it is found that the requirements of this Directive have been breached:

(a) the operator informs the competent authority and takes measures to ensure that compliance is restored within the shortest possible time;

(b) in cases of non-compliance causing immediate danger to human health and as long as compliance is not restored under the conditions of paragraph (a), operation of the activity is suspended.

Article 11

Information systems and reporting

1. At intervals of three years, Member States shall send information to the Commission on the implementation of this Directive in the form of a report. The report shall be drawn up on the basis of a questionnaire or outline drafted by the Commission in accordance with the procedure laid down in Article 6 of Directive 91/692/EEC (1). The questionnaire or outline shall be sent to the Member States six months before the start of the period covered by the report. The report shall be made to the Commission within nine months of the end of the three-year period covered by it. Member States shall publish the reports produced at the same time as they are transmitted to the Commission, subject to the restrictions laid down in Article 3(2) and (3) of Directive 90/313/EEC (2). The first report shall cover the period of the first three years after the date referred to in Article 15.

2. The information submitted under paragraph 1 shall, in particular, include sufficient representative data to demonstrate that the requirements of Article 5 and as the case may be, the requirements of Article 6 have been complied with.

3. The Commission shall draw up a report on the implementation of this Directive on the basis of the data provided by the Member States at the latest five years after the first reports are submitted by the Member States. The Commission shall submit this report to the European Parliament and the Council, accompanied by proposals if necessary.

Article 12

Public access to information

1. Without prejudice to Directive 90/313/EEC, Member States shall take the necessary measures to ensure that at

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(1) OJ L 377, 31.12.1991, p. 48.

(2) OJ L 158, 23.6.1990, p. 56.

least applications for authorisation for new installations or for substantial changes of those installations requiring a permit under Directive 96/61/EC are made available for an appropriate period of time to the public, to enable it to comment on them before the competent authority reaches a decision. Without prejudice to Directive 96/61/EC, no obligation to reformat the information for the public is implied.

The decision of the competent authority, including at least a copy of the authorisation, and any subsequent updates, must also be made available to the public.

The general binding rules applicable for installations and the list of registered and authorised activities shall be made available to the public.

2. The results of emission-monitoring as required under the authorisation or registration conditions referred to in Articles 8 and 9 and held by the competent authority must be made available to the public.

3. Paragraphs 1 and 2 shall apply, subject to the restrictions regarding grounds for refusal by public authorities to provide information, including commercial and industrial confidentiality, laid down in Article 3(2) and (3) of Directive 90/313/EEC.

Article 13

Committee

The Commission shall be assisted by a committee of an advisory nature composed of the representatives of the Member States and chaired by the representative of the Commission.

The representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft, within a time limit which the chairman may lay down according to the urgency of the matter, if necessary by taking a vote.

The opinion shall be recorded in the minutes; in addition, each Member State shall have the right to ask to have its position recorded in the minutes.

The Commission shall take the utmost account of the opinion delivered by the committee. It shall inform the committee of the manner in which its opinion has been taken into account.

Article 14

Sanctions

Member States shall determine the sanctions applicable to breaches of the national provisions adopted pursuant to this Directive and shall take all necessary measures for their implementation. The sanctions determined must be effective, proportionate and dissuasive. Member States shall notify these provisions to the Commission at the latest by the date mentioned in Article 15, and shall notify any subsequent modification of them as soon as possible.

Article 15

Transposition

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than ... April 2001. They shall forthwith inform the Commission thereof.

When Member States adopt these measures, they shall contain a reference to this Directive or shall be accompanied by such a reference on the occasion of their official publication. The methods of making such a reference shall be laid down by the Member States.

2. Member States shall communicate to the Commission the text of the main provisions of national law which they adopt in the field covered by this Directive.

Article 16

Entry into force

This Directive shall enter into force on the day of its publication in the *Official Journal of the European Communities*.

Article 17

Addressees

This Directive is addressed to the Member States.

Done at Brussels, 11 March 1999.

For the Council
The President
J. TRITTIN

ANNEX I

SCOPE

This Annex contains the categories of activity referred to in Article 1. When operated above the thresholds listed in Annex IIA, the activities mentioned in this Annex fall within the scope of the Directive. In each case the activity includes the cleaning of the equipment but not the cleaning of products unless specified otherwise.

Adhesive coating

- Any activity in which an adhesive is applied to a surface, with the exception of adhesive coating and laminating associated with printing activities.

Coating activity

- Any activity in which a single or multiple application of a continuous film of a coating is applied to:
  - vehicles as listed below:
    - new cars, defined as vehicles of category M1 in Directive 70/156/EEC (¹), and of category N1 in so far as they are coated at the same installation as M1 vehicles,
    - truck cabins, defined as the housing for the driver, and all integrated housing for the technical equipment, of vehicles of categories N2 and N3 in Directive 70/156/EEC,
    - vans and trucks, defined as vehicles of categories N1, N2 and N3 in Directive 70/156/EEC, but not including truck cabins,
    - buses, defined as vehicles of categories M2 and M3 in Directive 70/156/EEC,
  - trailers, defined in categories O1, O2, O3 and O4 in Directive 70/156/EEC,
  - metallic and plastic surfaces including surfaces of airplanes, ships, trains, etc.,
  - wooden surfaces,
  - textile, fabric, film and paper surfaces,
  - leather.

  It does not include the coating of substrate with metals by electrophoretic and chemical spraying techniques. If the coating activity includes a step in which the same article is printed by whatever technique used, that printing step is considered part of the coating activity. However, printing activities operated as a separate activity are not included, but may be covered by the Directive if the printing activity falls within the scope thereof.

Coil coating

- Any activity where coiled steel, stainless steel, coated steel, copper alloys or aluminium strip is coated with either a film forming or laminate coating in a continuous process.

Dry cleaning

- Any industrial or commercial activity using VOCs in an installation to clean garments, furnishing and similar consumer goods with the exception of the manual removal of stains and spots in the textile and clothing industry.

(¹) OJ L 42, 23.2.1970, p. 1. Directive as last amended by Directive 97/27/EC (OJ L 233, 25.8.1997, p. 1).

Footwear manufacture

- Any activity of producing complete footwear or parts thereof.

Manufacturing of coating preparations, varnishes, inks and adhesives

- The manufacture of the above final products, and of intermediates where carried out at the same site, by mixing of pigments, resins and adhesive materials with organic solvent or other carrier, including dispersion and predispersion activities, viscosity and tint adjustments and operations for filling the final product into its container.

Manufacturing of pharmaceutical products

- The chemical synthesis, fermentation, extraction, formulation and finishing of pharmaceutical products and where carried out at the same site, the manufacture of intermediate products.

Printing

- Any reproduction activity of text and/or images in which, with the use of an image carrier, ink is transferred onto whatever type of surface. It includes associated varnishing, coating and laminating techniques. However, only the following sub-processes are subject to the Directive:
  - *flexography* — a printing activity using an image carrier of rubber or elastic photopolymers on which the printing areas are above the non-printing areas, using liquid inks which dry through evaporation,
  - *heatset web offset* — a web-fed printing activity using an image carrier in which the printing and non-printing area are in the same plane, where web-fed means that the material to be printed is fed to the machine from a reel as distinct from separate sheets. The non-printing area is treated to attract water and thus reject ink. The printing area is treated to receive and transmit ink to the surface to be printed. Evaporation takes place in an oven where hot air is used to heat the printed material,
  - *laminating associated to a printing activity* — the adhering together of two or more flexible materials to produce laminates,
  - *publication rotogravure* — a rotogravure printing activity used for printing paper for magazines, brochures, catalogues or similar products, using toluene-based inks,
  - *rotogravure* — a printing activity using a cylindrical image carrier in which the printing area is below the non-printing area, using liquid inks which dry through evaporation. The recesses are filled with ink and the surplus is cleaned off the non-printing area before the surface to be printed contacts the cylinder and lifts the ink from the recesses,
  - *rotary screen printing* — a web-fed printing activity in which the ink is passed onto the surface to be printed by forcing it through a porous image carrier, in which the printing area is open and the non-printing area is sealed off, using liquid inks which dry only through evaporation. Web-fed means that the material to be printed is fed to the machine from a reel as distinct from separate sheets,
  - *varnishing* — an activity by which a varnish or an adhesive coating for the purpose of later sealing the packaging material is applied to a flexible material.

Rubber conversion

- Any activity of mixing, milling, blending, calendering, extrusion and vulcanisation of natural or synthetic rubber and any ancillary operations for converting natural or synthetic rubber into a finished product.

Surface cleaning

- Any activity except dry cleaning using organic solvents to remove contamination from the surface of material including degreasing. A cleaning activity consisting of more than one step before or after any other activity shall be considered as one surface cleaning activity. This activity does not refer to the cleaning of the equipment but to the cleaning of the surface of products.

Vegetable oil and animal fat extraction and vegetable oil refining activities

— Any activity to extract vegetable oil from seeds and other vegetable matter, the processing of dry residues to produce animal feed, the purification of fats and vegetable oils derived from seeds, vegetable matter and/or animal matter.

Vehicle refinishing

— Any industrial or commercial coating activity and associated degreasing activities performing:

  — the coating of road vehicles as defined in Directive 70/156/EEC, or part of them, carried out as part of vehicle repair, conservation or decoration outside of manufacturing installations, or

  — the original coating of road vehicles as defined in Directive 70/156/EEC or part of them with refinishing-type materials, where this is carried out away from the original manufacturing line, or

  — the coating of trailers (including semi-trailers) (category O).

Winding wire coating

— Any coating activity of metallic conductors used for winding the coils in transformers and motors, etc.

Wood impregnation

— Any activity giving a loading of preservative in timber.

Wood and plastic lamination

— Any activity to adhere together wood and/or plastic to produce laminated products.

ANNEX IIA

I. THRESHOLDS AND EMISSION CONTROLS

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
1	Heatset web offset printing (> 15)	15—25 > 25	100 20	30 (1) 30 (1)				(1) Solvent residue in finished product is not to be considered as part of fugitive emissions.
2	Publication rotogravure (> 25)		75	10	15			
3	Other rotogravure, flexography, rotary screen printing, laminating or varnishing units (> 15) rotary screen printing on textile/cardboard (> 30)	15—25 > 25 > 30 (1)	100 100 100	25 20 20				(1) Threshold for rotary screen printing on textile and on cardboard.
4	Surface cleaning (1) (> 1)	1—5 > 5	20 (2) 20 (2)	15 10				(1) Using compounds specified in Article 5(6) and (8). (2) Limit refers to mass of compounds in mg/Nm^3, and not to total carbon.
5	Other surface cleaning (> 2)	2—10 > 10	75 (1) 75 (1)	20 (1) 15 (1)				(1) Installations which demonstrate to the competent authority that the average organic solvent content of all cleaning material used does not exceed 30 % by weight are exempt from application of these values.
6	Vehicle coating (< 15) and vehicle refinishing	> 0,5	50 (1)	25				(1) Compliance in accordance with Article 9(3) should be demonstrated based on 15 minute average measurements.

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
7	Coil coating (> 25)		50 (1)	5	10			(1) For installations which use techniques which allow reuse of recovered solvents, the emission limit shall be 150.
8	Other coating, including metal, plastic, textile (5), fabric, film and paper coating (> 5)	5—15 > 15	100 (1) (4) 50/75 (2) (3) (4)	20 (4) 20 (4)				(1) Emission limit value applies to coating application and drying processes operated under contained conditions. (2) The first emission limit value applies to drying processes, the second to coating application processes. (3) For textile coating installations which use techniques which allow reuse of recovered solvents, the emission limit applied to coating application and drying processes taken together shall be 150. (4) Coating activities which cannot be applied under contained conditions (such as shipbuilding, aircraft painting) may be exempted from these values, in accordance with Article 5(3)(b). (5) Rotary screen printing on textile is covered by activity No 3.
9	Winding wire coating (> 5)					10 g/kg (1) 5 g/kg (2)		(1) Applies for installations where average diameter of wire ≤ 0,1 mm. (2) Applies for all other installations.
10	Coating of wooden surfaces (> 15)	15—25 > 25	100 (1) 50/75 (2)	25 20				(1) Emission limit applies to coating application and drying processes operated under contained conditions. (2) The first value applies to drying processes, the second to coating application processes.

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
11	Dry cleaning					20 g/kg (1) (2) (3)		(1) Expressed in mass of solvent emitted per kilogram of product cleaned and dried. (2) The emission limit in Article 5(8) does not apply for this sector. (3) The following exemption refers only to Greece: the total emission limit value does not apply, for a period of 12 years after the date on which this Directive is brought into effect, to existing installations located in remote areas and/or islands, with a population of no more than 2 000 permanent inhabitants where the use of advanced technology equipment is not economically feasible.
12	Wood impregnation (> 25)		100 (1)	45		11 kg/m^3		(1) Does not apply for impregnation with creosote.
13	Coating of leather (> 10)	10—25 > 25 (> 10) (1)				85 g/m^2 75 g/m^2 150 g/m^2		Emission limits are expressed in grams of solvent emitted per m^2 of product produced. (1) For leather coating activities in furnishing and particular leather goods used as small consumer goods like bags, belts, wallets, etc.
14	Footwear manufacture (> 5)					25 g per pair		Total emission limit values are expressed in grams of solvent emitted per pair of complete footwear produced.
15	Wood and plastic lamination (> 5)					30 g/m^2		

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
16	Adhesive coating (> 5)	5—15 > 15	50 (1) 50 (1)	25 20				(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150.
17	Manufacture of coating preparations, varnishes, inks and adhesives (> 100)	100—1 000 > 1 000	150 150	5 3		5 % of solvent input 3 % of solvent input		The fugitive emission value does not include solvent sold as part of a coatings preparation in a sealed container.
18	Rubber conversion (> 15)		20 (1)	25 (2)		25 % of solvent input		(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150. (2) The fugitive emission value does not include solvent sold as part of products or preparations in a sealed container.
19	Vegetable oil and animal fat extraction and vegetable oil refining activities (> 10)					Animal fat: 1,5 kg/tonne Castor: 3 kg/tonne Rape seed: 1 kg/tonne Sunflower seed: 1 kg/tonne Soya beans (normal crush): 0,8 kg/tonne Soya beans (white flakes): 1,2 kg/tonne Other seeds and other vegetable matter: 3 kg/tonne (1) 1,5 kg/tonne (2) 4 kg/tonne (3)		(1) Total emission limit values for installations processing individual batches of seeds and other vegetable matter should be set by the competent authority on a case-by-case basis, applying the best available techniques. (2) Applies to all fractionation processes excluding de-gumming (the removal of gums from the oil). (3) Applies to de-gumming.

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases ($mg\ C/Nm^3$)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
20	Manufacturing of pharmaceutical products (> 50)		20 (1)	5 (2)	15 (2)	5 % of solvent input	15 % of solvent input	(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150. (2) The fugitive emission limit value does not include solvent sold as part of products or preparations in a sealed container.

II. THE VEHICLE COATING INDUSTRY

The total emission limit values are expressed in terms of grams of solvent emitted in relation to the surface area of product in square metres and in kilograms of solvent emitted in relation to the car body.

The surface area of any product dealt with in the table below is defined as follows:

— the surface area calculated from the total electrophoretic coating area, and the surface area of any parts that might be added in successive phases of the coating process which are coated with the same coatings as those used for the product in question, or the total surface area of the product coated in the installation.

The surface of the electrophoretic coating area is calculated using the formula:

$$\frac{2 \times \text{total weight of product shell}}{\text{average thickness of metal sheet} \times \text{density of metal sheet}}$$

This method shall also be applied for other coated parts made out of sheets.

Computer aided design or other equivalent methods shall be used to calculate the surface area of the other parts added, or the total surface area coated in the installation.

The total emission limit value in the table below refers to all process stages carried out at the same installation from electrophoretic coating, or any other kind of coating process, through to the final wax and polish of topcoating inclusive, as well as solvent used in cleaning of process equipment, including spray booths and other fixed equipment, both during and outside of production time. The total emission limit value is expressed as the mass sum of organic compounds per m^2 of the total surface area of coated product and as the mass sum of organic compounds per car body.

Activity (solvent consumption threshold in tonnes/year)	Production threshold (refers to annual production of coated item)	Total emission limit value	
		New	Existing
Coating of new cars (> 15)	> 5 000	$45\ g/m^2$ or $1,3$ kg/body + $33\ g/m^2$	$60\ g/m^2$ or $1,9$ kg/body + $41\ g/m^2$
	≤ 5 000 monocoque or > 3 500 chassis-built	$90\ g/m^2$ or $1,5$ kg/body + $70\ g/m^2$	$90\ g/m^2$ or $1,5$ kg/body + $70\ g/m^2$

Activity (solvent consumption threshold in tonnes/year)	Production threshold (refers to annual production of coated item)	Total emission limit value	
		New	Existing
		Total emission limit (g/m^2)	
Coating of new truck cabins (> 15)	≤ 5 000 > 5 000	65 55	85 75
Coating of new vans and trucks (> 15)	≤ 2 500 > 2 500	90 70	120 90
Coating of new buses (> 15)	≤ 2 000 > 2 000	210 150	290 225

Vehicle coating installations below the solvent consumption thresholds in the table above shall meet the requirements for the vehicle refinishing sector in Annex IIA.

ANNEX IIB

REDUCTION SCHEME

1. Principles

The purpose of the reduction scheme is to allow the operator the possibility to achieve by other means emission reductions, equivalent to those achieved if the emission limit values were to be applied. To that end the operator may use any reduction scheme, specially designed for his installation, provided that in the end an equivalent emission reduction is achieved. Member States shall report according to Article 11 of the Directive to the Commission about the progress in achieving the same emission reduction, including the experience from the application of the reduction scheme.

2. Practice

In the case of applying coatings, varnishes, adhesives or inks, the following scheme can be used. Where the following method is inappropriate the competent authority may allow an operator to apply any alternative exemption scheme which it is satisfied fulfils the principles outlined here. The design of the scheme takes into account the following facts:

(i) where substitutes containing little or no solvent are still under development, a time extension must be given to the operator to implement his emission reduction plans;

(ii) the reference point for emission reductions should correspond as closely as possible to the emissions which would have resulted had no reduction action been taken.

The following scheme shall operate for installations for which a constant solid content of product can be assumed and used to define the reference point for emission reductions:

(i) the operator shall forward an emission reduction plan which includes in particular decreases in the average solvent content of the total input and/or increased efficiency in the use of solids to achieve a reduction of the total emissions from the installation to a given percentage of the annual reference emissions, termed the target emission. This must be done on the following time frame:

Time period		Maximum allowed total annual emissions
New installations	Existing installations	
By 31.10.2001	By 31.10.2005	Target emission × 1,5
By 31.10.2004	By 31.10.2007	Target emission

(ii) The annual reference emission is calculated as follows:

(a) The total mass of solids in the quantity of coating and/or ink, varnish or adhesive consumed in a year is determined. Solids are all materials in coatings, inks, varnishes and adhesives that become solid once the water or the volatile organic compounds are evaporated.

(b) The annual reference emissions are calculated by multiplying the mass determined in (a) by the appropriate factor listed in the table below. Competent authorities may adjust these factors for individual installations to reflect documented increased efficiency in the use of solids.

Activity	Multiplication factor for use in item (ii)(b)
Rotogravure printing; flexography printing; laminating as part of a printing activity; varnishing as part of a printing activity; wood coating; coating of textiles, fabric film or paper; adhesive coating	4
Coil coating, vehicle refinishing	3
Food contact coating, aerospace coatings	2,33
Other coatings and rotary screen printing	1,5

(c) The target emission is equal to the annual reference emission multiplied by a percentage equal to:

— (the fugitive emission value + 15), for installations falling within item 6 and the lower threshold band of items 8 and 10 of Annex IIA,

— (the fugitive emission value + 5) for all other installations.

(d) Compliance is achieved if the actual solvent emission determined from the solvent management plan is less than or equal to the target emission.

ANNEX III

SOLVENT MANAGEMENT PLAN

1. Introduction

This Annex provides guidance on carrying out a solvent management plan. It identifies the principles to be applied (item 2) and provides a framework for the mass balance (item 3) and an indication of the requirements for verification of compliance (item 4).

2. Principles

The solvent management plan serves the following purposes:

(i) verification of compliance as specified in Article 9(1);

(ii) identification of future reduction options;

(iii) enabling of the provision of information on solvent consumption, solvent emissions and compliance with the Directive to the public.

3. Definitions

The following definitions provide a framework for the mass balance exercise.

Inputs of organic solvents (I):

I1 The quantity of organic solvents or their quantity in preparations purchased which are used as input into the process in the time frame over which the mass balance is being calculated.

I2 The quantity of organic solvents or their quantity in preparations recovered and reused as solvent input into the process. (The recycled solvent is counted every time it is used to carry out the activity.)

Outputs of organic solvents (O):

O1 Emissions in waste gases.

O2 Organic solvents lost in water, if appropriate taking into account waste water treatment when calculating O5.

O3 The quantity of organic solvents which remains as contamination or residue in products output from the process.

O4 Uncaptured emissions of organic solvents to air. This includes the general ventilation of rooms, where air is released to the outside environment via windows, doors, vents and similar openings.

O5 Organic solvents and/or organic compounds lost due to chemical or physical reactions (including for example those which are destroyed, e.g. by incineration or other waste gas or waste water treatments, or captured, e.g. by adsorption, as long as they are not counted under O6, O7 or O8).

O6 Organic solvents contained in collected waste.

O7 Organic solvents, or organic solvents contained in preparations, which are sold or are intended to be sold as a commercially valuable product.

O8 Organic solvents contained in preparations recovered for reuse but not as input into the process, as long as not counted under O7.

O9 Organic solvents released in other ways.

4. Guidance on use of the solvent management plan for verification of compliance

The use made of the solvent management plan will be determined by the particular requirement which is to be verified, as follows:

(i) Verification of compliance with the reduction option in Annex IIB, with a total emission limit value expressed in solvent emissions per unit product, or otherwise stated in Annex IIA.

(a) For all activities using Annex IIB the solvent management plan should be done annually to determine consumption (C). Consumption can be calculated according to the following equation:

$C = I1 - O8$

A parallel exercise should also be undertaken to determine solids used in coating in order to derive the annual reference emission and the target emission each year.

(b) For assessing compliance with a total emission limit value expressed in solvent emissions per unit product or otherwise stated in Annex IIA, the solvent management plan should be done annually to determine emissions (E). Emissions can be calculated according to the following equation:

$E = F + O1$

where F is the fugitive emission as defined in section (ii)(a). The emission figure should then be divided by the relevant product parameter.

(c) For assessing compliance with the requirements of Article 5(5)(b)(ii), the solvent management plan should be done annually to determine total emissions from all activities concerned, and that figure should then be compared with the total emissions that would have resulted had the requirements of Annex II been met for each activity separately.

(ii) Determination of fugitive emissions for comparison with fugitive emission values in Annex IIA:

(a) *Methodology*

The fugitive emission can be calculated according to the following equation:

$F = I1 - O1 - O5 - O6 - O7 - O8$

or

$F = O2 + O3 + O4 + O9$

This quantity can be determined by direct measurement of the quantities. Alternatively, an equivalent calculation can be made by other means, for instance by using the capture efficiency of the process.

The fugitive emission value is expressed as a proportion of the input, which can be calculated according to the following equation:

$I = I1 + I2$

(b) *Frequency*

Determination of fugitive emissions can be done by a short but comprehensive set of measurements. It need not be done again until the equipment is modified.

附件二：2002 年歐盟委員會對溶劑排放公約之修正提案

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COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 23.12.2002
COM(2002) 750 final

2002/0301 (COD)

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

On the limitation of emissions of volatile organic compounds due to the use of organic solvents in decorative paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC

(presented by the Commission)

EXPLANATORY MEMORANDUM

1. INTRODUCTION

The Sixth Action Programme

The Sixth Environment Action Programme (6EAP)[1] recognises that significant effort is still required to reduce emissions so that all citizens of the Community can enjoy clean air. For this reason, air quality is one of the areas for which the 6EAP foresees the adoption of a thematic strategy. This will be developed in the context of the Clean Air for Europe programme (CAFE) announced by the Commission in 2001[2].

The main objectives are to identify omissions in present policy, and priorities for further action, especially for particulate matter and for tropospheric ozone ("photochemical smog"), taking into account risks to vulnerable groups. The CAFE programme will review and, if necessary, update existing air quality standards and national emission ceilings and develop better systems for gathering information, modelling and forecasting. The objective is to achieve levels of air quality with no unacceptable impact on, and risks to, human health and the environment.

This proposal is consistent with the CAFE programme. For the reasons given it is clear that since volatile organic compounds contribute to the formation of tropospheric ozone, further reductions in their emissions are required to meet current environmental goals and to contribute to further environmental improvement in the longer term. This was also recognised by the Council, which, when adopting the Common Position for a Directive on National Emission Ceilings,[3] invited the Commission to come up with legislative proposals to help meet current and future obligations to reduce emissions of volatile organic compounds.

Background

Scientific basis

Volatile organic compounds (VOC's) are emitted into the air from the processes where they are used or produced: in transport there are emissions in the form of evaporation from hydrocarbon-based fuels and vehicle exhausts and there are emissions from the use of solvent-containing products. These emissions undergo chemical reactions in the atmosphere, which cause a number of indirect effects, in particular the formation of photochemical oxidants such as tropospheric ozone. When highly concentrated in air, ozone can impair human health and can damage forests, vegetation and crops, reducing yields. Ozone is also a potent greenhouse gas. VOC's cause episodic ozone formation at local and at regional level, involving precursors and photochemical oxidants transported over long distances.

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[1] OJ L 242, 10.9.2002, p. 1.

[2] COM(2001)245, 4.5.2001.

[3] A substantial reduction in VOC emissions will be necessary if the interim environmental objectives set out in Article 5 of the Directive on national emission ceilings for certain pollutants are to be met by 2010. In view of this, the Environmental Council strongly urges the Commission to propose Community rules on products, so as to reduce VOC emissions. These rules would have to be in force by 2004 in order to take this reduction into account in the evaluation of the directive on national emission ceilings (Council Declaration in Annex 4 from the report on the 2278th meeting of the "Environment" Council, Luxembourg, 22 June 2000).

Pollution by tropospheric ozone in the European Community

Pollution by tropospheric ozone is a widespread and chronic problem within the Community. Data submitted by the Member States to the Commission under Directive 92/72/EEC[4] indicate that during the summer months the threshold level for the protection of human health (110 µgm^{-3}, expressed as an average value over eight hours) is exceeded in all the Member States and that in urban environments more than 40 million people are estimated to be exposed to potentially harmful concentrations of this aggressive pollutant. Similarly, monitoring data indicates that the threshold value for the protection of vegetation (65µgm^{-3} expressed as an average value over 24 hours) is exceeded in all Member States. Directive 2002/3/EC[5] sets even more ambitious thresholds and target values. Member States must transpose this Directive by September 2003.

As a result of ozone pollution, sensitive members of the population can expect to experience symptoms such as eye irritation, sore throats and respiratory problems. In the environment, it affects photosynthesis producing lesions and discoloration of leaves, thus adversely affecting the yield of certain crops.

Further to the Framework Directive on ambient air quality management and assessment, a new Directive establishing air quality objectives and target values for ozone has recently been adopted.[6] Member States are required to establish air quality management plans setting out the measures they will take to reach these target values and objectives. While Member States will benefit from existing Community legislation to reduce VOC emissions, it is clear that further measures at Community level are necessary.

Community legislation to reduce VOC emissions

There is already a substantial body of legislation in the Community to reduce emissions of volatile organic compounds into the air. Directive 96/61/EC[7] on Integrated Pollution Prevention and Control addresses reduction of emissions into all media from a large number of industrial sectors. Directive 1999/13/EC[8] on the limitation of volatile organic compounds due to the use of organic solvents in certain activities and installations specifically addresses emissions of volatile organic compounds from industrial sectors that are substantial users of solvents by setting both stack and fugitive emission limit values. In addition, that Directive sets out to clean up production processes by proposing solvent emission reduction plans as an alternative method of compliance to the conventional use of pollution abatement equipment.

In the transport sector, the Auto Oil I programme resulted in tighter vehicle emissions standards (Directive 98/69/EC[9]), along with the necessary improvements in fuel quality[10] to ensure the effectiveness of more advanced exhaust emission abatement equipment. Directive 94/63/EC[11] also seeks to reduce VOC emissions from transport by requiring vapour recovery at various points in the petrol distribution chain.

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[4] OJ L 297, 13.10.1992, p. 1.

[5] OJ L 67, 9.3.2002, p. 14.

[6] OJ L 67, 9.3.2002, p. 14.

[7] OJ L 257, 10.10.1996, p. 26.

[8] OJ L 85, 29.3.1999, p. 1.

[9] Directive 98/69/EC (OJ L 350, 28.12.1998, p. 1) relating to measures to be taken against air pollution by emissions from motor vehicles.

[10] Directive 98/70/EC (OJ L 350, 28.12.1998, p. 58) on the quality of petrol and diesel fuels. Amended by Commission Directive 2000/71/EC (OJ L 287, 28.11.2000, p. 46) to adapt the measuring methods.

Table 1 gives a breakdown of EU emissions for 2010 by source category. Existing Community legislation has helped bring about a 50% reduction in all projected man-made VOC emissions in 2010 compared to a 1990 baseline.

The National Emission Ceilings Directive

Because there is a transboundary dimension to the formation of tropospheric ozone, the Commission proposed a Directive introducing national emission ceilings (NEC), whereby national emissions of sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia would be restricted to certain ceilings in each Member State in 2010. The analysis underpinning this proposal took into account the geographical distribution of emission sources throughout the Community, the long-range transport aspect, the cost effectiveness of emission reductions for each pollutant in each Member State, and the need to simultaneously reach environmental targets for both acidification and tropospheric ozone (because nitrogen oxide contributes both to tropospheric ozone formation and acidification).

Although emissions of VOCs in the Community are predicted to fall from 14.1 million tonnes in 1990 to 7.1 million tonnes by 2010, the Commission's analysis[12] showed that it would be necessary to reduce emissions of VOCs to 5.5 million tonnes in 2010 to meet even interim environmental objectives for this pollutant. According to the relevant studies (see footnote 12), to ensure complete protection of public health and vegetation, emissions will have to be reduced still further in the longer term.

After prolonged and difficult negotiations in Council and the European Parliament, Member States were able to commit to national emission ceilings for 2010 which give a combined Community ceiling of 6.5 million tonnes.[13] In so doing Member States highlighted the difficulty of reducing VOC emissions and asked the Commission to come up with further proposals in this area, in particular concerning the VOC content of products (see Table 2).

2. PRODUCTS CONTAINING VOCs

Emissions from products used in industry which contain volatile organic compounds are in part covered by Community legislation. Directive 1999/13/EC - on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations - applies to a number of solvent using sectors. The Directive also covers emissions from the use of VOC-containing products in vehicle refinishing. However, as Directive 1999/13/EC is based on an authorisation system to reduce emissions from installations, there were practical limitations as regards implementation and enforcement given the size and number of installations amenable to an authorisation approach. Consumption thresholds were thus established below which the Directive would not apply in order to avoid an unrealistically excessive administrative burden, and diminishing

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[11] OJ L 365, 31.12.1994, p. 24.

[12] Cost-effective control of acidification and ground-level ozone (reports 1 to 8, IIASA)

[13] Directive 2001/81/EC on national emission ceilings for certain air pollutants, OJ L 309, 27.11.1999, p. 22.

environmental benefits. The Commission was therefore invited to explore product-based approaches, particularly as an alternative for the vehicle-refinishing sector.[14]

On the basis of a number of studies[15,16,17] the Commission has identified the following sectors as large users of VOCs and also sectors that at present are either wholly or partially outside the scope of Community legislation to limit VOC emissions:

- Paint industry: annual solvent usage is estimated at 1.5 million tonnes. About 50% of these products are "decorative paints", which are retailed to private individuals or professional decorators. Emissions from the use of these products are not controlled by Council Directive 1999/13/EC.

- Ink industry: annual solvent usage is estimated at 125 kilotonnes, principally in installations covered by Council Directive 1999/13/EC.

- Cosmetics, toiletries, perfumes: annual solvent usage is estimated at 200 kilotonnes/year. Emissions from the use of these products are not controlled by Council Directive 1999/13/EC.

- Cleaning materials and polishes: the range of products varies widely, but some may contain large amounts of VOCs. Annual solvent usage is estimated at 300 kilotonnes/year.

- Products used in the vehicle-refinishing sector: Annual solvent usage is estimated at 45 kilotonnes/year.

It is clear from the above that paints and related products sold retail represent a significant source of VOC emissions although, even without legislation, there has already been a considerable shift away from solvent-based paint products to water-based products.

Two Commission studies looked in particular at decorative paint products[18] and vehicle refinishing products.[19] Both concluded that on the basis of established trends in these sectors in favour of products with lower solvent content, it would be technically and economically possible to reduce VOC content further within a realistic timeframe and without compromising product quality. These studies indicate that VOC emissions could be reduced by approximately 280 kt by 2010 (see Table 3 - Phase II) by reducing the solvent content of decorative paint and varnish products and by approximately 15kt by reducing the solvent content of vehicle refinishing products. These studies have highlighted some uncertainties in the technical feasibility and economic viability of significant improvement in certain product categories. This has been reflected in the maximum content limit values set out in this proposal.

There is less potential for reducing the solvent content in other product groups at this stage. In some product groups, VOCs are used in propellant systems to replace substances which were depleting the stratospheric ozone layer. The Commission has thus decided that further consideration is required before proposing any measures for these product groups in order to ensure that all the measures designed to achieve these particular environmental policy objectives are consistent.

Vehicle Refinishing Sector

Directive 1999/13/EC sets emission limit values for the vehicle refinishing sector which apply to plants with solvent consumption greater than 0.5 tonnes per year. The proposed product-based approach will reduce emissions from the sector as a whole, whereas the current provisions in Directive 1999/13/EC allow an exemption for plants using less than 0.5 tonnes of solvent per year. However, for the Community to set maximum VOC contents for products used in the sector and also to set limit values for emissions from the facilities themselves would be duplication. It is therefore proposed to repeal the relevant provisions of Directive 1999/13/EC.

3. DESCRIPTION OF THE LEGISLATIVE SITUATION IN THE MEMBER STATES

Austria

Legislation limits the VOC content of decorative coatings, lacquers and varnishes used to coat wooden floors. There is a ban on the sale of certain consumer products, and the use of other products aimed at professional users is prohibited.

Denmark

Legislation is already in place to protect worker health based on the "MAL-code" labelling system, so the sale of certain products is prohibited. Legislation on the VOC content of consumer paints is under preparation.

The Netherlands

Paints with high VOC contents have been prohibited for interior use by professional painters since 1/1/2000 because of occupational health concerns.

Sweden

Restrictions similar to those in the Netherlands have been in force since 1987.

France

The French have introduced the eco-label "*NF Environnement*" for paints and vanishes.

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[14] "The Council invites the Commission to present, as an alternative for controlling sector 6 of Annex IIA to this directive as a first step, its proposal for a regulation through a product based approach within the shortest possible time and consequently the adaptation or removal of this sector from the scope of this Directive." - Addendum to the minutes of the 2165th Council meeting on the environment held in Brussels on 11 March 1999.

[15] Study on the potential for reducing emissions of volatile organic compounds (VOC) due to the use of decorative paints and varnishes for professional and non-professional use (Chemiewinkel, Enterprise Ireland and Wetenschappelijk instituut voor milieu-management, June 2000).

[16] Reducing VOC emissions from the vehicle-refinishing sector (Entec UK Limited and the paint research Association, August 2000).

[17] Study to identify reductions in VOC emissions due to restrictions in the VOC content of products (Bipro, AFC consult and DFIU-IFARE, February 2002).

[18] Study on the potential for reducing emissions of volatile organic compounds (VOC) due to the use of decorative paints and varnishes for professional and non-professional use (Chemiewinkel, Enterprise Ireland and Wetenschappelijk instituut voor milieu-management, June 2000).

[19] Reducing VOC emissions from the vehicle-refinishing sector (Entec UK Limited and the paint research Association, August 2000).

Germany

The preparation of legislation on the VOC content of paints is being considered. There is a national eco-label *"Blaue Engel"* for paints.

Spain

The Spanish have had an eco-label for paints and varnishes *"AENOR medio ambiente"* since 1994.

Greece, Italy, Luxembourg, Portugal, Ireland, Finland and **Belgium** have no specific legislation to control the VOC content of products for environmental purposes, although **Belgium** has recently notified the Commission that it intends to introduce legislation on this subject.

Justification for Community action

A Commission Decision[20] already specifies ecological criteria, including VOC content, for the eco-labelling of paints and varnishes. Community eco-labels are awarded on the basis of a life cycle analysis, which encompasses manufacturing, limiting substances which harm the environment and health, reducing air pollution, reducing potential for hazardous waste production, and health and environmental labelling for consumer information. The eco-label criterion for VOC content is more ambitious than the mandatory values prescribed herein, but compliance is voluntary.

As described above, emissions of volatile organic compounds can contribute to tropospheric ozone formation both in the Member States where they are emitted and elsewhere due to long range transboundary transport. Thus, while Member States are able to take some measures domestically to reduce VOC emissions to counter the formation of tropospheric ozone formation, no Member State can comprehensively control its exposure to this pollutant. Moreover, a Community level product-oriented legislation offers the best guarantees to attain the proposed environmental aim in a cost-effective way while preserving the Internal Market.

The transboundary problem and the need to take co-ordinated action is clearly covered by the recently adopted Gothenburg Protocol under the Geneva Convention on Long-Range Transboundary Air Pollution to which the Member States and the Community are Parties.[21] The Commission therefore believes that action at Community level is justified both to ensure a co-ordinated response within the Community and to enable the Community to help combat this pollutant within the broader geographical dimension of the United Nations Economic Commission for Europe, many members of which are candidate countries.

Choice of legal instrument

Although there are pressing reasons for Community action in this field, a number of approaches were considered before deciding on the most effective and efficient instrument.

Voluntary commitments by industrial stakeholders, although they already led to a shift towards low-VOC content products, were considered to be insufficient in terms of providing the necessary assurance that the objectives would be achieved, having regard to the large number of manufacturers in the sector and the certain difficulties of monitoring and enforcing compliance. Equally, a Community regulation, while it would assure a more even implementation across the Member States, was not considered practicable, having regard to existing structures and related rules in Member States.

As the price of solvents in paint products is a small percentage of the total price, the effectiveness of tax incentives would be limited, given the number of factors other than price (e.g. product quality) that are also important to consumers.

A European Parliament and Council Directive should thus provide the necessary balance between ensuring a harmonised and consistent approach across the Community, while at the same time allowing Member States some flexibility as to the details required to ensure proper enforcement and also allowing them to build on any measures already in place.

4. CHOICE AND JUSTIFICATION OF LEGAL BASIS

As the basic proposed Directive aims primarily at reducing VOCs emissions though the approximation of technical specifications, Article 95 is used as the legal basis of the proposed Directive in view of the single market dimension. The provisions of the Proposal are intended to achieve approximation of laws. Although values for the maximum VOC content of certain products content are included in the Directive, Member States can maintain or impose stricter limit values if they can justify the reasons for these measures, as set out in Article 95 (4) and (5) of the Treaty.

5. COSTS AND BENEFITS OF THE PROPOSED DIRECTIVE

Reduction of VOC emissions has already been justified in economic terms in the Commission Proposal for a Directive on national emission ceilings (NEC).[22] The economic analysis conducted for that proposal[23] showed that the benefits of reducing VOC emissions to 5.5 million tonnes in 2010 outweighed the cost, even without including avoided damage to ecosystems. As the Member States committed to reduce their emissions only to 6.5 million tonnes by 2010, this shortfall of 1 million tonnes falls within the reduction range that has already been shown to be justifiable on cost-benefit grounds.

In order to assess the technical potential of reducing VOC emissions from decorative paints and vehicle refinishing products, the Commission Services conducted two studies (see footnotes 13 and 14). These studies indicated that the emission reduction costs of measures such as those proposed herein are well within the range of the costs of the VOC emission reduction measures envisaged for all Member States in an NEC context.

These studies were used as a basis for a cost-benefit analysis[24] of the proposed Directive. The overall annual reduction in VOC emissions resulting from the proposal is estimated to be 280 kilotonnes in 2010, and to cost between €108 and €157 million per annum in 2010. The

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[20] C(1998) 4257; OJ L 5, 9.1.1999, p. 77.

[21] Protocol to abate acidification, eutrophication and ground-level ozone adopted in Gothenburg on 30 November 1999 by the executive body to the Convention on long-range trans-boundary air pollution.

[22] COM (1999) 125 final.

[23] In the "Economic evaluation of air quality targets for tropospheric ozone" carried out by IIASA, AEA, DNMI and RIVM, conclusions show that total estimates of benefits appear likely to exceed costs for all of the scenarios considered.

[24] For details, see "The costs and benefits of the reduction of volatile organic compounds from paints" Prepared by Directorate-General Environment, Air and Noise Unit, 2 May 2002.

average cost of reducing the VOC content of paints is estimated at between €387 and €563 per tonne of VOC reduced. The difference in cost estimates stems from the uncertainty about additional costs for exterior paints.[25] The range of abatement costs per tonne of VOC reduced (from €387 to €563) is smaller than the average of the cost-effective options to reach the objectives of the NEC Directive (€687 per tonne of VOC abated).

It has been estimated that eliminating 280 kilotonnes of VOCs in the EU would bring health-related benefits totalling €582 million each year. It should be noted that some benefits were not monetised.[26] Table 4 summarises costs and benefits by Member State.

The benefits of the proposed Directive were estimated to be four to five times higher than the costs, and higher than costs in all Member States. In sum, the proposed Directive would bring significant benefits, even if the costs have been somewhat underestimated or the benefits somewhat overestimated.

Due to lack of data, it was not possible to include candidate countries in the cost-benefit analysis. However, the reduction potential in respect of VOCs in paints is unlikely to be very different from the Member States. If there were any differences, it would probably be that costs in these countries would be lower than in the Member States. In any case, the ozone formation problem is of equal concern. Therefore, the cost-benefit ratio of undertake the action proposed in the Directive is likely to be at least equally favourable in the candidate countries.

6. EXPLANATION OF THE PROVISIONS OF THE PROPOSAL

The proposal aims to reduce VOCs emissions by setting maximum values for the VOC content in certain categories of decorative paints and vehicle refinishing products, limits that have to be respected for the marketing of these products within the EU. However, in accordance with the principle of subsidiarity, some flexibility is provided, for example, by allowing Member States discretion in the development and implementation of market surveillance mechanisms. The principle features of the proposal are as follows:

Article 1

This Article sets out the purpose of the proposal and its scope. The purpose of the proposed Directive is to protect public health and the environment from the direct and indirect effects of emissions of organic solvents. Occupational health is not the main aim of this proposal, but the health-related benefits resulting from reduced levels of tropospheric ozone have been considered.

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[25] The higher cost refers to a "pessimistic" case. It is assumed that the prices of all categories of paints for exterior walls of mineral substrate, interior/exterior trim and cladding paints for wood and metal would increase because of a technology shift which would among other things increase the price of raw materials. In the "optimistic" case the only additional cost is assumed to be increased research and development costs.

[26] These unmonetised effects are the improved health of painters (due to less solvent exposure) and the benefits to ecosystem (due to lower ozone concentrations).

Article 2

This Article contains the necessary definitions. Three possibilities were considered for the definition of "volatile organic compound". The first reflects the fact that VOCs are precursors of tropospheric ozone, and would be in line with the one used in the NEC Directive (2001/81/EC). The second measures volatility using the physical property of vapour pressure and is the one used in Directive 1999/13/EC on the limitation of solvent emissions from certain industrial installations. The third is based on another physical property: boiling point. Given the basic requirement of the Directive, the Commission opted for the definition based on boiling point, which provides a simple and effective method for checking compliance.

Definitions of product categories are given in Annex I.

Article 3

This Article obliges Member States to ensure that product categories falling within the scope of the Directive can be marketed only if they comply with the specifications in Annex II.

Article 4

A labelling requirement has been introduced to ensure that consumers are adequately informed of the environmental credentials of the product at the time of purchase. Given the number of detailed factors that need to be considered as regards both label design and application, it is proposed to delegate this task to the committee established under Article 12 of the Directive.

Articles 5, 6 and 7

These Articles require Member States to develop a market surveillance system in order to assess and control effective implementation of the Directive. Member States will also be required to summarise the results of their surveillance activities every three years, and to submit annual results to the Commission on request only. To facilitate reporting, a common reporting format will be developed by the Commission via a committee procedure.

Article 8

This Article states that the principle of free movement has to be respected for the products covered by this Directive which comply with its requirements.

Article 9

This Article introduces a review clause to decide permitted VOC content for 2010 for the particular sub-category of interior/exterior trim and cladding paints for wood and metal (Annex II.A). At the moment, technical and economic considerations do not make the balance between advantages and disadvantages in setting a more stringent limit in 2010 for this category sufficiently clear. The Commission will carry out this review before the end of 2006, so that it can make a proposal to the European Parliament and the Council in 2006 for a value to be applied from 2010. This review will be based on a study that will take into account all the elements of sustainability: the incremental environmental benefit compared to the 2007 limit value, but also the economic implications, including impact on SMEs, the consequences for employment and the technical feasibility.

Article 10

This is a standard Article requiring Member States to establish appropriate penalties for non-compliance.

Article 11

The regulatory committee established in Article 12 will assist the Commission in deciding on the mandatory use of ISO or CEN methods as soon as they become available for testing the VOC content of the products covered by the Directive.

Article 12

This Article proposes to establish a regulatory committee that will function in accordance with the Council Decision conferring decision-making powers on the Commission.[27] It will provide technical assistance to the Commission and help to take decisions concerning the implementation of the Directive, such as common formats for reporting data.

Article 13

This Article repeals the provisions of Directive 1999/13/EC that set emission limit values for the vehicle refinishing sector in favour of the product-based approach contained in this proposal. It should be made clear that this proposal does not repeal provisions dealing with the solvents used in the coating of new vehicles. For this reason, only the first sub-indent of Annex I of Directive 1999/13/EC will be repealed: "the coating of road vehicles as defined in Directive 70/156/EEC, or part of them, carried out as part of vehicle repair, conservation or decoration outside of manufacturing installations, or". In Annex II A.I, the words "vehicle refinishing" are also removed from section 6 of the "Activity" column.

Articles 14, 15 and 16

These Articles contain standard provisions concerning entry into force and transposition into national law.

Annex I

This Annex defines the categories and subcategories of decorative paint and vehicle refinishing covered by the proposal.

Annex II

This Annex sets out the proposed content limit values.

The maximum limit value for subcategory A.d in Annex II: *Interior/exterior trim and cladding paints for wood and metal, solvent-borne* has been left blank for 2010. See comment to Article 7.

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[27] Council Decision 1999/468/EC of 28 June 1999, OJ L 184, 17.7.1999, p. 23.

7. Business Impact Assessment (BIA): The impact of the proposal on business, with special reference to Small and Medium-Sized Enterprises

7.1. The proposal:

- A limitation on the content of volatile organic compounds (VOCs) in certain categories of products

Community legislation is necessary in this area to help protect public health, in particular by reducing VOC emissions so as to reduce population and vegetation exposure to photochemical oxidants. A two-phase approach is proposed for reduction of the VOC content of the decorative paint products falling within the scope of the proposal. This will give the sectors affected adequate time to adapt without compromising the long-term environmental benefits. One phase will apply from 1 January 2007 while a second will apply from 1 January 2010. In the case of vehicle refinishing products only the 2007 values apply.

7.2. The impact on business

- Who will be affected by the proposal?

Decorative paint manufacturers and production chain

The proposal affects the manufacture of decorative paints and the production chain for these products. This includes the paint industry itself and the resin industry, the solvent industry, and binder and pigment manufacturers.

Despite the ongoing consolidation in this sector, there are almost 1300 large-scale paint manufacturers and over 3200 smaller businesses in the sector, including businesses in six of the candidates countries.[28] The sector has around 120 000 employees. The ten largest paint manufacturers account for almost 50% of total production. The largest number of small manufacturing enterprises are in Southern Europe.

Over 200 raw material suppliers serve the European paint industry. Multinational chemical companies dominate the binder, pigment and solvent markets, while the alkyd resin market includes a considerable number of small manufacturers.

Vehicle refinishing sector

The proposal also affects vehicle-refinishing plants. Plants with a solvent threshold consumption greater than 500 kilos per year are already covered by Council Directive 1999/13/EC. However, since the adoption of that Directive it has been recognised that this sector is more amenable to a product-based approach to achieving emission reductions than an emission limit value approach requiring the use of pollution abatement equipment. Consultations with industrial stakeholders indicate that this change in the regulatory regime (this proposal combined with repeal of the relevant provisions of Directive 99/13) will not mean that investment to comply with Directive 1999/13/EC was wasted, as products with lower VOC content have already been identified as the preferred route for compliance in this sector.

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[28] Czech Republic, Hungary, Poland, Slovenia, Slovakia and Turkey

This proposal could affect about 50 000 plants in the Community, many with less than 5 employees. The proposal will also affect the product supply market, although it appears to be well prepared for the proposal. Seven companies account for 90% of the market, the other 10% being small and medium companies.

- What will businesses have to do to comply with the proposal?

Compliance costs

Products sold on the European Community market will have to respect the maximum volatile organic compound content limit values set down in this proposal. This will mean new equipment costs in some cases (e.g. paint manufacturers and retailers. Retailers will have to modify or change their mixing machines), research and development costs (e.g. in the resin industry), or the need to use alternative products (e.g. for vehicle refinishing). These costs will be spread over a number of years, as the timetable for compliance extends until 2010.

The paint market will remain unchanged in terms of total sales volume, but it is uncertain whether there will take place a redistribution between "do it yourself" and professionals. Retailers could increase or decrease their sales. For professional users the impact will probably be related to different applicability of the new products.

Administrative burdens

Monitoring and reporting are necessary for the successful implementation of this proposal. However, Member States will have some discretion in deciding how this is done at the outset. The Commission will monitor progress in this area and put forward proposals for a more harmonised approach at a later stage, if appropriate.

- What economic effects is the proposal likely to have?

Decorative paint sector

In general, the estimated cost of emission reduction is about €500/ktonne abated. In terms of consumption the paint market is expected to remain unchanged. There should be no major effects for the paint industry although there will be costs for research, reformulation, and investment in stainless steel equipment, and the costs of developing new resins. Paints will probably then be 1-1.5% more expensive for the final consumer. The industry has already coped with a major shift from solvent-borne to water- borne products and this proposal builds on that process.

Reduced solvent consumption will reduce the revenue of the solvent industry by about €65 million per year. However, this effect is relatively modest in relation to the economic strength of the companies involved, but fixed costs will have to be spread over a decreased production volume in the absence of the development of substitute products.

Paint retailers and professional painters may fear that higher prices might lead to a decrease in sales. However, this is unlikely to happen, as the decision to commence a painting job is not really influenced by the price of paint (material costs are only 15-25% of the total cost). Nevertheless, some retailers will need to adapt their equipment, and professional painters may have to adapt their working methods and schedules to new products.

No major impact on employment is expected, as overall market demand should remain unchanged. However, there will be internal redistribution; decreasing demand for solvent- borne products should be offset by increasing demand for water- borne products.

While the proposal should not have much effect on the whole production chain, it could have a real impact on the SME sector and in particular those reliant on the production of only solvent-borne products. The need to invest, re-train and adapt will be all the greater given the smaller scale of their operations. However, the timeframes proposed should allow them to adapt, since the extra costs should ultimately be passed on at the retail stage.

- Does the proposal contain measures to take account of the specific situation of small and medium-sized firms?

The transitional periods in the proposal allow for the differing capacities in the sectors concerned to respond to the new requirements in terms of technology and in terms of financing. Solvent-borne paints will still be permitted for a large number of applications, thus allowing for more gradual change than would be required if greater emphasis were placed on water-based technologies.

The content limit values set out in the proposal do not take into account the latest developments in technology. The reason for not applying the strictest formulations available on the market is to facilitate SMEs in making the changeover. In addition, the proposal provides for a review of one of the VOC content limit values for 2010, for which costs and benefits are not now sufficiently clear. The review shall take into account the specificity of SMEs.

Views of Member States and stakeholders

There was widespread consultation of industrial stakeholders during preparation of the proposal lasting almost two years. In general they support further action to reduce emissions of VOCs, but some doubt whether all of the values proposed for 2010 for the maximum solvent content of paints are currently achievable on a commercial scale (CEPE,[29] ERMA[30]). Industry has also expressed its concerns about the cost-benefit analysis, that some factors have not been adequately taken into account, and some costs underestimated. Others (ESIG[31]) question whether this sector is the most cost-effective sector in which to legislate for VOC emission reductions. They wonder whether the proposal is premature and suggest that it might be preferable to await further progress with the CAFE programme.

The impact of the proposal on SMEs was a concern of some representative associations. UNIEP,[32] UEAPME,[33] and Union Chimica-Confapi[34] mentioned the difficulties of complying with the proposed legislation because of limited resources,

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[29] European Confederation of paint, printing, ink and artist's colours manufacturers association

[30] European Resin Manufacturers Association

[31] European Solvent Industry Group

[32] Union Internationale des Entrepreneurs de Peinture

[33] European Association of craft, small and medium-sized enterprises

[34] Unione nazionale piccola e media industria chimica, conciaria, materie plastiche, gomma, vetro, ceramica e prodotti affini

absence of R&D capacity and the increased impact of these issues due to their smaller scale.

The idea of moving towards a product-based approach in the vehicle-refinishing sector met with a positive response from industrial stakeholders.

Member States are generally supportive of the proposal, although Italy and Spain have expressed some reservations because of concerns regarding SMEs (in Italy) and the increased regulatory burden (in Spain).

Table 1: Estimates of VOC emissions (2010) by sector (SNAP divisions)
Source: Estimates based on independent studies for the Commission

VOC emissions EU-15 (%) Estimates 2010	
Solvent and other product use	26%
Road transport	22%
Production processes	14%
Extraction and distribution of fossil fuels/geothermal energy	12%
Other mobile sources and machinery	12%
Non-industrial combustion plants	8%
Waste treatment and disposal	3%
Combustion in energy and transformation industries	2%
Combustion in manufacturing industry	1%

Table 2: Estimated VOC emissions in 2010 by Member State

	Commission's NEC proposal	NEC Directive
Austria	129	159
Belgium	102	139
Denmark	85	85
Finland	110	130
France	932	1050
Germany	924	995
Greece	173	261
Ireland	55	55
Italy	962	1159
Luxembourg	6	9
Netherlands	156	185
Portugal	102	180
Spain	662	662
Sweden	219	241
UK	964	1200
EU-15	**5581**	**6510**

Table 3. Estimated abatement resulting from the proposal for 2010
Source: Commission Services' own estimation

		Limit values g/l		Estimated abatement
Product Subcategory		Phase I(2007)	Phase II(2010)	Ktons abated in 2010
a) Interior matt walls and ceilings	WB	55	30	85,5
(Gloss <25@60°)	SB	350	30	34,6
b) Interior glossy walls and ceilings	WB	150	100	18,5
(Gloss >25@60°)	SB	350	100	34,5
c) Exterior walls of mineral substrate	WB	60	40	27,8
	SB	450	430	4,3
d) Interior/exterior trim and	WB	130	130	3
cladding paints for wood and metal	SB	250	250	35
e) Interior/exterior trim varnishes and	WB	140	100	2,9
woodstains	SB	500	400	17,1
f) Interior and exterior minimal build	WB	150	130	0,6
woodstains	SB	700	700	0,6
g) Primers	WB	50	30	1,7
	SB	450	350	0
h) Binding primers	WB	50	30	1,2
	SB	750	750	0
i) One-pack performance coatings	WB	140	140	0,3
	SB	600	500	1,2
j) Two-pack reactive performance coatings	WB	140	140	1,6
for specific end use such as floors	SB	550	500	0
k) Multi-coloured coatings	WB	150	100	0,6
	SB	400	100	3,8
l) Decorative effect coatings	WB	300	200	1,3
	SB	500	200	3,8
Sub-total	WB			**145**
	SB			**135**
Total				**280**

Table 4: Costs and benefits of the proposed Directive in Member States in 2010
Source: "The costs and benefits of the reduction of volatile organic compounds from paints" prepared by Directorate-General Environment, Air and Noise Unit, 2 May 2002

	Total benefits(€m)	Costs (€m)		Benefits/costs (€m)		Benefits/costs (€m)	
		Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic
Austria	7,3	1,6	2,6	5,7	4,7	4,5	2,8
Belgium	21,6	2,2	3,6	19,3	18	9,6	6,1
Denmark	34,3	1,5	2,4	32,8	31,9	23,1	14,5
Finland	1,4	0,9	1,5	0,5	0	1,6	1
France	99,2	36,8	43,8	62,4	55,4	2,7	2,3
Germany	174	19,4	30.8	154,6	143,2	9	5,7
Greece	8,7	2,9	4,7	5,8	4,1	3	1,9
Ireland	5,1	1,2	2	3,9	3,2	4,2	2,6
Italy	79,5	8,9	14,1	70,7	65,5	9	5,7
Luxembourg	0,8	0,1	0,1	0,7	0,7	9,3	5,9
Netherlands	34,9	4,5	7,2	30,4	27,7	7,7	4,8
Portugal	14,2	3	4,7	11,3	9,5	4,8	3
Spain	39,7	14,1	22,4	25,7	17,4	2,8	1,8
Sweden	3,8	1,7	2,8	2,1	1	2,2	1,4
UK	57,1	9,4	14,9	47,7	42,2	6,1	3,8
Total	**581,8**	**108,3**	**157,2**	**473,5**	**424,6**	**5,4**	**3,7**

2002/0301 (COD)

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

On the limitation of emissions of volatile organic compounds due to the use of organic solvents in decorative paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 95 thereof,

Having regard to the proposal from the Commission,[35]

Having regard to the opinion of the European Economic and Social Committee,[36]

Acting in accordance with the procedure laid down in Article 251 of the Treaty,[37]

Whereas:

(1) The Community and its Member States are parties to the Gothenburg Protocol of 1 December 1999 to the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution, which aims at abating acidification, eutrophication and ground-level ozone. The Gothenburg Protocol lays down emission ceilings for volatile organic compounds (hereinafter: "VOCs"), as well as limit values for emissions of VOCs from stationary sources.

(2) VOCs are transported in the atmosphere over long distances and represent one of the main sources of transboundary air pollution. In particular, as regards ozone in ambient air, VOCs are an "ozone precursor substance" within the meaning of Directive 2002/3/EC of the European Parliament and the Council of 12 February 2002 relating to ozone ambient air[38], which calls on the Commission to consider whether further action should be taken at Community level to reduce emissions of ozone precursor substances.

(3) Since the objectives of the proposed action, namely reducing the emissions of VOCs, cannot be sufficiently achieved by the Member States, since emissions of VOCs in one Member State affect air quality in other Member States, and can therfore by reasons of the scale and effects of the action, be better achieved at Community level, the Community may adopt measures, in accordance with the principle of subsidiarity as

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[35] OJ C , , p. .

[36] OJ C , , p. .

[37] Opinion of the European Parliament of … (OJ …) , Council Common Position of … (OJ …).

[38] OJ L 67, 9.3.2002, p. 14.

set out in Article 5 of the Treaty. In accordance with the principle of proportionality, as set out in that Article, this Directive does not go beyond what is necessary in order to achieve those objectives.

(4) Directive 2001/81/EC of the European Parliament and the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants[39] sets national ceilings for emissions of certain pollutants, including VOCs, to be attained by 2010 as part of the Community's integrated strategy to combat acidification and ground-level ozone, but does not include limit values for emissions of those pollutants from specific sources.

(5) Because of the characteristics of organic solvents, their use in certain products gives rise to emissions of organic compounds into the air, which contributes to the local and transboundary formation of photochemical oxidants in the boundary layer of the troposphere and, under certain exposure conditions, have harmful effects on human health.

(6) Emissions of VOCs should therefore be avoided or reduced, especially since potentially less harmful substitutes are available or will soon be.

(7) The use of organic solvents and the emissions of VOCs should be reduced as much as technically and economically feasible.

(8) A high level of environmental protection requires the setting and achievement of content limit values for VOCs used in certain categories of products.

(9) For the product subcategory (d) in Annex II point A "interior/exterior trim and cladding paints for wood and metal" the balance between technical feasibility and economic impact is not sufficiently clear yet. It is therefore, necessary to carry out a further study in order to determine the economic and technical feasibility of an improved maximum value in 2010 compared to the value set for 2007.

(10) Content limit values need to be monitored in order to determine whether the mass concentrations of VOCs found in each category of products covered by this Directive are within the permitted limits.

(11) Council Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations[40] should therefore be amended accordingly.

(12) National laws and provisions in this field need to be harmonised in order to ensure that the free movement of the goods covered by this Directive is not restricted.

(13) The Member States should lay down rules on penalties applicable to infringements of the provisions of this Directive and ensure that they are implemented. Those penalties must be effective, proportionate and dissuasive.

(14) This Directive does not prejudice nor affect measures taken at Community or national level to protect the health of workers and their working environment.

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[39] OJ L 309, 27.11.2001, p. 22.

[40] OJ L 85, 29.3.1999, p. 1.

(15) The measures necessary for the implementation of this Directive should be adopted in accordance with Council Decision 1999/468/EC of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission[41]

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Purpose and scope

1. The purpose of this Directive is to prevent or reduce the direct and indirect effects of emissions into the environment of VOCs due to the use of organic solvents in decorative paints and varnishes and vehicle refinishing products, and the potential risks to human health, by limiting the maximum content of VOCs.

2. To the extent necessary for the achievement of the objective set out in paragraph 1, this Directive shall approximate the technical specifications for decorative paints and vehicle refinishing products.

3. This Directive shall apply to the products set out in Annex I.

Article 2

Definitions

For the purposes of this Directive, the following definitions shall apply:

1. *competent authority* means the authority or authorities or bodies responsible under the legal provisions of the Member States for carrying out the obligations arising from this Directive;

2. *VOC content limit value* means the mass of volatile organic compounds, expressed in terms of certain specific parameters, such as concentration expressed in g/l, which may not be exceeded in the formulation of the product;

3. *substances* mean any chemical element and its compounds, as they occur in the natural state or as produced by industry, whether in solid or liquid or gaseous form;

4. *organic compound* means any compound containing at least the element carbon and one or more of hydrogen, halogens, oxygen, sulphur, phosphorus, silicon or nitrogen, with the exception of carbon oxides and inorganic carbonates and bicarbonates;

5. *volatile organic compound (VOC)* means any organic compound having a boiling point less than or equal to 250°C measured at a standard pressure of 101.3 kPa;

6. *organic solvent* means any VOC which is used alone or in combination with other agents, and without undergoing a chemical change, to dissolve raw materials, products, or waste materials, or is used as a cleaning agent to dissolve contaminants, or as a dispersion

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[41] OJ L 184, 17.7.1999, p. 23.

medium, or as a viscosity adjuster, or as a surface tension adjuster, or as a plasticiser, or as a preservative;

7. *coating* means any preparation, including all the organic solvents or preparations containing organic solvents necessary for its proper application, which is used to provide a decorative, protective or other functional effect on a surface;

8. *water- borne coatings (WB)* means coatings, the viscosity of which is adjusted by the use of water;

9. *solvent- borne coatings (SB)* means coatings, the viscosity of which is adjusted by the use of organic solvent;

Article 3

Requirements

Member States shall ensure that only products set out in Annex I with a VOC content not exceeding the values set out in Annex II shall be placed on the market within their territory after the dates laid down in that Annex.

Article 4

Labelling

Member States shall ensure that the products set out in Annex I carry a label when they are placed on the market. The indications required on the label shall be determined in accordance with the procedure referred to in Article 12.

Article 5

Competent authority

1. Member States shall take all necessary measures to ensure that the requirements of Article 3 and 4, and Annex II, are complied with.

2. For the purposes of paragraph 1, Member States shall designate a competent authority responsible for fulfilling the obligations laid down in this Directive, and shall inform the Commission thereof not later than one year after the date referred to in Article 15.

Article 6

Monitoring

Member States shall set up a monitoring programme for the purpose of monitoring the VOC content of the products set out in Annex I.

Member States shall use national methods of determination of the VOC content if relevant CEN or ISO methods are not available.

Article 7

Report

Member States shall report every three years, by the 30th of June of the year following the three year period considered, and for the first time [30 June 200...], the results of the monitoring programme to demonstrate compliance with the Directive. Annual data shall be made available to the Commission upon request. The Commission shall develop a common format for the submission of monitoring data in accordance with the procedure referred to in Article 12.

Article 8

Free circulation

Member States shall not, prohibit, restrict or prevent the placing on the market of products which comply with the requirements of this Directive.

Article 9

Review

By 31 December 2006 at the latest, the Commission shall review the technical and economic feasibility of applying from 2010 a content limit value to the solvent- borne products in subcategory (d) of Annex II pointA, and shall make a proposal to the European Parliament and Council for the value to be applied from 2010.

Article 10

Penalties

Member States shall lay down the rules on penalties applicable to infringements of the national provisions adopted pursuant to this Directive and shall take the necessary measures to ensure that they are implemented. The penalties provided for must be effective, proportionate and dissuasive. Member States shall notify those provisions to the Commission by the date specified in Article 15 at the latest, and shall notify it without delay of any subsequent amendment affecting them.

Article 11

Adaptation to technical progress

Any amendments necessary in order to adapt the Directive to take account of technical progress in the measuring methods used to determine the VOC content of products shall be adopted by the Commission in accordance with the regulatory procedure referred to in Article 12 (2).

Article 12

Committee

1. The Commission shall be assisted by the committee established by Article 13 of Council Directive 1999/13/EC, hereinafter referred to as "the Committee".

2. Where reference is made to this paragraph Articles 5 and 7 of Decision 1999/468/EC shall apply, having regard to the provisions of Article 8 thereof.

   The period laid down in Article 5(6) of Decision 1999/468/EC shall be set at three months.

3. The Committee adopt its rules of procedure.

Article 13

Amendment to Directive 1999/13/EC

Directive 1999/13/EC shall be amended as follows:

1. In section "vehicle refinishing" of Annex I, the first indent is deleted.

2. In the first column of row 6 in Annex IIA, the words "and vehicle refinishing" are deleted.

Article 14

Transposition

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by [...] at the latest, and immediately inform the Commission thereof.

   When Member States adopt those provisions, they shall contain a reference to this Directive or be accompanied by such a reference on the occasion of their official publication. Member States shall determine how such reference is to be made.

2. Member States shall communicate to the Commission the text of the provisions of national law which they adopt in the field covered by this Directive, together with a table showing how the provisions of this Directive correspond to the national provisions adopted.

Article 15

Entry into force of the Directive

This Directive shall enter into force on the twentieth day after that of its publication in the *Official Journal of the European Communities*.

Article 16

Addressees

This Directive is addressed to the Member States.

Done at Brussels,

For the European Parliament
The President

For the Council
The President

ANNEX I

SCOPE

I.1.-Decorative paints and varnishes means products listed in the subcategories below. They are coatings applied to buildings, their trim and fittings, and associated structures for decorative, functional and protective purpose. Products used in the coating of substrates at their original point of manufacture are excluded.

I.1.1.- Subcategories:

- ***a) Matt coatings for interior walls and ceilings*** means coatings designed for application to indoor walls and ceilings with a degree of gloss <25@60°.
- ***b) Glossy coatings for interior walls and ceilings*** means coatings designed for application to indoor walls and ceilings with a degree of gloss >25@60°.
- ***c) Exterior walls of mineral substrate*** means coatings designed for application to outdoor walls of masonry, brick or stucco.
- ***d) Interior/exterior trim and cladding paints for wood and metal*** means coatings designed for application to trim and cladding which produce an opaque film. These coatings are designed either for a wood or metal substrate. This subcategory includes *opaque woodstains*. Opaque woodstains means coatings producing an opaque film for the decoration and protection of wood, against weathering, as defined in EN 927-1 within the semi-stable category.
- ***e) Interior/exterior trim varnishes and woodstains*** means coatings designed for application to trim which produce a transparent or semi-transparent film for decoration and protection of wood, metal and plastics.
- ***f) Minimal build woodstains*** means woodstains which, in accordance with EN 927 - 1:1996, have a mean thickness less than 5μm when tested according to ISO 2808: 1997, method 5A.
- ***g) Primers*** means coatings with sealing and/or blocking properties designed for use on wood or walls and ceilings.
- ***h) Binding primers*** means coatings designed to stabilise loose substrate particles or impart hydrophobic properties and/or to protect wood against blue stain.
- ***i) One-pack performance coatings*** means performance coatings based on film-forming material. They are designed for applications requiring a special performance, such as primer and top coats for plastics, primer coat for ferrous substrates, primer coat for reactive metals such as zinc and aluminium, anticorrosion finishes, floor coatings, including for wood and cement floors, graffiti resistance, flame retardant, and hygiene standards in the food or drink industry or health services.
- ***j) Two-pack performance coatings*** means coatings with the same use as one-performance coatings, but with a second component (e.g. tertiary amines) added prior to application.
- ***k) Multicoloured coatings*** means coatings designed to give a two-tone or multiple-colour effect, directly from the primary application.
- ***l) Decorative effect coatings*** means coatings designed to give special aesthetic effects over specially prepared pre-painted substrates or base coats and subsequently treated with various tools during the drying period.

I.2.- Vehicle refinishing products means products used to coat a road vehicle or part of it, whether as part of a repair job, or to coat the vehicle with refinish-type materials, where this is done away from the original manufacturing line.

I.2.1.- Subcategories:

- ***a) Preparation and cleaning*** means products designed for application, either mechanically or chemically, to remove old coatings and rust or to provide a key for new coatings.
  - ***Gunwash*** means a cleaning product designed for use with spray-guns and other equipment. It includes paint strippers, degreasers (including anti-static types for plastic) and silicon removers.
  - ***Precleaner*** means a cleaning product designed for the removal of surface contamination during preparation for and prior to the application of coating materials.
- ***b) Filler and bodyfiller/stoppers*** means heavy-bodied compounds designed to be sprayed or applied by knife in order to fill deep surface imperfections prior to application of the paint system.
- ***c) Primer*** means any coating that is designed for application to bare metal or existing finishes to provide corrosion protection prior to application of a primer surfacer.
  - ***Surfacer*** means any coating designed for application prior to the application of top coat for the purpose of corrosion resistance, to ensure adhesion of the topcoat, and to promote the formation of a uniform surface finish by filling in minor surface imperfections.
  - ***General metal primers*** means coatings designed for application as primers, such as adhesion promoters, sealers, surfacers, undercoats, plastic primers, wet-on-wet, non-sand fillers and spray fillers.

  Wash primer means any coating containing at least 0.5% by weight of phosphoric acid designed to be applied directly to bare metal surfaces to provide corrosion resistance and adhesion. It includes coatings used as weldable primers, or mordant solutions (galvanised and zinc).

- *d)* ***Topcoat*** means any pigmented coating that is designed to be applied either as a single-layer or as a multiple-layer base to provide gloss and durability. It includes all products involved such as base coatings and clear coatings.
  - ***Base coatings*** means pigmented coatings designed to provide colour and any desired optical effects, but not the gloss or surface resistance of the coating system.
  - ***Clear coating*** means a transparent coating designed to provide the final gloss and resistance properties of the coating system.
- *e)* ***Special finishes*** means coatings designed for application as topcoats requiring special properties, such as metallic or pearl effect, in a single layer, high-performance solid-colour and clear coats, (e.g. anti-scratch and fluorinated clear- coat), reflective base coat, texture finishes (e.g. hammer), anti-slip, under-body sealers, anti-chip coatings and interior finishes.

ANNEX II

A. MAXIMUM VOC CONTENT LIMIT VALUES FOR DECORATIVE PAINTS AND VARNISHES

	Product Subcategory	Type	Phase I (g/l*) (from 1.1.2007)	Phase II (g/l*) (from 1.1.2010)
a	*Interior matt walls and ceilings (Gloss <25@60°)*	WB SB	75 400	30 30
b	*Interior glossy walls and ceilings (Gloss >25@60°)*	WB SB	150 400	100 100
c	*Exterior walls of mineral substrate*	WB SB	75 450	40 430
d	*Interior/exterior trim and cladding paints for wood and metal*	WB SB	150 300	130 -
e	*Interior/exterior trim varnishes and woodstains, including opaque woodstains*	WB SB	150 500	100 400
f	*Interior and exterior minimal build woodstains*	WB SB	150 700	130 700
g	*Primers*	WB SB	50 450	30 350
h	*Binding primers*	WB SB	50 750	30 750
i	*One-pack performance coatings*	WB SB	140 600	140 500
j	*Two-pack reactive performance coatings for specific end use such as floors*	WB SB	140 550	140 500
k	*Multi-coloured coatings*	WB SB	150 400	100 100
l	*Decorative effect coatings*	WB SB	300 500	200 200

*g/l ready to use

B. MAXIMUM VOC CONTENT LIMIT VALUES FOR VEHICLE REFINISHING PRODUCTS

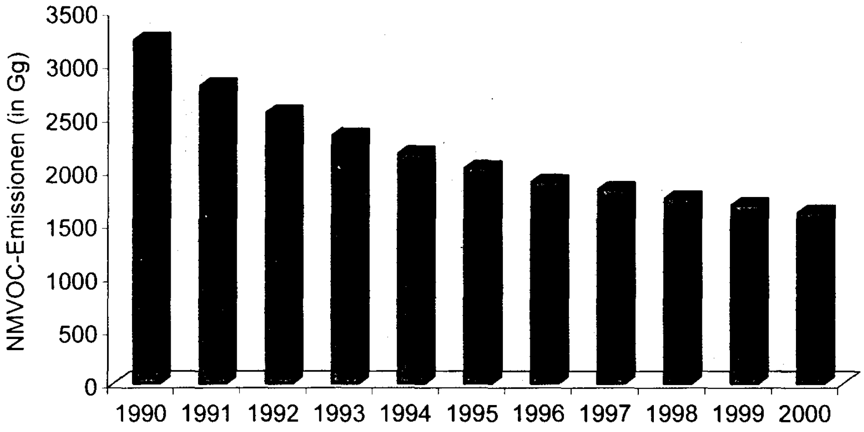
	Product Subcategory	Coatings	VOC g/l* (1.1.2007)
a	*Preparation and cleaning*	Gun wash Pre-cleaner	850 200
b	*Bodyfillers/stoppers*	All types	250
c	*Primers / Sealers / Surfacers / Fillers*	General (metal) primers Wash primers	540 780
d	*Topcoat*	All types	420
e	*Special finishes*	All types	840

*g/l of ready for use paint, discounting any water content of the coating

附件三：德國揮發性有機物管制制度
簡報資料

附件三：德國揮發性有機物管制制度簡報資料

NMVOC- Emissionen in Deutschland für die Jahre 1990-2000



Jahr	NMVOC-Emissionen (in Gg)
1990	3221
1991	2796
1992	2539
1993	2326
1994	2158
1995	2020
1996	1892
1997	1823
1998	1739
1999	1675
2000	1602

NMVOC-Emissionen der Sektoren in Deutschland im Jahr 2000

☐ 30% Energiebedingte Emissionen

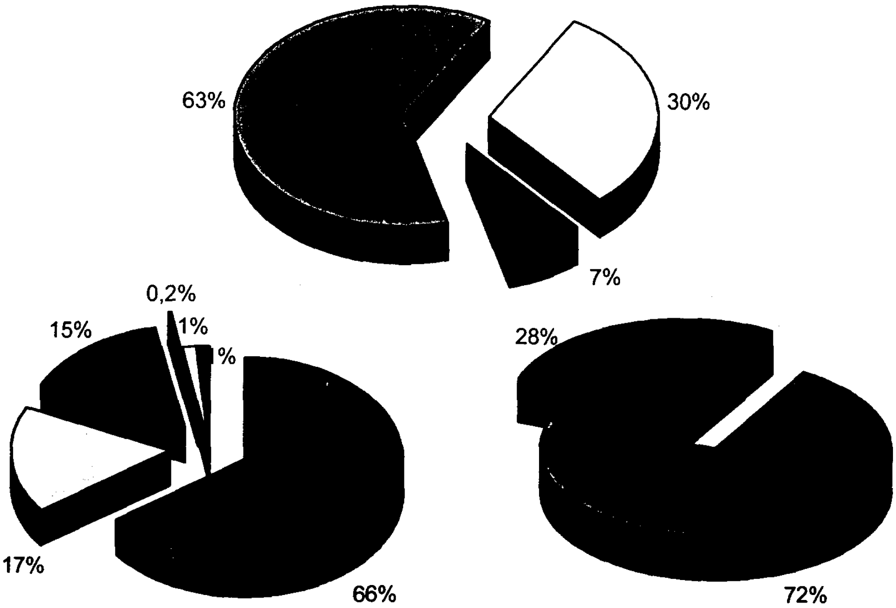
davon:	☐ Energieerzeugung und -umwandlung	1%
	■ Industriefeuerungen	1%
	■ Verkehr	74%
	☐ Kleinfeuerungen/ Haushalt/ Militär	17%
	■ Emissionen* -festen Brennstoffen	15%
	☐ -Öl und Erdgas	0,2%

■ 7% Industrie

davon:	☐ Stein- und Zementinsdustrie	0%
	▨ Chemische Industrie	72%
	■ Eisen- und Stahlindustrie	28%

▨ 63% Lösungsmittel

* aus der Förderung, Weiterverarbeitung und der Verteilung von:

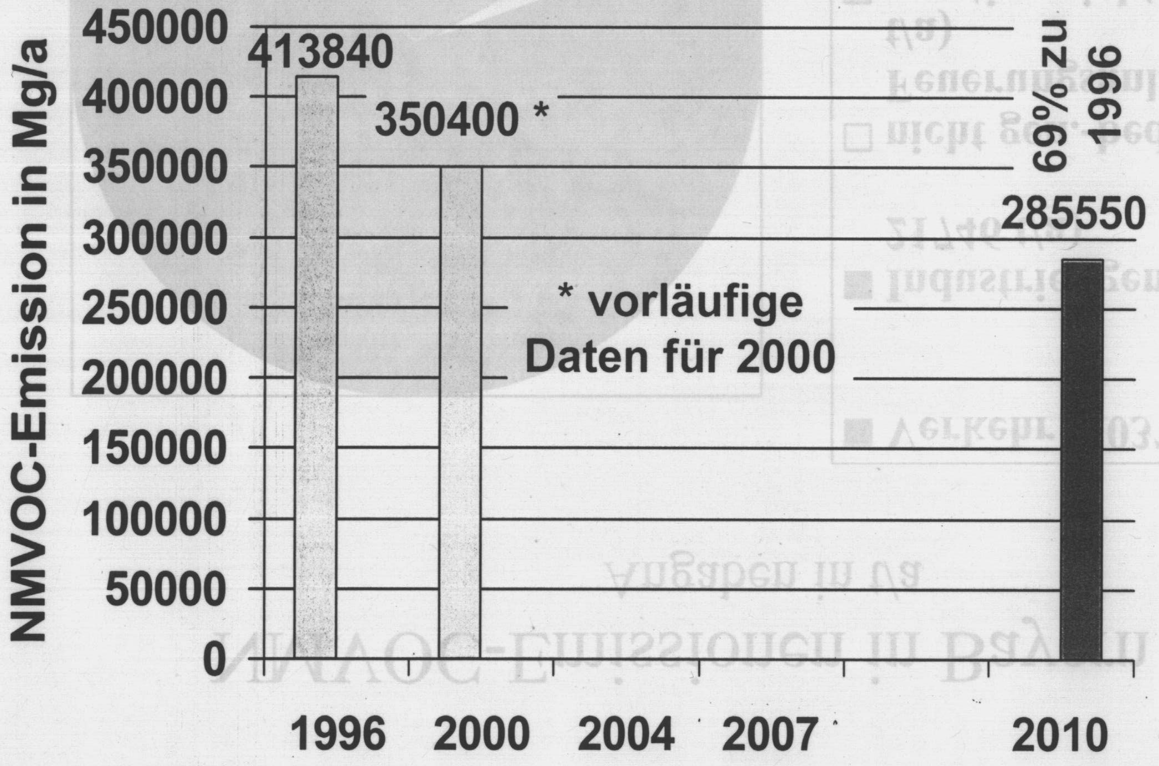


Sektor			NMVOC-Emissionen (in Gg)	
Energiebedingte Emissionen			484	
davon:	Energieerzeugung und -umwandlung			7
	Industriefeuerungen			7
	Verkehr			314
	Kleinfeuerungen/ Haushalt/ Militär			82
	Emissionen*	-festen Brennstoffen		73
		-Öl und Erdgas		1
Industrie			118	
davon:	Stein- u. Zementindustrie			0
	Chemische Industrie			85
	Eisen- und Stahlindustrie/ sonstige			33
Lösungsmittel			1000	
Gesamt:			1602	

* aus der Förderung, Weiterverarbeitung und der Verteilung von:

Germany

Langfristziel 3.2:
Reduzierung von
- kanzerogenen Luftschadstoffen und Ultrafeinstäuben (u.a. Benzol und Rußpartikel) um 75 % bis 2010
- ozonbildenden Luftschadstoffen (NO_2: 60 %; VOC: 69 %) bis 2010

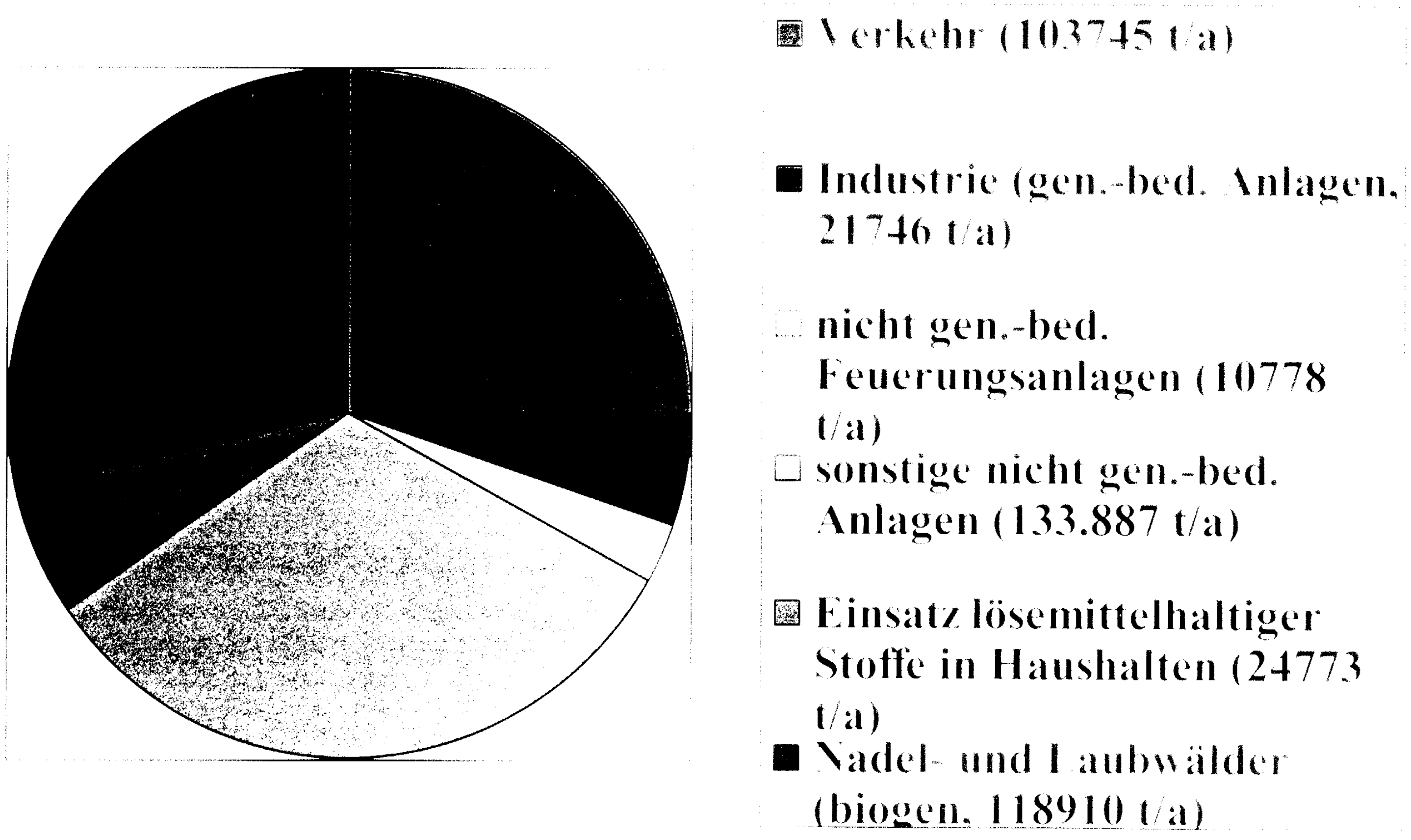


Indikator: NMVOC-Emissionen in Bayern in Mg/a

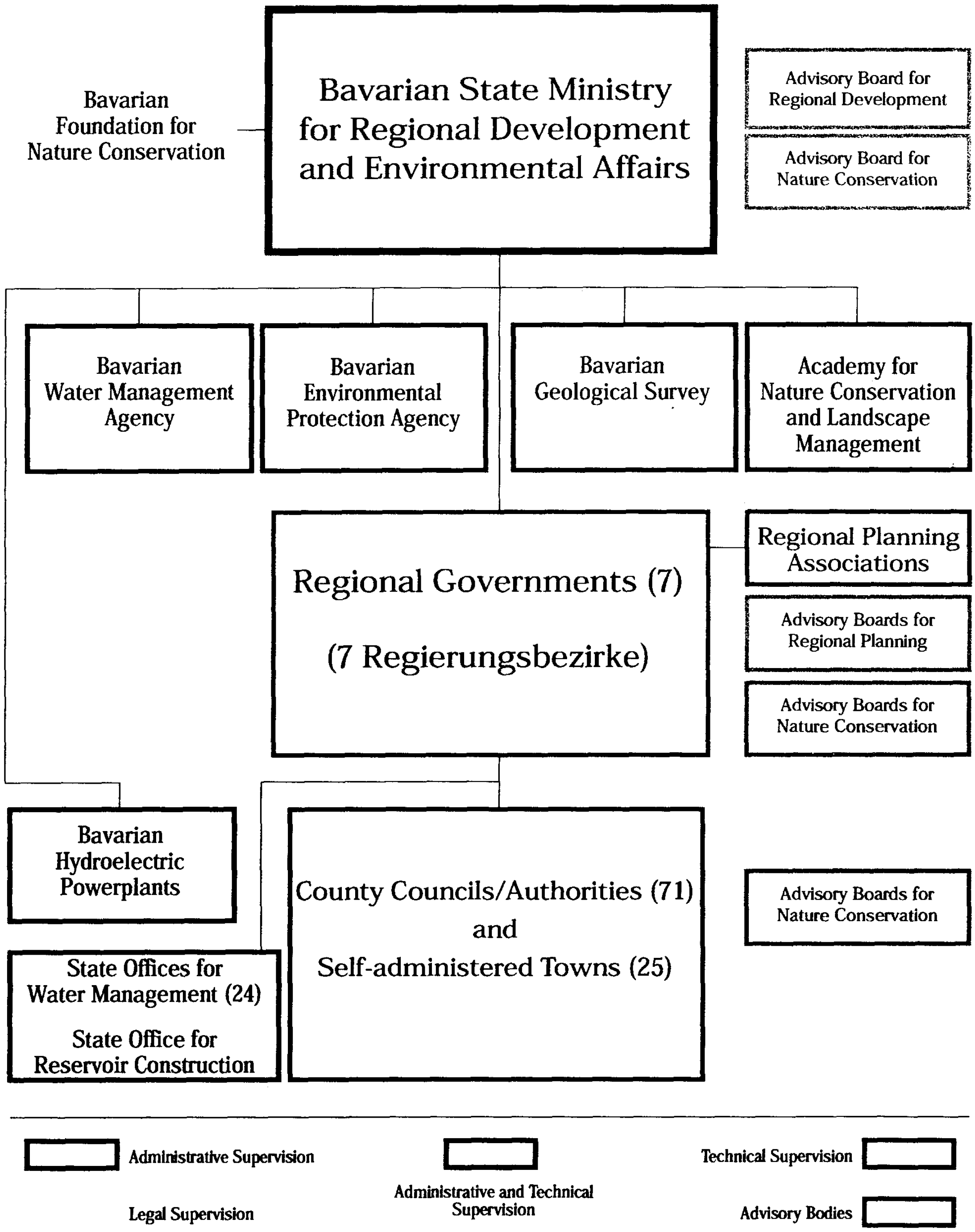
(Die hoch aggregierten Daten liegen jeweils erst mit großer zeitlicher Verzögerung vor)

NMVOC-Emissionen in Bayern 1996

Angaben in t/a



Area of Responsibility of the Bavarian State Ministry for Regional Development and Environmental Affairs



Bavarian State Ministry for Regional Development and Environmental Affairs

Bavarian Foundation for Nature Conservation

Advisory Board for Regional Development

Advisory Board for Nature Conservation

Bavarian Water Management Agency

Bavarian Environmental Protection Agency

Bavarian Geological Survey

Academy for Nature Conservation and Landscape Management

Regional Governments (7)

(7 Regierungsbezirke)

Regional Planning Associations

Advisory Boards for Regional Planning

Advisory Boards for Nature Conservation

Bavarian Hydroelectric Powerplants

State Offices for Water Management (24)

State Office for Reservoir Construction

County Councils/Authorities (71) and Self-administered Towns (25)

Advisory Boards for Nature Conservation

Administrative Supervision

Administrative and Technical Supervision

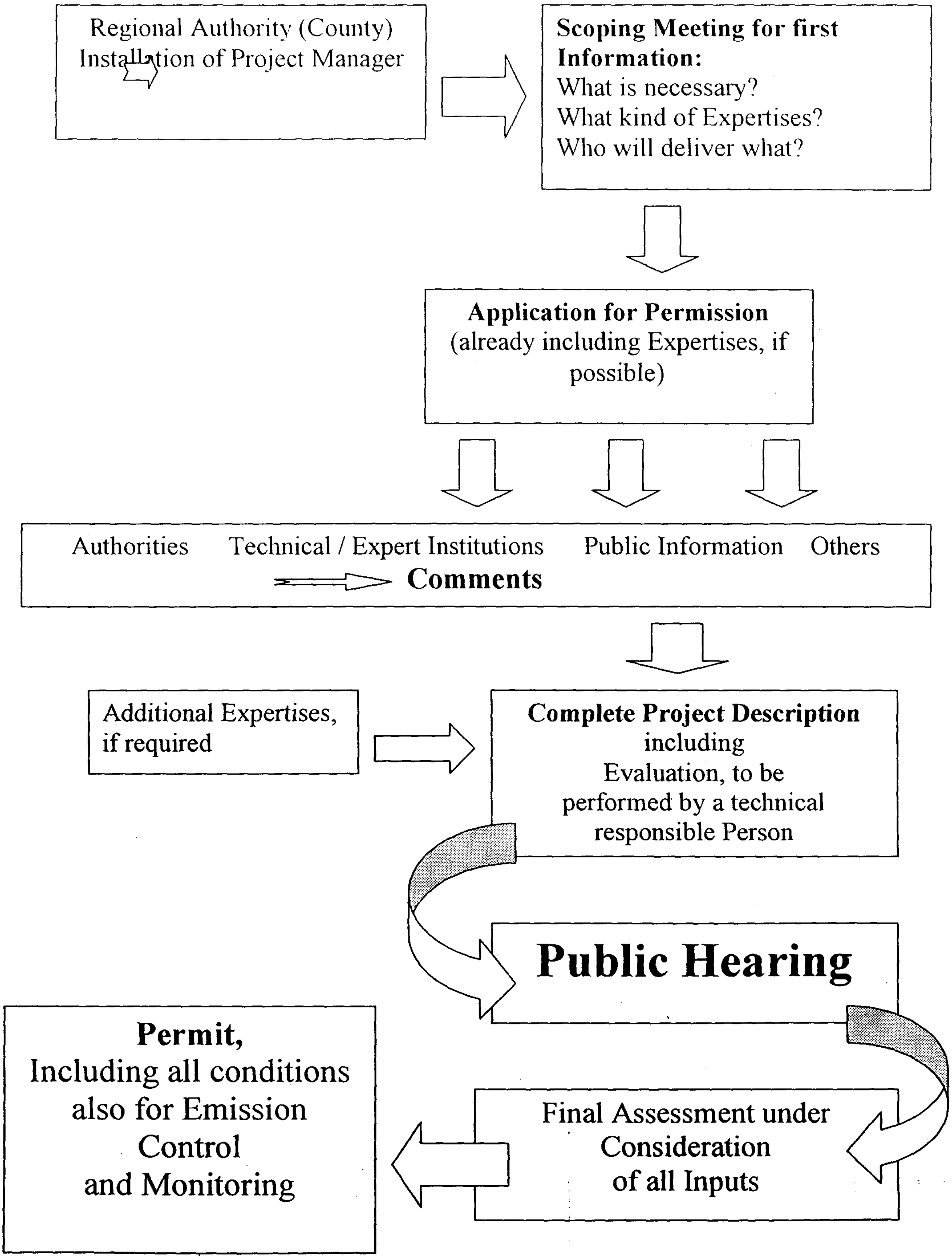
Technical Supervision

Legal Supervision

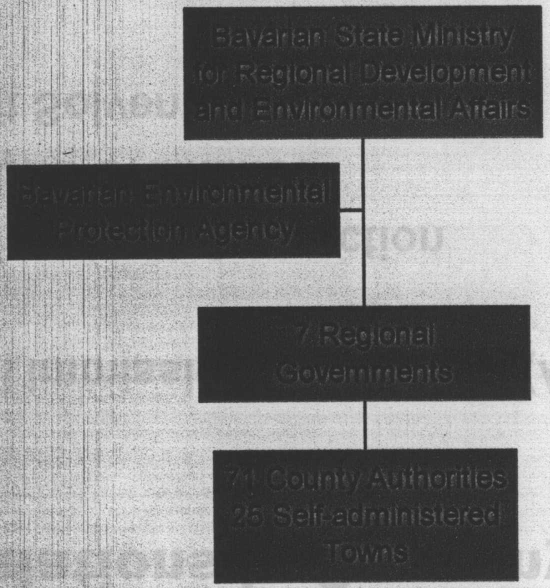
Advisory Bodies

Herausgeber: Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen, Okt. 2001
Rosenkavalierplatz 2 • D-81925 München • Tel: 089/9214-3376 • Fax: 089/9214-2249 • e-mail:abteilung2@stmlu.bayern.de

Licensing Procedure including Public Hearing, Example Bavaria



Responsibilities of the immission control administration in Bavaria



Administration levels	*Responsibilities*
Bavarian State Ministry for Regional Development and Environmental Affairs	*Aims of environmental policy*
Bavarian Environmental Protection Agency	*Experts´ opinion and report, central measurement*
7 Regional Governments	*Licensing and control of complex facilities*
71 County Authorities 25 Self-administered Towns	*Enforcement of the Immission Control Act, licensing and control of facilities*

Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen

Introduction

Regulations in Germany

Federal Immission Control Act (Air Pollution Act)

- Technical Air Instruction
- Second Ordinance
- Draft Solvent Ordinance

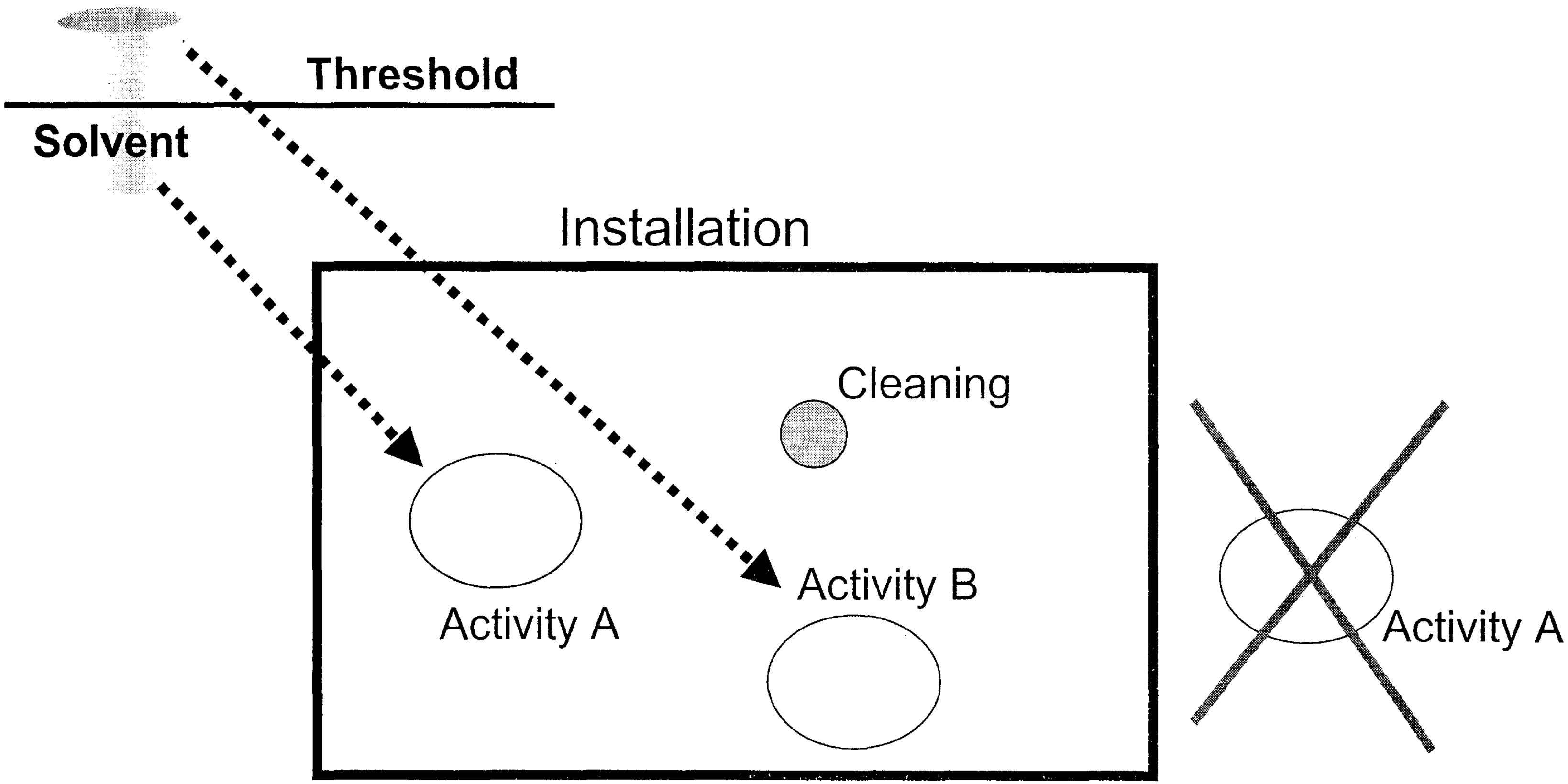
Situation in Germany

Source of VOC-Emissions

Emission source category	Quantity [kt] 1998	in %
Solvent use (e.g. surface coating printing, cleaning adhesive coating	1000	58.9
Industrial process	126	7,4
Production and distribution of fuels	42	2.5
Industrial processes	462	27
Residential	56	3.3
Industrial boilers/power plants, district heating plants,	19	1.1
Total	1 705	100

The scope of the The Solvent Ordinance (~~Draft~~ 2001/08)

Who falls under the directive? (picture designed by Ökopol)



Threshold

Solvent

Installation

Cleaning

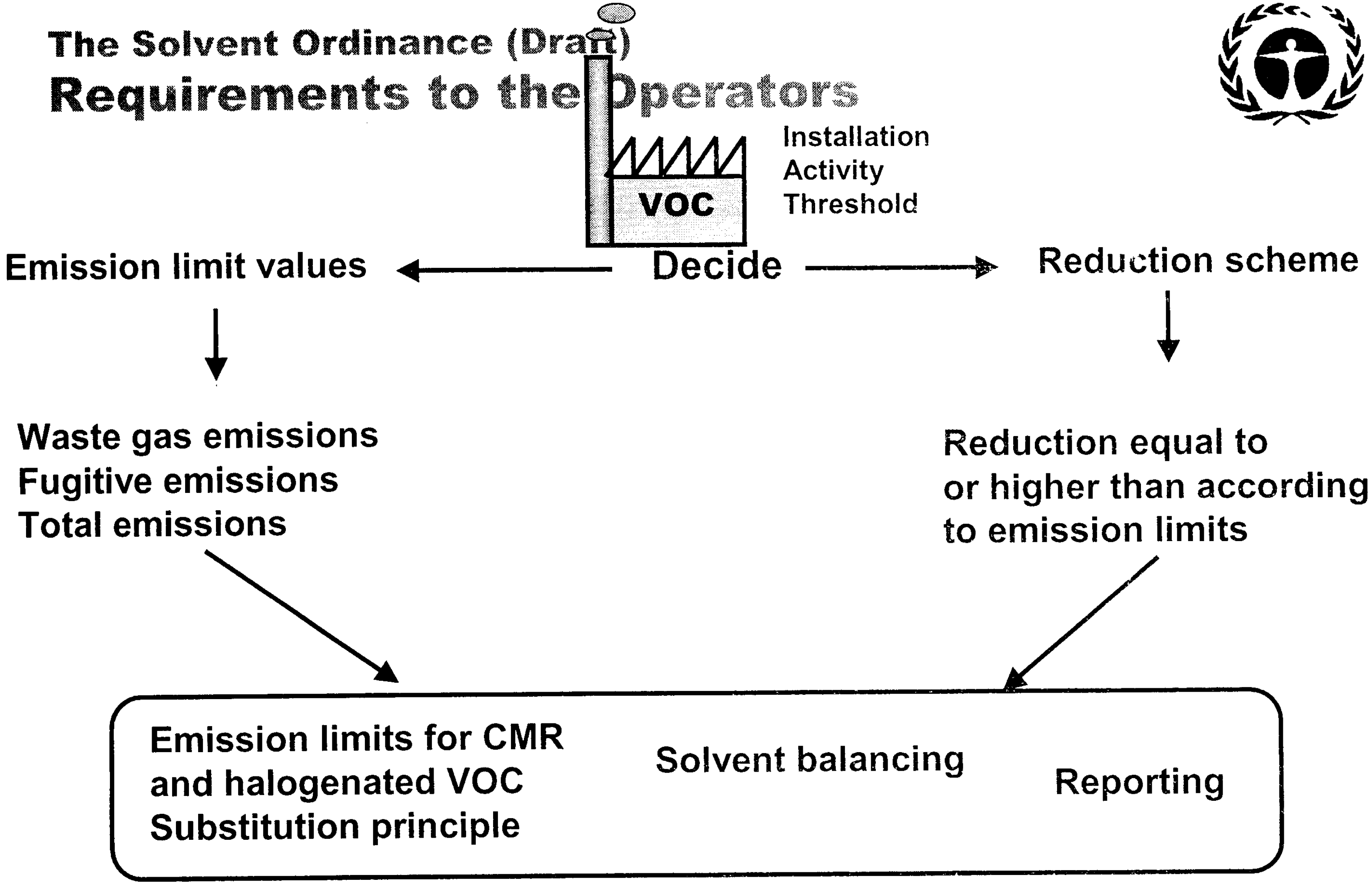
Activity A

Activity B

Activity A

The Solvent Ordinance (Draft)

Requirements to the Operators



Decide

Emission limit values

Waste gas emissions
Fugitive emissions
Total emissions

Reduction scheme

Reduction equal to
or higher than according
to emission limits

Emission limits for CMR
and halogenated VOC
Substitution principle

Solvent balancing

Reporting

The Solvent Ordinance (Draft)
Emission limits

Either

- **mgC/m^3 in waste gas + fugitive emissions in % of solvent input**

  and/or

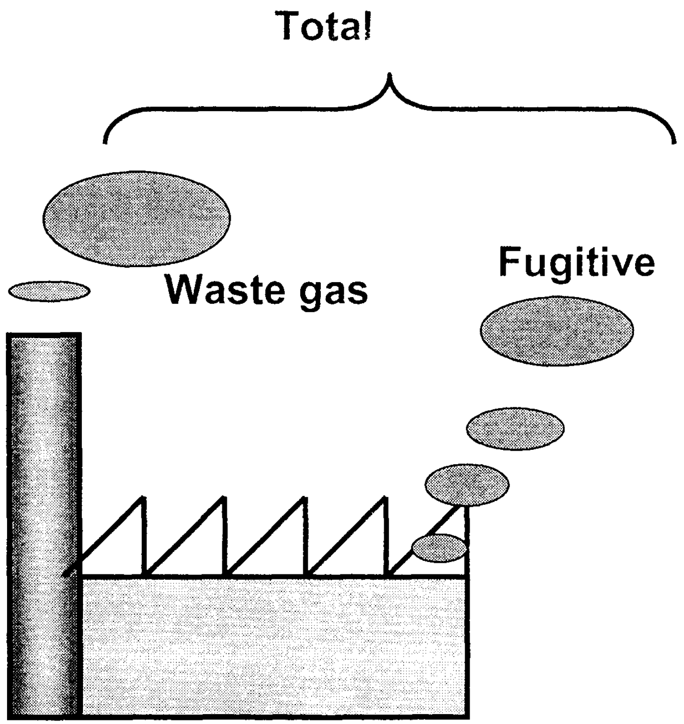
- **total emissions**
  - waste gases + fugitive in % of solvent input
  - per product, piece or weight (e.g. shoes, kg animal fat)
  - per m^2, m^3 (e.g. leather coating, wood impregnation)

The Solvent Ordinance (Draft)
VOC Definition

- Any organic compound having a vapour pressure of 0,01kPa at 293,15 °K (19,85 °C)
- Any organic compound having a similar volatility under particular conditions of use

The Solvent Ordinance (Draft)

Emission limit values (picture designed by Ökopol)



The Solvent Ordinance (Draft)

Emission limits of particular hazardous substances

- Carcinogens, mutagens or substances toxic to reproduction shall be substituted as fast as possible
- Emission limit values for CMR
- Emission limit values for halogenated VOC
- Need to be fulfilled also in reduction schemes or national plans

Requirements to the operator
Reduction scheme

Flexibility to the operator by various options

- Substitution of input (lower VOC content)
- Compensate fugitive emissions with good abatement
- Compensate emissions from activity A with those from activity B
- Other reduction options

Requirements to the operator

Reduction scheme - Prerequisites

- **Emission reduction equivalent to reduction by emission limits**
- **Negotiations with authorities**
- **General scheme proposed in directive**
  - submission of emission reduction plan
  - calculation of target emission
  - time period for new and existing installations

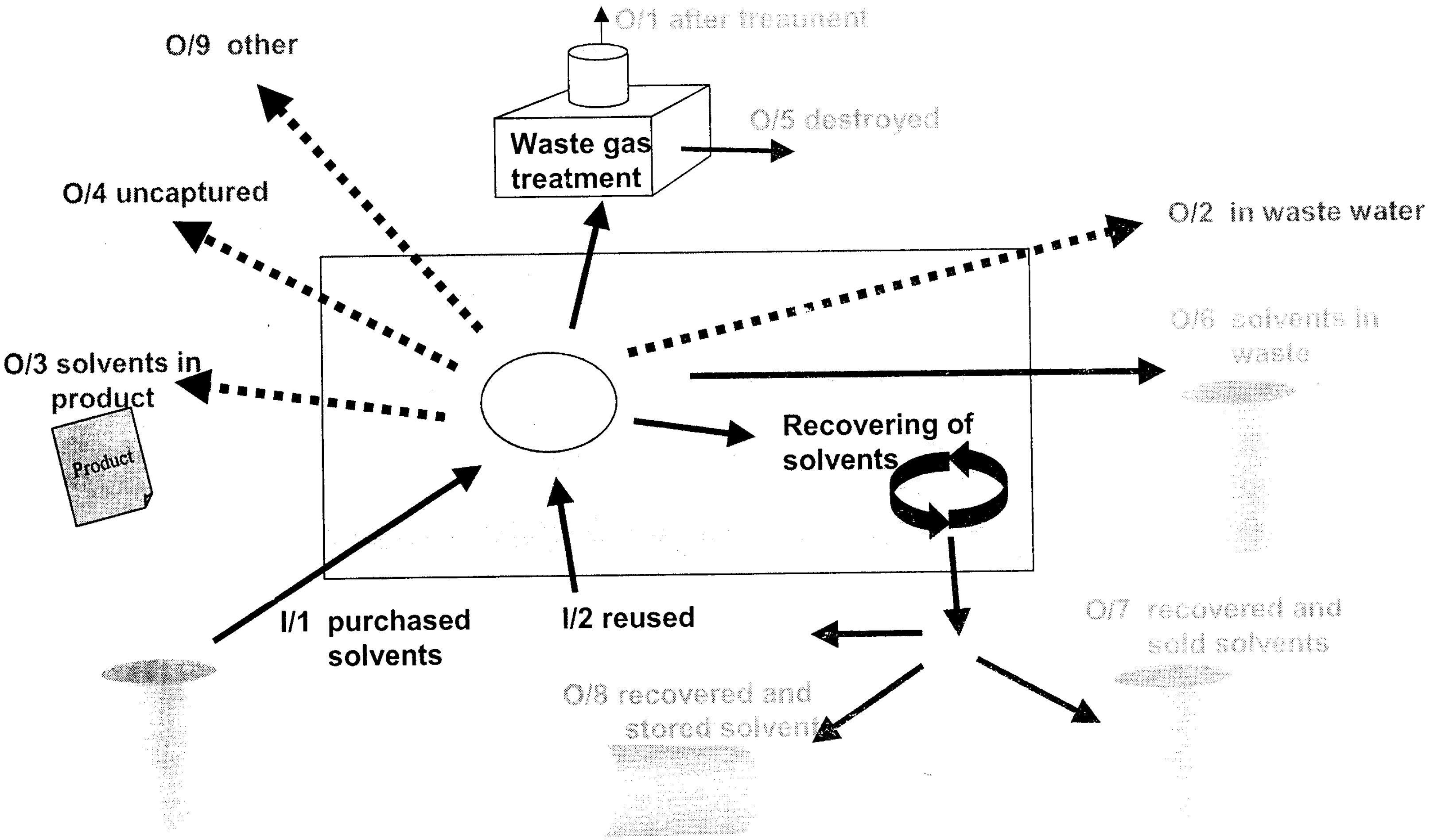
Requirements to the operator

Emission monitoring

Regardless of how requirements on reductions are met:

- Periodic or continuous measurements of waste gas emissions
- Submission of data to competent authority once a year or on request
- Proof of compliance based on a Solvent management plan

The Solvent Ordinance (Draft)
Requirements to the operator (picture designed by Ökopol)



O/1 after treatment

O/9 other

O/5 destroyed

Waste gas treatment

O/4 uncaptured

O/2 in waste water

O/6 solvents in waste

O/3 solvents in product

Recovering of solvents

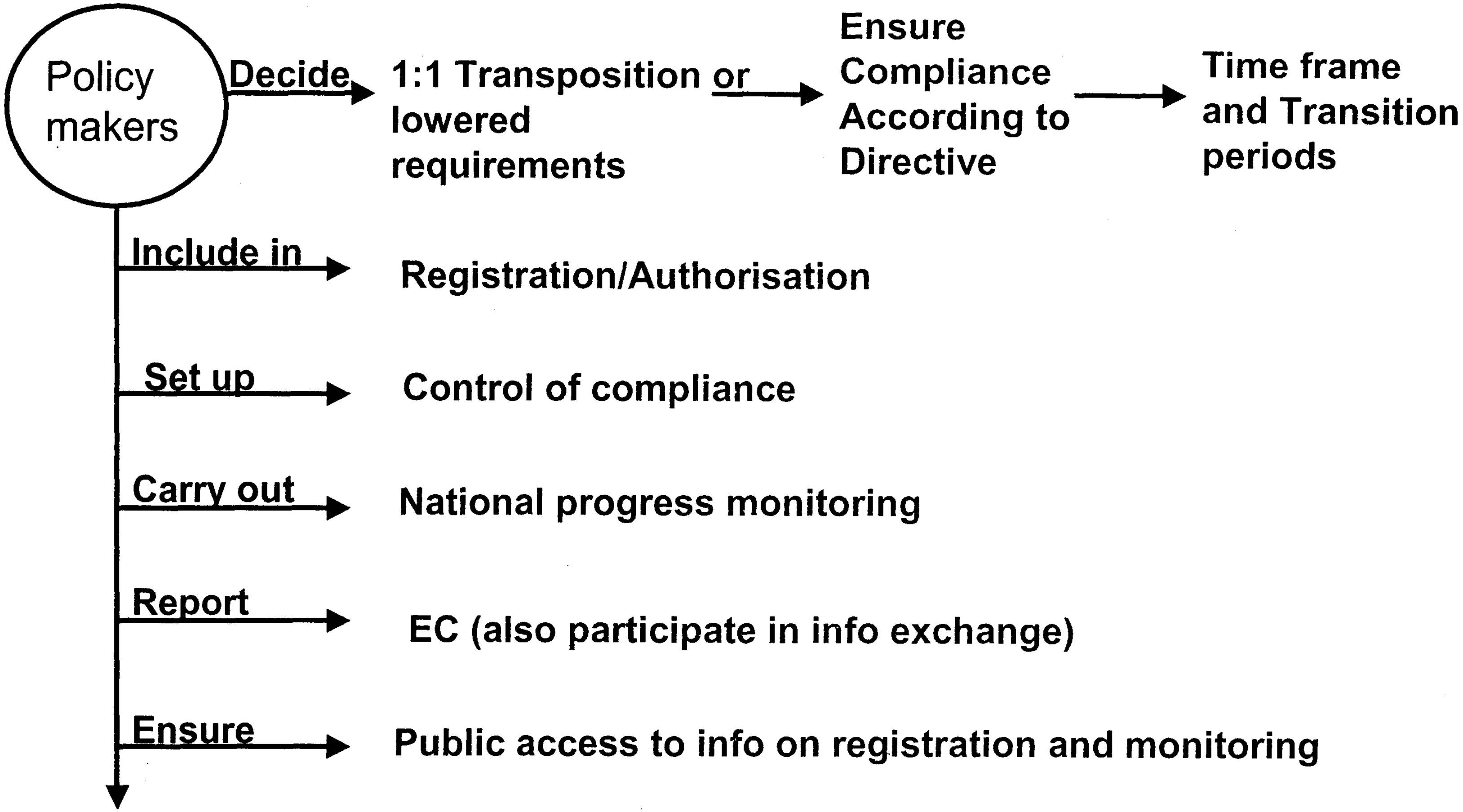
I/1 purchased solvents

I/2 reused

O/7 recovered and sold solvents

O/8 recovered and stored solvents

Requirements to authorities
Overview (picture designed by Ökopol)



Policy makers

Decide → 1:1 Transposition or lowered requirements → Ensure Compliance According to Directive → Time frame and Transition periods

Include in → Registration/Authorisation

Set up → Control of compliance

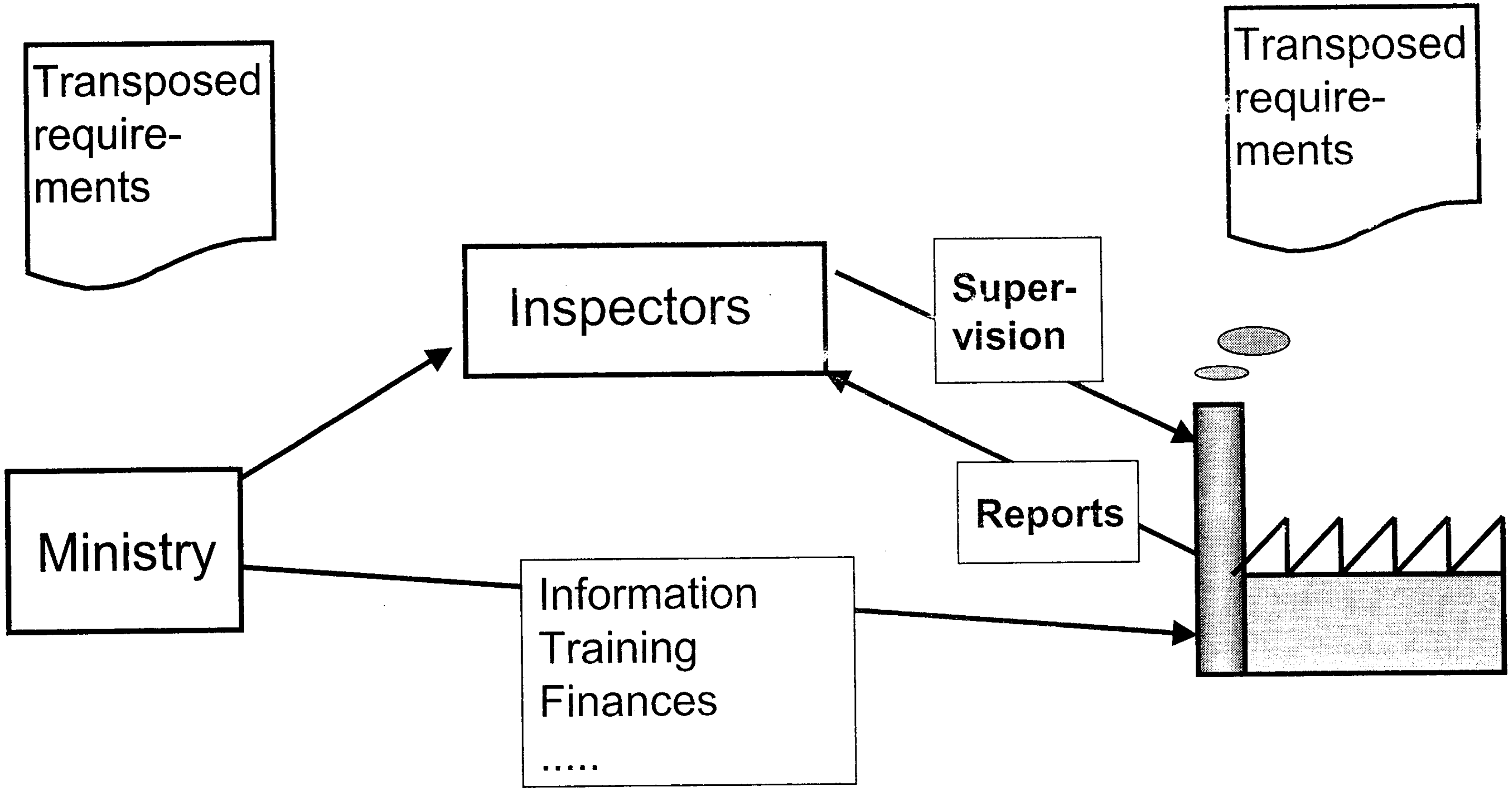
Carry out → National progress monitoring

Report → EC (also participate in info exchange)

Ensure → Public access to info on registration and monitoring

The Solvent-Ordinance (Draft)

Conclusions (picture designed by Ökopol)



Transposed requirements

Inspectors

Super-vision

Ministry

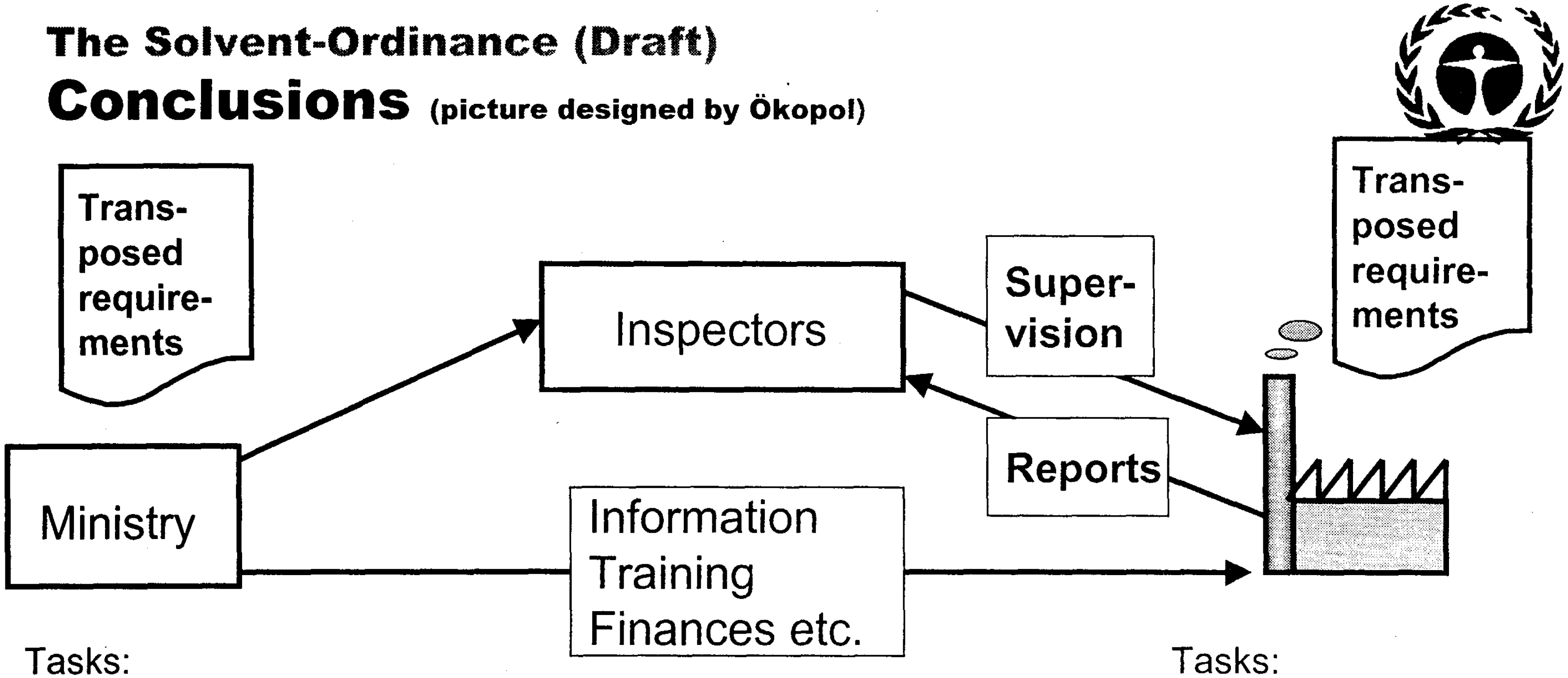
Reports

Information
Training
Finances
.....

Transposed requirements

The Solvent-Ordinance (Draft)

Conclusions (picture designed by Ökopol)



Trans-posed require-ments

Ministry

Inspectors

Super-vision

Reports

Information
Training
Finances etc.

Trans-posed require-ments

Tasks:
- Decide on transposition strategy
- Registration/Authorisation
- Set up control
- Report to EU
- Public access to information

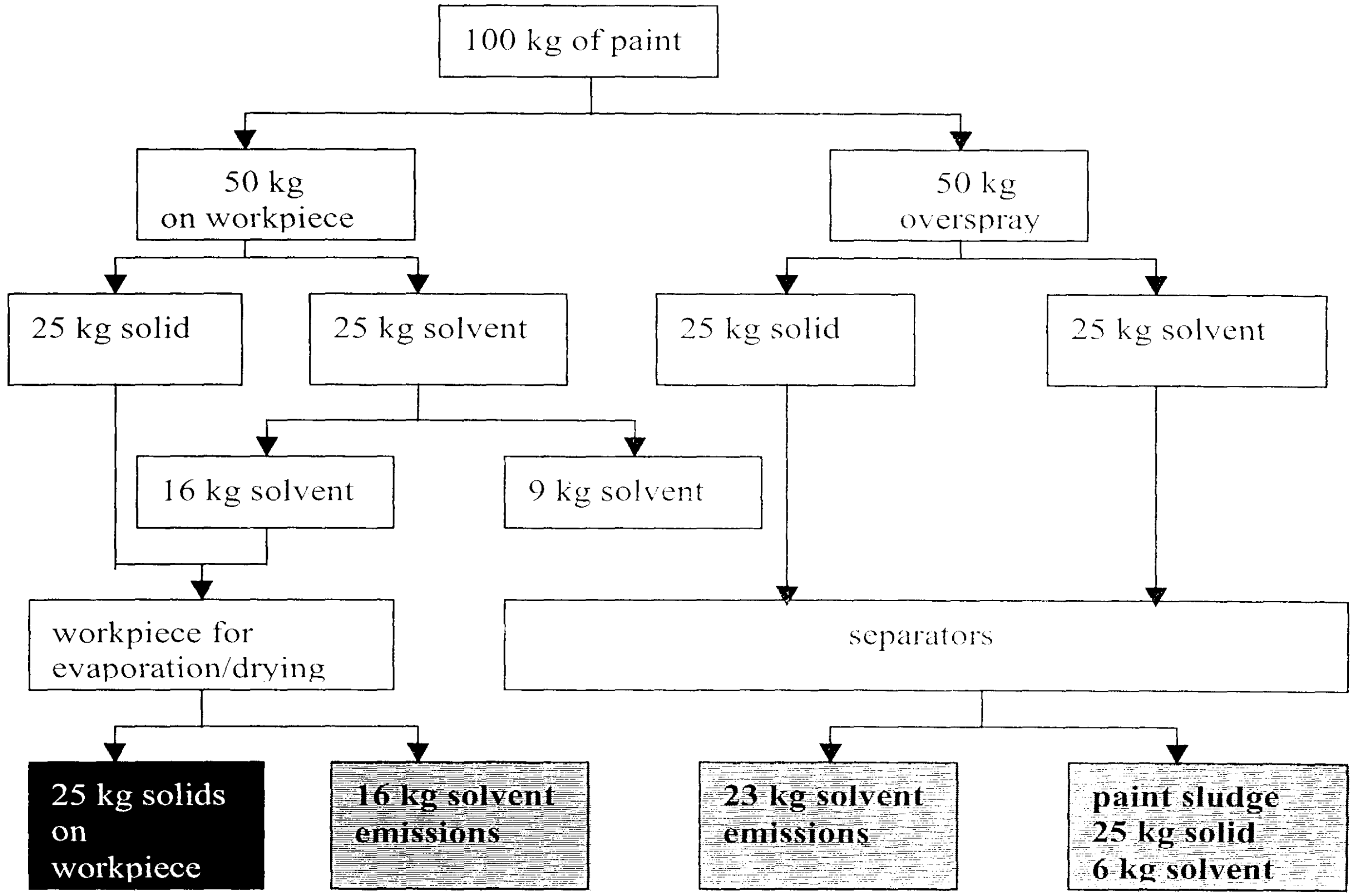
Tasks:
- Decide emission limit values or reduction scheme
- Emission reduction
- Substitution of CMR
- Emission limit values (CMR/halogenated)
- Solvent balance
- Report

Solvent Ordinance (Draft)

Reduction scheme – Refinishing of cars

Coating material	VOC value in g/l (ready- to -spray)
UP stopper and UP sprayfiller	250
Wash primer	780
Adhesion primer /Primer surfacer / Filler (including wet-on-wet filler)	540
1-coat topcoat	420
2-component clearcoat	420
Basecoat	420

Material flows in conventional spray-painting


100 kg of paint

50 kg on workpiece

50 kg overspray

25 kg solid

25 kg solvent

25 kg solid

25 kg solvent

16 kg solvent

9 kg solvent

workpiece for evaporation/drying

separators

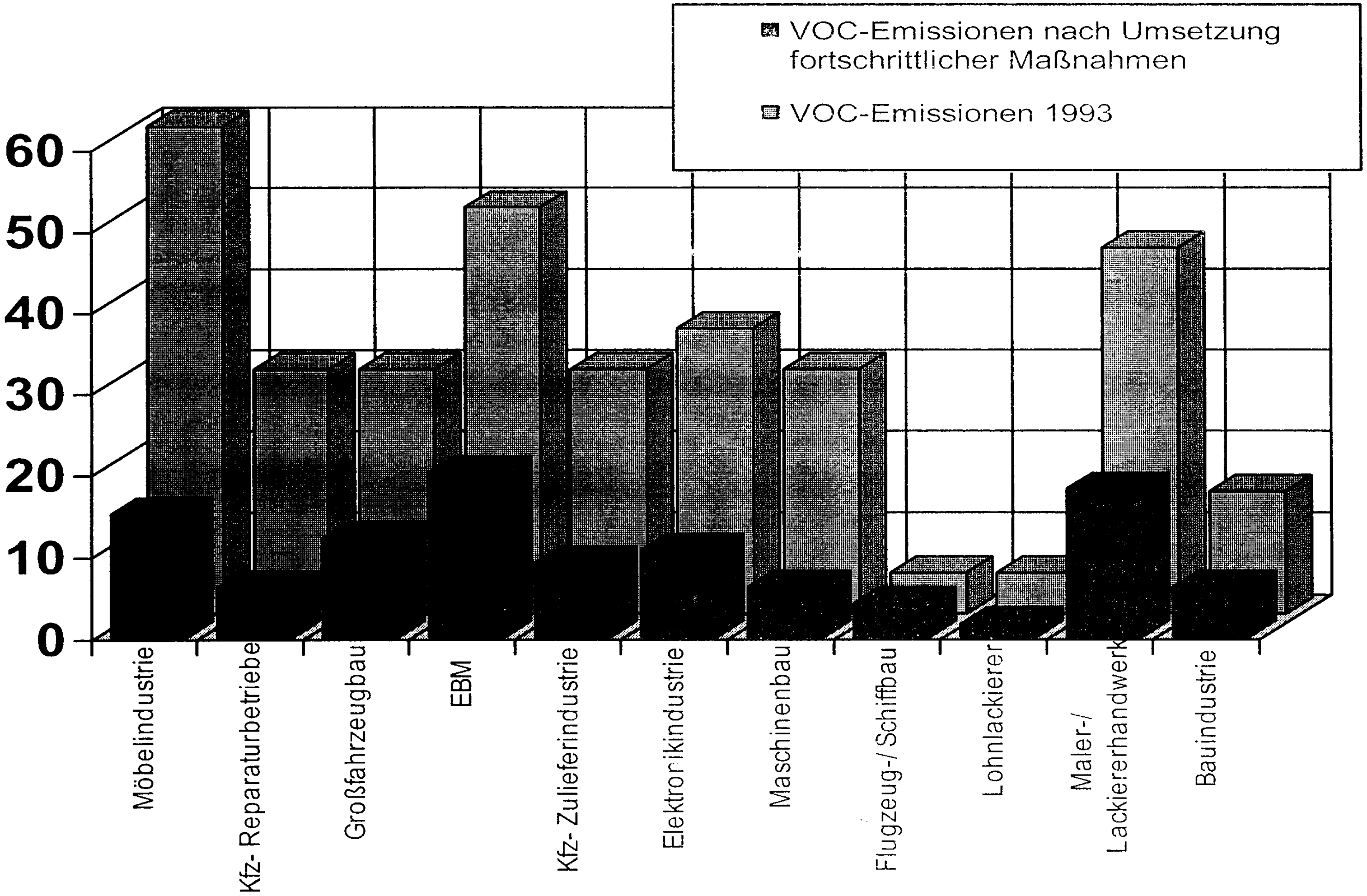
25 kg solids on workpiece

16 kg solvent emissions

23 kg solvent emissions

paint sludge
25 kg solid
6 kg solvent

VOC emission reduction potential in Coating sector



The Solvent Ordinance (31.BImSchV)
Introduction

Implementation of the

Council directive 1999/13/EC of 11th of March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations

Introduction
General Context

- Precursors to tropospheric ozone
- Reduction of tropospheric ozone
- Hazardous to environment and human health
- Part of legislation for prevention and reduction of air pollution

附件四：德國減少表面處理作業VOC排放之管制及防制措施

附件四：德國減少表面處理作業 VOC 排放之管制及防制措施

Regulatory measures and possible activities for Reducing VOC in the surface treatment in Germany

- Implementation of EU Solvent Emission Directive-

Birgit Mahrwald, Federal Environment Agency, Germany

Introduction

In this information paper it will be given an overview on sources of VOC-Emissions, on coating and surface cleaning processes and devices. Regulatory and possible technical measures especially primary measures to reduce VOC emissions will be described. One important instrument for reducing is the EU VOC Emission Directive. The background of the implementation of this directive in Germany will be also represented.

1. Coating processes and Environmental Pollution

On the one hand, coating has the ecologically desirable aim of prolonging the service life of products through the paint's protective function, but on the other hand, the coating process also pollutes the environment. In coating with conventional techniques and materials, only about 25% of the input is utilised for producing the coat. The remainder is released to the environment as emissions to air and water, or as waste. Figure 1 shows exemplarily how these emissions are generated

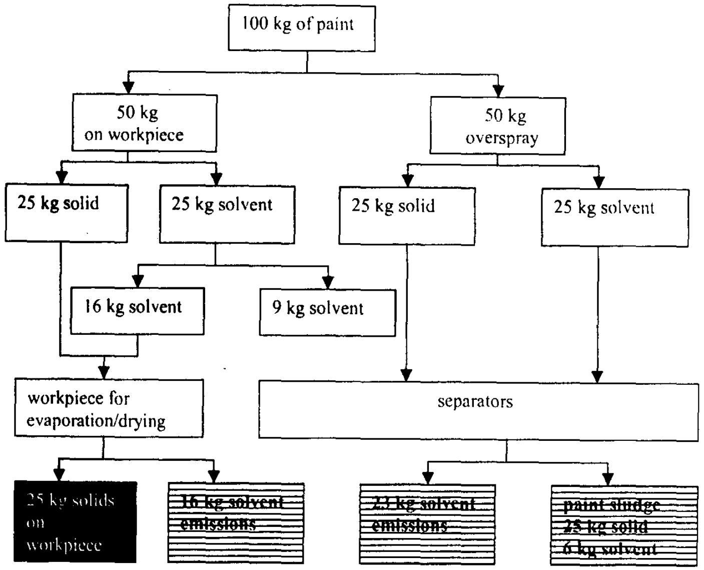


Figure 1: Material flows in conventional spray-painting

Figure 2 shows the relevant shares for Germany. It can be seen that coating activities are a major source sector.

In addition, some 250,000 300,000 tonnes of paint sludge is generated each year in coating activities, and this sludge has to be disposed of as hazardous waste.

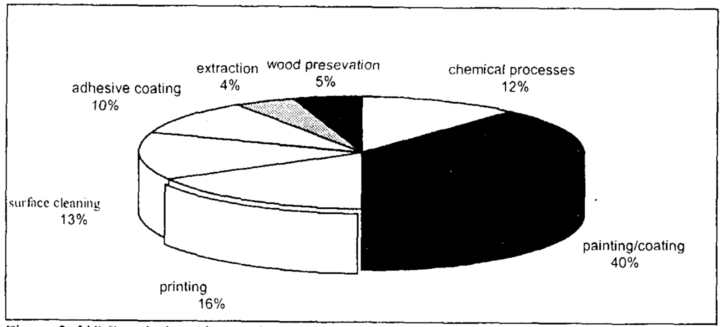


Figure 2: VOC emissions from solvent use in Germany

1.1 Contribution of important coating processes to total VOC emissions

An overview of the VOC emissions from coating sectors was compiled in the framework of a dialogue between the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Chemical Industry Association (VCI) concerning environmental targets, in which VOCs were used as an example (final report submitted at the end of 1997). In addition to the sectors **coating of buildings/facades (50 kt), vehicle refinishing/coating of commercial vehicles (30 kt), machinery construction (25 kt)** and the sector **wood processing** was identified as a relevant emission source, with **nearly 48 kt**. Furthermore, it was estimated that the solvents used in these sectors as constituents of paints, dilutions, stains and cleaning agents are emitted at a rate of more than 90%. This should give cause to assume that this sector has a particular obligation to devote major attention to VOC emission abatement in future.

1.2 VOC reduction potential

Coating installations that are subject to licensing under the Federal Immission Control Act (plants with solvent consumption of 25 kg/h or more) must comply with the emission control requirements of the Technical Instructions on Air Quality Control (TA Luft). However, these large coating plants only account for about 20% of the total VOC emissions from industrial coating activities whereas 80% of VOC emissions are generated in plants not subject to licensing. Specific statutory emission abatement requirements have not yet or little been established for these plants. Now reduction potential must be mobilised in these areas in particular.

Advanced measures to reduce solvent emissions were determined and emission reduction potentials were estimated for various coating application sectors, including the furniture industry, in a research project funded by the Federal Environmental Agency under the

Environmental Research Plan (project: "Determination of the emission situation and advanced emission reduction measures for coating plants in hitherto non-regulated sectors") (Figure 3).

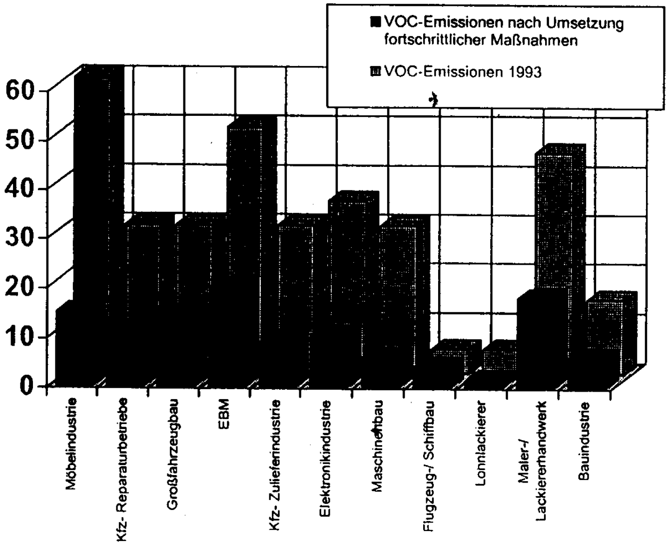


Figure 3: VOC reduction potential, by application sector
VOC emissions in 1993 and VOC emissions following implementation of advanced measures

1. column: furniture industry
2. column: vehicle refinishing
3. column: construction of large motor vehicles
4. column: metal coating
5. column: motor vehicle equipment industry
6. column: electronics industry
7. column: machinery construction
8. column: construction of aircraft/shipbuilding
9. column: contract coating
10. column: painting/coating trade
12. column: construction industry

In general, the use of low-solvent coating materials, e.g. water-based paints, constitutes the state of the art in the area of wood coating as well, both for large and for small- and medium-sized plants (WKI-Frauenhoferinstitut für Holzforschung). In Austria, coating of furniture is among the sectors for which VOC abatement requirements have been established for plants > 5 t/a under Austria's Coating Installations Ordinance. This was based on the assumption that

both the use of low-solvent paints and the use of a waste gas treatment system are technically feasible emission abatement measures.

An overview of primary measures successfully used in the furniture industry is given below:

Abatement measures	Applications	Remarks	Source
Air-drying water-based coatings and UV coatings for all coats; solvent content between 0-0.8%, 3% maximum.	Chipboards for manufacture of low-and medium-priced bedroom furniture, children's room furniture and small pieces of furniture		LAHMAYER research project no. 104 03 525, Federal Environmental Agency (UBA), March 1995
Conventional primer. Water-based paints for filler, basecoat, topcoat; recovery of overspray via booth walls sprinkled with paint	Coating of pinewood and oak coffins		ditto
No- or low-solvent coating materials: water-based primers and acrylate-based UV surface coatings; application by rolling and flooding; use of PUR paint instead of NC lacquer for spraying of edges	bedroom furniture / wood core plywood coated with high-quality veneer	Reduction potential: VOCs: 85% coating waste: 65% coating consumption: 70% 20% capacity increase	Investment project: company Wackenhut, Baden-Württemberg
Water-based primer (1% solvents); acrylate-based UV topcoat (8% solvents); application by rolling	Panels		Pilot project, Bavaria
Water-based paints (primer, topcoat); electrostatic spray coating	Tables and chairs made from beechwood	DM 12 million investment for new plant (paint-in-paint booth)	JOT 1998/4 Brunner GmbH, Baden-Württemberg
Use of UV water-based paint; recovery of overspray; thermoreactor	Profiled solid-wood boards		LIFE project
Powder coating	MDF boards	Development project	DBU project 01/1999 + JOT 10/98
Water-based paint	Windowframes children's furniture		Company Eisenmann - Catalogue
Low-emission coating systems: stain, water-based: ca. 95% H_2O/3% solids combination stains: 30% solvents/70% H_2O PUR paint, medium: 40-50% solvents/50-60% solids UPE rolling lacquer, UV: 0-2% solvent UPE stopper, UV: 0% solvents Water-based paint, conv.: 5-7% solvents/approx. 30% solids Water-based paint, UV: 2% solvents/approx. 40% solids Water-based paint, 2-component PUR: 9% solvent/approx. 30% solids	Flat surfaces large surfaces, office furniture, parquet, doors, bedroom furniture Tabletops chair industry, furniture industry in general		VDI 3462, Part 3: Emission Control – Wood Machining and Processing Bearbeitung und Veredlung des Holzes und der Holzwerkstoffe, 10/96
Natural-resin systems:	Solid wood		JOT 4/98

water-based Hard primer, water-dilutable: no solvents Hard oil 13% solvents hard wax 16% solvents hot-spray wax 1% solvents hot-spray oil no solvents	10-20 g of coating/m^2 10-30 g of coating/m^2 10-30 g of coating/m^2		Mr. Hansemann, Votteler Lackfabrik
Solvent-free UV coatings (100% solids) UV structural coatings (100% solids) vacuum coating technique	Panels, boards, ledges	New for application by rolling State of the art for UV water-based coatings, innovative for UV 100% solids coating	LIFE project, Technologie-zentrum
Use of water-based paints for all coats (stain, primer, filler, clear coat, top coat lacquer)	High-quality kitchen furniture	DM 2 million investment	1 company in Bavaria
Mixed coat structures (water-based paint, solvent-containing coatings)	High-quality kitchen furniture		1 company in federal state Baden Württemberg
Use of water-based paints in carpentry	Research project	project completed successfully, follow-up project on optimised drying has started	federal state Baden-Württemberg

2. VOC reduction potential in the area of surface cleaning with organic solvents (except for high volatile halogenated solvents)

In a research project carried out by Ökorecherche, Frankfurt, the emission situation in the surface cleaning sector was determined, advanced measures for reducing VOC emissions were identified and conclusions were drawn with regard to the emission reductions achievable by the use of technically and economically feasible measures (project: "The state of art and the potential to reduce VOC-emissins from surface cleaning installations" Federal environment agency, Berlin 1999)

As major surface-cleaning sub-sectors, the following were investigated and described in terms of solvents used and cleaning techniques applied:

- the service sector, with particular emphasis on car repairing installations
- Car dewaxing
- industrial metal degreasing in general, with the sub-sectors: manual degreasing (in industrial workshops, of production equipment, metallic products) and plant cleaning,
- special industrial applications, with the sub-sectors: rinsing of resin casting plants, tank cleaning in the manufacture of sealants, cleaning of tampon printing blocks, and product finishing,
- precision cleaning, with the sub-sectors: electronics, optics and precision engineering,
- removal of coatings.

Data were compiled on the materials flows associated with the use of solvents in these sub-sectors (cf. Table 1).

Table 1: Surface cleaning with non-halogenated organic solvents in Germany in 1998, by sub-sector: solvent consumption, VOC emissions to air, disposal of spent solvents

Sub-sector	**Solvent consumption in t/a**	**VOC emissions in t/a**	**Waste solvents in t/a**
Non-industry service sector	11000	6200	4800
Car dewaxing	6600	1225	5375
Industrial metal degreasing, total;	27200	12000	15200
- *manual cleaning*	*25000*	*11100*	*13900*
- *plant cleaning*	*2200*	*900*	*1300*
Special industrial applications;	12000	8600	3400
of which, manual finishing of products	4500	3500	1000
Precision cleaning	4400	2755	1645
Coating removal	2500	370	2130
Total	**63700**	**31150**	**32550**

Consumption of non-halogenated organic solvents in the sub-sectors investigated amounts to a total of about 63,700 tonnes. Of this amount, just under 50% is emitted to air. The other half leaves the process primarily via the waste path and is mainly incinerated. In specific sub-sectors, such as stripping with organic solvents, an efficient solvents cycle with external regeneration has established itself. A fact that is also of importance is that manual applications account for about two-thirds of the emissions and that cold application of the solvents predominates.

Substitution of organic solvents by water-based cleaners, going over from using volatile solvents to using non-volatile solvents, and use of closed cleaning systems instead of manual cleaning or open cleaning systems, were found to be important measures for VOC abatement. A 50% reduction in VOC emissions is achievable in the sector investigated if these measures are implemented.

Against the background of the EC Solvent Emission Directive, the study also explored the question of how much of the emission reduction potential determined would be harnessed if the Directive were implemented as is. Table 2 gives an overview of the estimates made for the various surface cleaning activities.

Table 2: Reduction of VOC emissions in various surface-cleaning sub-sectors through implementation of the EC Solvents Directive as is and based on the state of the art, in tonnes/year

Sub-sector	Total number of plants/total emissions		Plants with solvent consumption ≥2 t/a		Emission reduction through implementation of EU Dir. as is (plants > 2 t/a)	Additional emission reduction based on state of the art
	Plants (number)	Emissions (t/a)	Plants (number)	Emissions (t/a)	(t/a)	(t/a)
Service sector	50000	6200	40	25	5	2900
Car dewaxing	2300	1225	250	890	n.a.	1125
Metal degreasing	27000	12000	2100	9800	6090	1080
Special applications	138000	8600*	400	750	300	2200
Precision cleaning	1100	2755	240	2365	1915	100
Removal of coatings	250	370	100	360	< 1	70
Total	**218650**	**31150**	**3130**	**14190**	**8310**	**7475**

* including cleaning facilities for industrial tampon printers (120000 plants, emissions 3500 t)

According to this estimate, VOC emissions will probably be reduced by only 27% if the EC Solvents Directive is implemented as is, although a reduction of 50% would be achievable by the use of state-of-the-art measures. This is due, on the one hand, to lacking pressure towards implementation of advanced measures, because a fairly large number of users are not covered by the scope of the Directive. On the other hand, it is due to the requirements of the Directive themselves, which, in some sectors, are already being complied with by existing installations, so that any further VOC reduction cannot be expected from these sources, either. For the area of surface cleaning, it seems to be expedient to extend the scope by lowering the solvent consumption threshold from 2 t/a to 1 t/a, thus creating the prerequisite for an additional reduction of 1000 tonnes.

A main reason that a total reduction potential of only 50% was determined for the sectors investigated is that manual open-system cleaning accounts for a high percentage of the applications. In this area, an additional reduction is achievable only by reducing the solvent content of the cleaning products used. This requires initiative on the part of the manufacturers of cleaning products, in particular. Product-related regulations and restrictions on the solvent content could generate additional reduction potential.

3. VOC reduction in the area of surface cleaning with highly volatile halogenated Hydrocarbons by SECOND ORDINANCE

The aim of the Second ordinance on the implementation of the Federal Immission Control Act Ordinance on the Limitation of Emissions of Highly Volatile Halogenated Hydrocarbons – Second BImSchV) of 10 December 1990 was to prevent or to reduce the emissions of highly volatile halogenated Hydrocarbons, because they are very hazardous to environment and human health. The implementation of the second ordinance in 1991 led to a reduction of the of highly volatile halogenated hydrocarbons of more than 70 %. Devices with closed solvent loop, promoted by Second ordinance decrease extremely the use of halogenated solvents (e.g. in the area of dry cleaning from 20.000 tonnes before 1991 to 3 000 tonnes after 1991). Following the most important points of the Ordinance are listed especially with respect to dry cleaning devices.

Scope of the Ordinance:
This Ordinance had to apply to the construction, structure and operation of

- Surface Treatment Devices (including cleaning and degreasing),
- Dry Cleaning (including Textile Finishing) Devices) and
- Extraction Devices,

while using solvents containing Halogenated hydrocarbons with boiling points at 1013 mbar of up to 323 Kelvin [150°C] (highly volatile Halogenated hydrocarbons).

Requirements to solvents used:
When operating installations no solvents other than

- tetrachloroethylene,
- trichloroethylene or
- dichloromethane

in a technically pure form shall be used.
In dry cleaning devices only tetrachloroethylene shall be used.

Requirements to operateurs of dry cleaning:
Machines are to be constructed and operated in such a way

- that on completion of the drying process the mass concentration of tetrachloroethylene (PER) in the drying air at the point of exit from the drum area does not exceed **2 grammes per cubic metre**, when the drum is turning, the ventilation is switched on, the loading door is closed and the temperature of the goods to be treated is not lower than 308 Kelvin [35°C] and
- a safety device automatically takes effect at the beginning of the treatment process which locks the loading door until the mass concentration of PER is no longer exceeded after completion of the drying process according to the results of a continuous examination using measurement techniques.
- Waste gases drawn off by dry cleaning machines shall be fed to a separating device which ensures that the emissions of PER in the undiluted waste gas do not exceed a mass concentration of **20 milligrammes per cubic metre**, relative to the waste gas volume under standard conditions (273 K [0°C] 1013 mbar). The separated PER shall be retrieved. The separating device shall not be desorbed by fresh air or ambient air. Sentence 1 shall not apply to ventilation devices pursuant to para.
- After separation following treatment in dry cleaning devices and in the case of waste volume stream of over 500 cubic metres per hour either equipment for continuous measurement by means of a recording measurement device for the mass concentration of PER in the waste gas shall be used, or else equipment which registers an increase in the masse equipment which registers an increase in the mass concentration to over 1 gramme per cubic metre, which in such a case releases automatic switch-off of the dry cleaning and textile finishing devices connected to the separating device.
- In dry cleaning devices only regeneratable filters may be used for cleaning the liquid solvent.
- The operating rooms shall only be aired by drawing off the ambient air by means of ventilation equipment. Ventilation is to be carried out in such a way that the emissions of PER arising in the areas of the machines, where solvents are stored, where cleaned or

equipped treated goods are stored, where the ironing boards or the steam pressing equipment is place or where the machines are unloaded, are caught and drawn off.

- In the operating rooms no PER may be used outside the dry cleaning machines.

Handling of solvents:
Loading of devices with PER as well as unloading of used solvent shall be made in such a way that emissions of PER are avoided according to the state-of-the-art, in particular by ensuring that the displaced solvent-containing waste gases are

- drawn off and fed into a separating device or
- exchanged according to the gas displacement procedure.

Residual substances containing PER shall only be unloaded from the installations by means of a closed device.
Halogenated hydrocarbons or residuals containing such substances may only be stored, transported or handled in closed containers.

General Requirements:
Devices shall only be operated if the entry of halogenated hydrocarbons

- into a room designed for human use and not belonging to the installation or
- into an adjacent installation in which food pursuant to Article 1 of the Act on Food and Consumer Products (Lebensmittel- und Bedarfsgegenständegesetz) are produced, treated, brought into circulation, consumed or stored,

is limited according to the state-of-the-art technology.
If an **ambient air concentration** of PER of over **0.1 milligrammes** pro cubic metre is determined – calculated as a mean value over a period of seven days – which is due to the operation of an adjacent device the operator shall adopt measures within a period of six months which ensure that an ambient air concentration of 0.1 milligrammes per cubic metre is not exceeded.

4. German Solvents Ordinance of 25 August 2001

The German Solvent Ordinance regulates various activities in accordance with the EC Solvents Directive, from printing through surface treatment, dry cleaning, coating of surfaces, manufacture of coating preparations, varnishes, adhesives and pharmaceutical products to rubber conversion and extraction. Very detailed requirements have been formulated for these installations/activities, in the form of emission limit values in waste gases and fugitive emission values or as total emission limit values.

The Ordinance provides increased protection against solvents that are particularly harmful to human health: In addition to requiring the substitution of and very stringent emission limit values for carcinogenic, mutagenic and teratogenic substances, it also contains stricter requirements for volatile organic compounds suspected of causing irreversible damage, e.g. cancer, and/or assigned to Class I under section 3.1.7 of the TA Luft.

More stringent limit values have been defined above all for larger installations/installations subject to licensing. Furthermore, the scope was extended to include smaller plants in the sectors wood and furniture coating and vehicle refinishing, because these two sectors combined account for a very significant percentage of total VOC emissions from solvent use and abatement measures such as the use of coatings with a lower solvent content have been tried and are already in use. The use of a reduction scheme is possible in these plants and was therefore incorporated into the Ordinance as a requirement, in order to allow the considerable reduction potential to be tapped.

The Solvent Ordinance allows, in principle, the alternative of demonstrating, by the use of a reduction scheme, that emission reductions equivalent to those achieved if the emission limit values were to be applied, are achieved by other means. The possibility of using a reduction scheme is designed to encourage the application of primary measures, such as use of coatings containig no or little solvents and high-efficiency application techniques. Smaller and medium-sized installations in particular are thereby provided with an ecologically and economically sensible alternative to secondary (waste gas treatment) measures.

Further the German Solvent Ordinance provides for the use of a simplified reduction scheme for installations not subject to licensing belonging to specific sectors, such as vehicle refinishing and coating of wood and other materials. This means, the requirements of the reduction scheme will be considered as complied with if it has been demonstrated that coatings not containing VOCs in excess of a defined maximum-permissible value are used exclusively.

The marking of relevant products with their VOC value is an important prerequisite for the use of the simplified reduction scheme. Manufacturers, formulators and suppliers of coating preparations are called upon to meet their customers' future demand for information by providing easy-to-process information, e.g. on invoices.

4.1 Basics of the German Solvent Ordinance

Origin point of the German Ordinance was the implementation of the **EC Solvent Directive 1999/13/EG**. The Federal Environmental Agency has presented proposals for implementation, on behalf of and in cooperation with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, which have been under discussion since September 1999 and form the technical basis for the German Ordinance.

The aspects listed below had or still have a major influence on the implementation of the EC Directive:

- The necessary adaptation to the existing, very differentiated immission control legislation applicable in Germany.
- Consideration of the results of the dialogue between the Federal Environment Ministry and the Chemical Industry Association, which suggest that a VOC reduction of not more than 50% can be achieved in the relevant plants if the requirements of the EU Solvents Directive are implemented as they are.
- Continuation of the state of the art in the field of emission control and the current authorisation practice for plants subject to licensing.
- Consideration of research results and VDI standards on the state of the art in emission control.
- Consideration of the medium- to long-term objective of tackling the ozone problem, which requires a 70-80% reduction of both precursors (VOC and NO_x).

As the EU Solvents Directive lags behind, in some areas substantially, the level of development already achieved in Germany in the field of emission control, simply adopting the Directive does not constitute a useful approach.

Therefore, more stringent requirements have been formulated in some cases for its implementation into german law.

Stricter limit values have been set in some cases, notably for installations subject to licensing, and, furthermore, the scope was extended to include smaller plants in the areas of wood coating and vehicle refinishing. Overall, these two sectors account for a very significant proportion of total VOC emissions from solvent use, and abatement measures such as the use of coatings with a lower solvent content have been tried and are already in use. The use of a reduction scheme is possible for these plants and is planned to be introduced in order to tap the considerable reduction potential.

Important requirements of the Solvents Ordinance for surface treatment plants/activities such as surface coating, adhesive coating, laminating and cleaning are presented in the following.

Threshold values: The solvent consumption thresholds are of particular importance. If a threshold defined for a particular activity is exceeded, the installation or activity in question are subject to notification and must comply with the requirements of the Ordinance. More stringent requirements apply to installations that exceed a further, higher, solvent consumption threshold (i.e., larger installations and installations subject to licensing under the Federal Immission Control Act). Table 3 shows the thresholds and limit values to be complied with in a number of relevant surface treatment activities.

Table 3: Requirements for relevant surface treatment sectors

Activity/installation Solvent consumption threshold in t/a	Emission limit value in waste gases (mg C/Nm^3)	Fugitive emission value (percentage of solvent input)	Remarks
Vehicle refinishing (no threshold)	50	25	<u>simplified</u> reduction scheme applicable
Coil coating > 25	50 / 20[1] 75[2]	3	[1] in the case of TCP** [2] in case of solvent recovery
Other metal and plastic coating * > 5 > 15	 100 50 20[2]	 25 / 15[1] 20 / 10[1]	[1] automated coating of sheets [2] in the case of TCP**
Coating of wooden surfaces > 5 > 15 > 25	 No requirement 100 50 20[1]	 No requirement 25 20	Simplified reduction scheme [1] in the case of TCP**
Adhesive coating > 5 > 15	 50 / 100[1] 50 / 20[2]	 25 20	[1] if solvents recovery takes place [2] in the case of TCP**
surface cleaning[1 2] (but not with highly volatile halogenated organic compounds) > 1 > 10	 75 75	 20 15	[1] Exemptions from compliance with limit values if cleaners with a solvents content of less than 20% are used [2] More stringent values apply if cleaners labelled with risk phrases 40, 45, 46, 49, 60, 61 are used

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* This includes coating processes in such diverse sectors as the electrical and electronics industry, machine construction, metal coating, automotive equipment, aircraft construction and shipbuilding.

** TCP = thermal post-combustion

In this context, **waste gases** mean all captured solvent emissions discharged via a waste gas treatment system.

In contrast, **fugitive emissions** mean uncaptured emissions of solvents to air, soil and water as well as of solvents which may be contained in the products as impurities. They include emissions that are released within a plant to in-plant waste air and discharged via ventilation systems without waste gas treatment. The fugitive emission value refers to the solvent input, which is composed of the input of fresh solvents, as such or in preparations, and the input of regenerates.

The fugitive emissions are determined on the basis of a solvent management plan (see p. 14).

Total emission limit values for the vehicle coating sector: In some sectors such as vehicle coating, total emission limit values have been defined instead of emission limit values in waste gases and fugitive emission values. This makes it possible for the plant operator to choose between different combinations of measures that are adapted to the specific production conditions and allow safe compliance with this limit value. The following total emission limit values, related to square metre of coated surface, have been proposed for vehicle coating with a solvent consumption of more than 15 tonnes per year:

Table 3: Surface-related emission limit values for the vehicle coating sector

Vehicle coating sub-sector Solvent consumption > 15 t/a	**Total emission limit value [g VOC/m^2]**	**Remarks**
Cars	35	Waste gas downstream of dryer: 50 mg C/m^3
Truck cabins	45	
Vans and trucks/Trailers	70	
Buses	150	
Track vehicles	110 Exist. installations, until 2005: 130	

Reduction scheme: As an alternative to the limit value arrangements presented above, operators of coating plants in particular have the option to draw up and fulfil a reduction plan. The purpose of the reduction scheme is to allow the operator the possibility to achieve by means of primary measures, such as use of low-solvent or solvent-free coating products and/or application methods with a higher coating efficiency, emission reductions equivalent to those achieved if the emission limit values were to be applied and thus not to have to install a waste gas treatment system downstream of the process. This provides small and medium-sized installations with an ecologically and economically sensible VOC minimisation alternative.

The starting point for the emission reduction plan is the total mass of solids in the quantity of coating consumed in the respective reference period (annual consumption of solids). In the case of "Other coating of metallic or plastic surfaces", for example, this mass is multiplied by a factor of 1.5. This gives the so-called "annual reference emission". The maximum allowed total annual emissions, termed "target emission", is calculated by multiplying the reference emission by a percentage which in the case of large installations is equal to the fugitive emission value + 5 and in the case of smaller installations, to the fugitive emission value + 25.

This means:

Annual reference emission = kg solids/year x factor 1.5 (for the sector "Other metal coating")

Target emission = reference emission x (fugitive emission value + 5/25) %

The respective target emissions must be achieved by 31 October 2004 for new installations and by 31 October 2007 for existing installations. As a requirement designed to set **"intermediate targets"** towards achievement of the target emission, existing installations must demonstrate compliance with 1.5 times the target emission by 31 October 2005 (*mass balance* for the year 2004). The bases for the reduction scheme calculation are shown below for a number of major surface treatment sectors:

Installations/Activities	Solvent consumption t/a	Multiplication factor for calculation of annual reference emission	Percentage for calculation of target emission
Coating of track vehicles	5-15	1.5	(25+15)%
	> 15		(20+5)%
Vehicle coating	≤ 15 t	2.5	(25+15)%
Vehicle refinishing	No threshold	2.5	(25+15)%
Coil coating (No. 6)		2.5	(5+5)%
Other metal and plastic coating (No. 8)			
- other coating	5-15		(25+15)%
	> 15	1.5	(20+5)%
- coating of sheets	5-15		(15+15)%
	> 15		(10+5)%
Coating of wooden surfaces (No. 9)	5-15	4	(25+15)%
	≥ 15-25	3	(25+15)%
	> 25	3	(20+5)%
(Adhesive coating) No. 14			
- other coating	5-15		(25+5)%
	> 15	3	(20+5)%
- coating of sheets	5-15		(15+5)%
	> 15		(10+5)%

Solvent management plan: A solvent management plan (cf. Figure 4) is to be used to verify compliance with the total emission limit values, the diffuse emission values or the requirements of the reduction scheme, and it constitutes the basis for calculating the solvent consumption. This is to be done using the following equations:

→ solvent consumption = I1 – O8

→ fugitive emissions = I1 – O1 – O5 – O6 – O7 – O8, or

= O2 + O3 + O4

→ total emissions = fugitive emissions + O1

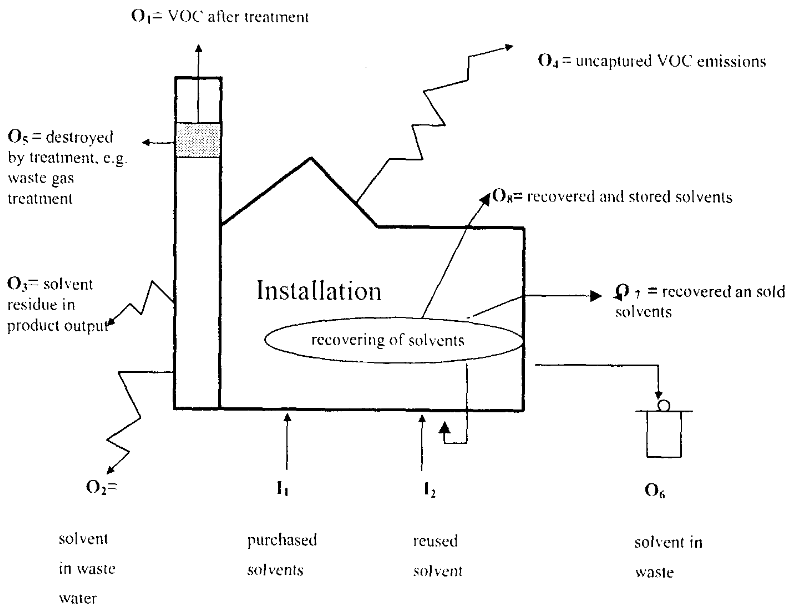

Figure 4: Solvents mass balance (*input = I, output = O*)

4.2. Simplified reduction schemes for specific sectors

The Federal Environmental Agency has estimated that in addition to the plants already subject to licensing under the 4th BImSchV (about 1,000), there are some 15,000 plants which will become subject to notification, so that both the plants subject to notification and the plants already subject to licensing will have to demonstrate compliance with the requirements. This means an impending additional burden for both operators and supervisory authorities. The use of simplified reduction schemes could bring about considerable simplifications for operators and supervisory authorities. The draft Solvents Ordinance allows such a possibility for installations not subject to licensing belonging to specific sectors.

Vehicle refinishing, for example: Plant operators will be released from the obligation to draw up a solvent management plan and prove compliance with the target emission if they instead furnish a simple declaration concerning the coatings they use. In this declaration, the operator merely has to prove that he only uses coatings whose VOC content does not exceed a defined value as shown in the table below:

Table: VOC values for products used in vehicle refinishing

Product	VOC value
Tool cleaner	**≤ 850**
Precleaner	**≤ 200**
Stopper	**≤ 250**
Wash primer	**≤ 780**
Primer surfacer	**≤ 540**(1)
1-coat topcoat	**≤ 420**
Basecoat	**≤ 420**
Clear coat	**≤ 420**(2)

(1) 250 g/l will apply as of 2010

(2) To be adapted to the state of the art as of 2010

A VDI guideline on emission control in vehicle refinishing identifies the coatings specified above as low in emissions according to the present state of the art and shows that the use of these coatings in conjunction with a low-emission application technique (HVLP) allows VOC emissions to be reduced by up to 70% compared to conventional coating practice. This would mean compliance with the requirements of the reduction scheme.

Wood coating, for example: For wood coating installations not subject to licensing, the requirements of the reduction scheme are to be considered as complied with if the VOC content of the coatings used is not more than 250 grams per litre for coating of flat and plane surfaces, not more than 450 grams per litre for coating of other surfaces, and not more than 300 grams per litre in the case of stains.

Other coating, for example: In this area, the requirements of the reduction scheme will be considered as complied with if coatings with a VOC content of not more than 250 g/l are used exclusively.

The marking of relevant products with their VOC value is an important prerequisite for the use of the simplified reduction scheme. Manufacturers, formulators and suppliers of solvent-containing products are called upon to satisfy their customers' future demand for information by the provision of easy-to-process information, e.g. on invoices.

4.3 Conclusions / Outlook

Industrial users of solvent-containing products are well-advised not to delay getting a picture, by drawing up a solvent management plan, of whether the future emission abatement requirements necessitate changes within their plants: Process modifications, the use of low-solvent products, more efficient solvent management practices, the installation of modern equipment and systems in the course of technical renewal, are all measures which should be planned or initiated today in order to avoid having to introduce measures later on with high urgency, which is usually the more costly alternative.

An other main conclusion should be that parallel to the national implementation of the regulations governing industrial activities, political efforts towards the introduction of product-related regulations, i.e. limitation of the VOC content of the solvent-containing products used, must be stepped up at the European level, for especially in the case of small installations, the manual trades and final consumers, use of primary measures is the only technically feasible and proportional option. Suitable low-solvent or solvent-free products are available on the market. Studies have shown that in many sectors the use of these products is also associated with economic advantages.

附件五：德國空氣污染管制技術參考手冊

附件五：德國空氣污染管制技術參考手冊

First General Administrative Regulation Pertaining the Federal Immission Control Act
(Technical Instructions on Air Quality Control – *TA Luft*)
Dated...

Pursuant to § 48 of the Federal Immission Control Act as promulgated on 14 May 1990 (BGBl. [*Bundesgesetzblatt* - Federal Law Gazette] I p. 880), as amended by Article 2 of the Act of 27 July 2001 (BGBl. I p. 1950), the Federal Government decrees the following General Administrative Regulation after having heard the parties concerned:

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1 Scope of Application

These Technical Instructions serve to protect the general public and the neighbourhood against harmful effects of air pollution on the environment and to provide precautions against harmful effects of air pollution in order to attain a high level of protection for the environment altogether.

The provisions of these Technical Instructions shall be observed when

a) examining applications for a licence to construct and operate a new facility (§ 6 para. (1) of the Federal Immissions Control Act) as well as to alter the location, nature or operation of an existing facility (§ 16 para. (1), also in connection with para. (4) of the Federal Immissions Control Act),

b) examining applications to grant a partial licence, to render a provisional decision or to grant permission of early start (§§ 8, 8a and 9 of the Federal Immissions Control Act),

c) examining whether an alteration is subject to licensing (§ 15 para. (2) of the Federal Immissions Control Act),

d) deciding about subsequent orders (§ 17 of the Federal Immissions Control Act) and

e) deciding about orders concerning the determination of the type and quantity of the emissions released from a facility and the immissions occurring within the sphere of influence of such facility (§ 26, also in connection with § 28 of the Federal Immissions Control Act).

The protection against harmful effects of odour immissions on the environment is not regulated by this Administrative Regulation; notwithstanding this, this Administrative Regulation regulates the prevention of harmful effects of odour emissions.

The requirements under 5.1 to 5.4 shall not apply to facilities subject to licensing insofar as requirements are made to the prevention and to the determination of emissions of air pollutants in Ordinances issued by the Federal Government.

Insofar as, regarding the obligations of operators of facilities not subject to licensing pursuant to § 22 para. (1) nos. 1 and 2 of the Federal Immissions Control Act, it shall be assessed whether harmful effects of air pollutants exist, the principles of determination and measures to assess harmful effects on the environment established under 4 shall apply. A determination of immission indicators pursuant to 4.6 shall not occur insofar as an individual test shows that the efforts to be made for this would lack proportionality. If facilities not subject to licensing substantially contribute to the development of harmful effects on the environment, it is to be checked whether all best available techniques by which to avoid such development have been applied. Harmful effects on the environment which cannot be avoided by applying the best available techniques shall be kept to a minimum. Insofar as, in order to fulfil the obligations arising from § 22 para. (1) nos. 1 and 2 of the Federal Immissions Control Act, requirements may be made to facilities not subject to licensing, the requirements for precautions under 5 which apply to facilities subject to licensing may also be used as a possible source of information. In the event of an order issued pursuant to §§ 24 and 25 of the Federal Immissions Control Act, clean air plans shall be observed.

2 Definitions of Terms and Units of Measurement

2.1 Immissions

For the purposes of this Administrative Regulation, immissions shall be air pollutants affecting humans, animals, plants, soil, water, atmosphere or cultural and any other property.

Immissions shall be indicated as follows:

a) mass concentration, as mass of air pollutants in relation to the volume of air polluted; with gaseous substances, the mass concentration shall refer to 293.15 K and 101.3 kPa.

b) deposition, as a time-related area cover caused by the mass of air pollutants.

2.2 Immission Indicators, Evaluation Parcels, Model Parcels

Immission indicators shall indicate the existing load, the additional load or the total load caused by the respective air pollutant. The existing load shall be indicated by an indicator which describes the existing load caused by a pollutant. The additional load shall be indicated by an indicator which describes the proportion of immissions which can be expected to be caused in the course of the project applied for (as regards facilities to be built) or which is actually caused (as regards existing facilities). As regards facilities to be built, the indicator for the total load shall be calculated on the basis of the existing load and the additional load indicators; as regards existing facilities, this indicator equals the existing load.

Evaluation parcels include those points in the vicinity of a facility for which immission indicators which indicate the total load are determined. Model parcels include those points in the vicinity of a facility for which the additional load is calculated (immissions projection).

2.3 Immission Values

The annual immission value shall be the concentration or deposition value of a substance averaged over one year.

The daily immission value shall be the concentration value of a substance averaged over one calendar day, taking into account the respective frequency limit for excess values (number of days) over one year.

The hourly immission value shall be the concentration value of a substance, averaged over a whole hour (e.g., from 8 a.m. to 9 a.m.), taking into account the respective frequency limit for excess values (number of hours) over one year.

2.4 Waste Gas Volume and Waste Gas Volume Flow

For the purposes of this Administrative Regulation, waste gases shall be carrier gases together with solid, liquid or gaseous emissions.
For the purposes of this Administrative Regulation, any data regarding the waste gas volume and the waste gas volume flow shall refer to standard conditions (273.15 K and 101.3 kPa) after subtraction of the humidity content of steam unless explicitly to be indicated otherwise.

2.5 Emissions

For the purposes of this Administrative Regulation, emissions shall be air pollutants originating from a facility.

Emissions shall be indicated as follows:

a) mass of substances or groups of substances emitted as related to volume (mass concentration)
   - aa) of waste gas under standard conditions (273.15 K and 101.3 kPa) after subtraction of the humidity content of steam,
   - bb) of waste gas (f) under standard conditions (273.15 K and 101.3 kPa) after subtraction of the humidity content of steam,

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b) mass of substances or groups of substances emitted, related to time as a mass flow (emitted mass flow); the mass flow is the total emission level occurring in one our of due operation of a facility under operating conditions which are most unfavourable to the maintenance of air quality;

c) quantity of fibres emitted (fibre dust concentration), in relationship to the volume of waste gas under standard conditions (273.15 K and 101.3 kPa) after subtraction of the humidity content of steam;

d) ratio of the mass of substances or groups of substances emitted to the mass of products generated or processed or to stocking density (emission factor);
the mass ratio shall take into account the total emissions from the facility occurring over one day of due operation of such facility under operating conditions most unfavourable to the maintenance of air quality;

e) amount of Odour Units of the odorous substances emitted, as related to the volume (odorous substances concentration) of waste gas at 293.15 K and 101.3 kPa before subtraction of the humidity content of steam; the odorous substances concentration is the olfactometrically measured ratio of volume flows when diluting a waste gas sample with neutral air down to the odour threshold, data shall be provided as a multiple to the odour threshold.

2.6 Emission Ratio and Emission Reduction Ratio

The emission ratio shall be the ratio of the mass of an air pollutant emitted in waste gas to the mass supplied together with fuels or charge substances; data shall be provided as a percentage.
The emission reduction ratio shall be the ratio of the mass of an air pollutant emitted in waste gas to the mass supplied together with crude gas; data shall be provided as a percentage. The odour reduction ratio is an emission reduction ratio.

2.7 Emission Standards and Emission Limits

Emission standards shall provide the basis for emission limits.

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The emission limits shall be established in the licensing notice or in a subsequent order as

a) permissible fibre dust, odorous substances or mass concentrations of air pollutants in waste gas provided that
    aa) any daily mean values do not exceed the established concentration level and
    bb) any half-hourly mean values do not exceed twice the established concentration level,
b) permissible mass flows, as related to one hour of operation,
c) permissible mass ratios, as related to one day (daily mean values),
d) permissible emission ratios, as related to one day (daily mean values),
e) permissible emission reduction ratios, as related to one day (daily mean values), or
f) any other requirements to provide precautions against harmful effects of air pollutants on the environment.

2.8 Units and Abbreviations

µm	micrometre:	1 µm = 0.001 mm
mm	millimetre:	1 mm = 0.001 m
m	metre:	1 m = 0.001 km
km	kilometre	
m^2	square metre	
ha	hectare:	1 ha = 10,000 m^2
l	litre:	1 l = 0.001 m^3
m^3	cubic metre	
ng	nanogram:	1 ng = 0.001 µg
µg	microgram:	1 µg = 0.001 mg
mg	milligram:	1 mg = 0.001 g
g	gram:	1 g = 0.001 kg
kg	kilogram:	1 kg = 0.001 Mg (t)

Mg	megagram (same as t: tonne)	
s	second	
h	hour	
d	day (calendar day)	
a	year	
°C	degrees Celsius	
K	Kelvin	
Pa	pascal:	1 Pa = 0.01 mbar (millibar)
kPa	kilopascal:	1 kPa = 1,000 Pa
MPa	megapascal:	1 MPa = 1,000,000 Pa
kJ	kilojoule	
kWh	kilowatt hour:	1 kWh = 3,600 kJ
MW	megawatt	
OU	Odour Unit	
OU/m^3	odorous substances concentration	
LU	livestock unit (1 livestock unit equals an animal live weight of 500 kg)	

2.9 Adjustment

Insofar as numerical values are to be checked in order to evaluate immissions or emissions (e.g. immission values, additional load values, irrelevance values, emission standards), the respective measurement variables and operands shall comprise one digit more than the numerical value used for evaluation. The last digit of the final result shall be adjusted in compliance with No. 4.5.1 of DIN 1333 (February 1992 version) and it shall be supplied in the same unit of measurement and with the same number of digits as the numerical value.

2.10 Existing Facilities

For the purposes of this Administrative Regulation, existing facilities shall be

1. facilities for which – by [insert: effective date of this Administrative Regulation] -
   a) a licence for construction and operation pursuant to § 6 or § 16 of the Federal Immissions Control Act or a permission of early start pursuant to § 8a of the Federal Immissions Control Act has been granted and obligations pursuant to § 5 para. (1) nos. 1 or 2 of the Federal Immissions Control Act are established in such permission,
   b) a partial licence pursuant to § 8 of the Federal Immissions Control Act has been issued or a provisional decision pursuant to § 9 of the Federal Immissions Control Act has been rendered, insofar as obligations pursuant to § 5 para. (1) nos. 1 or 2 of the Federal Immissions Control Act are established therein,
2. facilities which require notification pursuant to § 67 para. (2) of the Federal Immissions Control Act or which required notification pursuant to § 16 para. (4) of the Industrial Code before the Federal Immissions Control Act entered into force.

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3 General Principles for Licensing, Preliminary Decisions and Permissions for Early Start

3.1 Examination of Applications for Licences to Construct and Operate a New Facility

Pursuant to § 5 para. (1) no. 1 in connection with § 5 para. (1) nos. 1 and 2 of the Federal Immissions Control Act, a licence for construction and operation shall only be granted if it is ensured that the facility is constructed and operated in a way which facilitates that

a) the air pollution originating from the facility cannot induce harmful environmental effects for the general public and the neighbourhood and
b) precautionary measures have been taken against harmful environmental effects which may be caused by air pollution originating from this facility.

As to the examination of the prerequisites for licensing, 4 and 5 of this Administrative Regulation shall apply.

3.2 Examining Applications to Grant a Partial Licence (§ 8 of the Federal Immissions Control Act) or to Render a Provisional Decision (§ 9 of the Federal Immissions Control Act)

Insofar as examination refers to an object with regard to which a partial licence is applied for or to the occurrence of specific prerequisites for licensing in a procedure to render a provisional decision, 3.1 shall apply.

In the event of a provisional decision about a site, it shall be examined pursuant to 3.1 whether there are obstacles to the construction and operation of a facility of the type envisaged on the site stated which are connected to clean-air maintenance.

In evaluating the entire facility, as is also stipulated by §§ 8 and 9 of the Federal Immissions Control Act, the examination shall be restricted to whether unremovable obstacles exist to the project which are connected to clean-air maintenance. In order to evaluate the basic eligibility for licensing of a facility, it shall suffice to establish

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that the prerequisites of 3.1 can be met by applying technical or administrative measures; notwithstanding this, the type of project may not be altered by applying such measures.

3.3 Examining Applications for Permission of Early Start (§ 8a of the Federal *Immissions Control Act)*

A permission for early start to construct a facility shall only be granted if a decision in favour of the applicant can be expected. In this context, a brief examination of whether 4 and 5 are observed shall occur.

A positive statement may also be made if the requirements of clean-air maintenance may only be met if obligations which are still to be established are observed; in this event, however, it must be excluded that such obligations may affect the construction work approved pursuant to § 8a of the Federal Immissions Control Act to an extent which poses their implementation into question.

3.4 Examining whether an Alteration is subject to Licensing (§ 15 Para. (2) of the Federal Immissions Control Act)

If an envisaged alteration of location, nature or operation of a facility subject to licensing is notified, it shall be examined whether or not such alteration requires a licence. This shall be the case if the alteration can lead to adverse effects on the resources protected under § 1 of the Federal Immissions Control Act, which may be relevant for the examination pursuant to § 6 para. (1) no. 1 of the Federal Immissions Control Act unless the adverse effects are obviously minor and fulfilment of the obligations arising from § 6 para. (1) no. 1 of the Federal Immissions Control Act is guaranteed (§ 16 para. (1) of the Federal Immissions Control Act).

3.1 shall not apply to the examination of whether notified alterations may lead to adverse effects on clean-air maintenance. The reason for this is that examination shall not serve to clarify whether the licensing prerequisites have been met; the latter shall be dealt with in a licensing procedure, if applicable.

Additional air pollution shall require -- except in cases pursuant to the second sentence of § 16 para. (1) of the Federal Immissions Control Act - a licence for alteration.

3.5 Examining Applications to Grant a Licence for Alteration

3.5.1 The Concept of Alteration

Pursuant to the first sentence of § 16 para. (1) of the Federal Immissions Control Act, a major alteration of location, nature or operation of a facility subject to licensing shall require a licence. At the same time, alterations shall only be deemed to comprise changes of the approved condition but not extended uses of an existing licence.

3.5.2 Alterations with Subsequent Orders

A major alteration shall not require a licence if its implementation serves to carry out a subsequent order pursuant to § 17 of the Federal Immissions Control Act in which it is laid down definitely in which way the location, nature or operation of the facility are to be altered.

3.5.3 Examination Volume

When deciding about granting a licence for alteration, 3.1 shall apply accordingly. The components of the facility and the processes which are intended to be altered and the components of the facility and the processes which would be affected by such alteration shall be checked. As far as other components of the facility and processes are concerned, it shall be checked whether precautionary requirements of this Administrative Regulation can be met with the consent of the operator of the facility when implementing the alteration envisaged. Carrying out these various measures simultaneously may result in fewer efforts and in an early adaptation to the requirements of this Administrative Regulation.

3.5.4 Corrective Measures

A licence for alteration which has been applied for may not be refused even if not all immission values are observed after such alteration has occurred but

a) the alteration is exclusively or to a very high extent intended to reduce immissions,

b) such alteration is not an obstacle to the observation of immission values at a later date and

c) the actual situation does not require the licence to be revoked.

4 Requirements for the Protection against Harmful Effects on the Environment

4.1 Examining the Obligation to Protect

The provisions of 4 include

- immission values for the protection of human health, for the protection against significant nuisances or significant disadvantages and immission values for the protection against harmful effects on the environment due to deposition,
- requirements to determine the existing, additional and total load,
- established criteria which serve to evaluate immissions by drawing up comparisons with immission values,
- requirements in order to carry out a special-case examination.

These items are a tool by which to examine whether the protection against harmful effects on the environment caused by air pollutants emitted during facility operation is ensured.

In examining whether the protection against harmful effects of air pollutants on the environment is ensured (3.1 para. 1 letter a)), the competent authority shall first establish the extent of determination obligations.

As to pollutants whose immission values are established in 4.2 to 4.5, such determination of immission indicators shall -

a) in the event of a low quantity of emission mass flows (cf. 4.6.1.1),

b) in the event of a low existing load (cf. 4.6.2.1) or

c) in the event of an irrelevant additional load (cf. 4.2.2 letter a), 4.3.2 letter a), third sentence of 4.4.1, 4.4.3 letter a) and 4.5.2 letter a)) -

not apply. In these cases, it can be assumed that harmful effects on the environment cannot be caused by the facility unless sufficient evidence speaks in favour of a special-case examination pursuant to 4.8, despite low mass flows pursuant to letter a) or despite a low existing load pursuant to letter b).

When establishing immission values, a tolerance range shall be taken into account for indicator determination. The immission values shall also apply with several pollutants occurring simultaneously or if pollutants are subject to both chemical and physical transformation.

As to pollutants for which no immission values have been established, further determination shall only be necessary if the prerequisites of 4.8 are met.

4.2 Protection of Human Health

4.2.1 Immission Values

The protection against hazards for human health due to the air pollutants listed in Table 1 is ensured if the total load determined pursuant to 4.7 does not exceed the following immission values at any evaluation parcel.

Table 1: **Substance Immission Values in order to Ensure the Protection of Human Health**

Substance/Group of Substances	Concentration µg/m³	Averaging Period	Permissible Annual Frequency of Excess Values
sulphur dioxide	50 125 350	1 year 24 hours 1 hour	– 3 24
nitrogen dioxide	40 200	1 year 1 hour	– 18
benzene	5	1 year	–
tetrachloroethane	10	1 year	–
suspended particulate matter (mw 10)	40 50	1 year 24 hours	– 35

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Substance/Group of Substances	Concentration µg/m³	Averaging Period	Permissible Annual Frequency of Excess Values
lead and inorganic lead compounds, contained in suspended particulate matter (mw 10), to be indicated as Pb	0.5	1 year	

If and insofar as European Communities Directives include limits for poly-aromatic hydrocarbons, arsenic, cadmium, nickel or mercury, the provisions of this number shall apply to these immission values as of the date on which the respective national provision by which such Directives are implemented enters into force. Up to such date, an immission value of 0.02 µg/m³ shall be valid for cadmium and inorganic cadmium compounds contained in suspended particulate matter (mw 10) and to be indicated as Cd, with an averaging period of one year.

4.2.2 Licensing with Exceeded Immission Values

If the total load of an air pollutant listed under 4.2.1 which is determined in compliance with 4.7 exceeds the immission value at any evaluation parcel, a licence may not be refused on the grounds of such excess value, provided that, with regard to the respective pollutant,

a) the indicator for the additional load caused by emissions from the facility at this evaluation parcel does not exceed 3.0 per cent of the annual immission value and if it is ensured by imposed obligation that further measures for clean-air maintenance, including, in particular, measures which reach beyond the best available techniques, are carried out or

b) it is ensured by imposed condition that, as a rule no later than 12 months after the commissioning of the facility, remediation measures (dismantling, closing down, alteration) or other measures which ensure the observation of the

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immission values pursuant to 4.2.1 are carried out at existing facilities of the applicant or third parties.

Improved disposal conditions shall only be taken into account when evaluating the eligibility for licensing if the measures taken at the facilities concerned in order to limit emissions of the respective pollutant comply with the best available techniques.

4.2.3 Licensing with Future Observation of Immission Values

Even if the total load of an air pollutant listed under 4.2.1 which is determined in compliance with 4.7 exceeds the immission value at any evaluation parcel, a licence may not be refused on the grounds of such excess value, provided that, with regard to the respective pollutant,

a) in the legislation pursuant to Article 4, para. 5 of the Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management (OJ L 296 of 21 October 1996, p. 55), a respective limit value is defined the observation of which shall become mandatory on a certain date in the future and

b) it is ensured that the facility will not considerably contribute to the immission value to be exceeded from the given date.

The requirement under para. 1 letter b) is met if

a) by carrying out additional measures to reduce emissions from the facility, by using other raw materials, fuels or auxiliary materials, by altering the process runs or by improving the disposal conditions, the requirements under 4.2.2 can be met and if collateral licensing provisions (§ 12 of the Federal Immissions Control Act) stipulate that the measures which are necessary in order to meet these requirements are carried out before the date given in the EC Directive or

b) the observation of an immission value can be deemed ensured because of a clean air plan, because facilities are closed down or because of alterations taking place at other sources, groups of sources or on the grounds of any other information.

The second sentence of 4.2.2 shall be applied to all cases of para. 2 *mutatis mutandis*.

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4.3 Protection against Significant Nuisances or Significant Disadvantages due to Dustfall

4.3.1 Immission Value for Dustfall

The protection against significant nuisances or significant disadvantages due to dustfall is ensured if the total load determined in compliance with 4.7 does not exceed the immission values stated in Table 2 at any evaluation parcel.

Table 2: **Immission Value for the Protection against Significant Nuisances or Significant Disadvantages due to Dustfall**

Group of Substances	Deposition $g/(m^2 \cdot d)$	Averaging Period
Dustfall (non-dangerous dust)	0.35	1 year

4.3.2 Licensing with an Exceeded Immission Value

If the total load of dustfall which is determined in compliance with 4.7 exceeds the immission value at any evaluation parcel, a licence may not be refused on the grounds of such excess value, provided that

a) the indicator for the additional load caused by emissions from the facility at this evaluation parcel does not exceed a value of 10.5 $mg/(m^2 \cdot d)$ – taken as an annual mean value -,

b) it is ensured by imposed condition that, as a rule no later than 6 months after the commissioning of the facility, remediation measures (dismantling, closing down or alteration) which ensure the observation of the immission values are carried out at existing facilities of the applicant or third parties,

c) observation of the immission value can be expected to have taken place after a transitional period because of measures connected to a clean air plan or

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d) a special-case examination pursuant to 4.8 reveals that due to special circumstances prevailing in this individual case significant disadvantages cannot be induced.

4.4 Protection against Significant Disadvantages, in particular Protection of the Vegetation and of Ecosystems

4.4.1 Immission Values for Sulphur Dioxide and Nitrogen Oxides

The protection against hazards for ecosystems due to sulphur dioxide or for the vegetation due to nitrogen oxides is ensured if the total load determined in compliance with 4.7 does not exceed the immission values listed in Table 3 at the relevant evaluation parcels of 4.6.2.6 para. 6.

Table 3: **Immission Values for the Protection of Ecosystems and the Vegetation against Sulphur Dioxide and Nitrogen Oxides**

Substance	Concentration $\mu g/m^3$	Averaging Period	Protected Resource
sulphur dioxide	20	year and winter (1 October to 31 March)	ecosystems
nitrogen oxides, to be indicated as nitrogen dioxide	30	1 year	vegetation

It shall be checked in compliance with 4.8 whether the protection against any other significant disadvantages due to sulphur dioxide or nitrogen oxides is ensured. Such examination shall not apply if the additional load values for sulphur dioxide and nitrogen oxides pursuant to 4.4.3 are not exceeded at any evaluation parcel.

4.4.2 Immission Value for Hydrogen Fluoride; Ammonia

Notwithstanding para. 2, the protection against significant disadvantages due to hydrogen fluorides is ensured if the total load determined in compliance with 4.7 does not exceed the immission value listed in Table 4 at any evaluation parcel.

Table 4: **Immission Value for the Protection against Significant Disadvantages due to Hydrogen Fluoride**

Substance/Group of Substances	Concentration $\mu g/m^3$	Averaging Period
hydrogen fluorides and inorganic gaseous compounds of fluorine, to be indicated as fluorine	0.4	1 year

The protection against significant disadvantages arising from damage or harm caused to highly sensitive animals, plants and material goods is ensured if, with regard to hydrogen fluoride and inorganic gaseous compounds of fluorine, to be indicated as fluorine, an immission value of 0.3 $\mu g/m^3$, averaged over one year, is observed.

It shall be checked in compliance with 4.8 whether the protection against significant disadvantages due to damage or harm caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems is ensured.

4.4.3 Licensing with Exceeded Immission Values

If the total load of an air pollutant listed under 4.4.1 and 4.4.2 which is determined in compliance with 4.7 exceeds any immission value listed in Table 3, in Table 4 or 4.4.2 para. 2 at any evaluation parcel, a licence may not be refused on the grounds of such excess value, provided that, with regard to the respective pollutant,

a) the indicator for the additional load caused by emissions from the facility at this evaluation parcel does not exceed the values taken as yearly mean values which are listed in Table 5,

b) it is ensured by imposed condition that, as a rule no later than 6 months after the commissioning of the facility, remediation measures (dismantling, closing down, alteration) which ensure the observation of the immission values of 4.4.1 or 4.4.2 are carried out at existing facilities of the applicant or third parties,
c) observation of the immission value can be expected to have taken place after a transitional period because of measures connected to a clean air plan or
d) a special-case examination pursuant to 4.8 reveals that due to special circumstances prevailing in this individual case significant disadvantages cannot be induced.

Table 5: Irrelevant Additional Load Values for Immission Values for the Protection against Significant Disadvantages

Substance/Group of Substances	Additional Load µg/m³
sulphur dioxide	2
nitrogen oxides, to be indicated as nitrogen dioxide	3
hydrogen fluorides and inorganic gaseous compounds of fluorine, to be indicated as fluorine	0.04

4.5 Protection against Harmful Effects of Pollutant Deposition on the Environment

4.5.1 Immission Values for Pollutant Deposition

The protection against harmful effects of the deposition of air pollutants on the environment, including the protection against adverse soil alterations, is ensured if

a) the total load which is determined in compliance with 4.7 does not exceed any immission value listed in Table 6 at any evaluation parcel and
b) the evidence indicating that the relevant trigger and action values of Annex 2 of the Federal Soil Protection and Contaminated Sites Ordinance of 12 July 1999 (BGBl. I, p. 1554) have been exceeded by air pollutants at any evaluation parcel is insufficient.

Table 6: Immission Values for Pollutant Deposition

Substance/Group of Substances	Deposition µg/(m²·d)	Averaging Period
arsenic and its inorganic compounds, to be indicated as arsenic	4	1 year
lead and its inorganic compounds, to be indicated as lead	100	1 year
cadmium and its inorganic compounds, to be indicated as cadmium	2	1 year
nickel and its inorganic compounds, to be indicated as nickel	15	1 year
mercury and its inorganic compounds, to be indicated as mercury	1	1 year
thallium and its inorganic compounds, to be indicated as thallium	2	1 year

4.5.2 Licensing with Exceeded Immission Values for Pollutant Deposition or Exceeded Trigger and Action Values

If the total load of an air pollutant listed in Table 6 which is determined in compliance with 4.7 exceeds any immission value at any evaluation parcel or if the trigger and action values pursuant to 4.5.1 are exceeded, a licence may not be refused on the grounds of such excess value, provided that, with regard to the respective pollutant,

a) aa) the indicator for the additional load caused by deposition of emissions from the facility amounts to more than 5 per cent of the respective immission value listed in Table 6 at any evaluation parcel or bb) the emissions from the tapped sources of the facility, depending upon the respective stack heights, do not exceed the mass flows listed in Annex 2 after 8,760 hours of operation or, with a total number of hours of operation other than this, the mass flow equivalent which has been calculated accordingly,

b) it is ensured by imposed condition that, as a rule no later than 6 months after the commissioning of the facility, remediation measures (dismantling, closing down, alteration) which ensure the observation of the immission values pursuant to 4.5.1 or of the trigger and action values are carried out on existing facilities of the applicant or third parties,

c) observation of these values can be expected to have taken place after a transitional period because of measures connected to a clean air plan or

d) a special-case examination pursuant to 4.8 reveals that due to special circumstances prevailing in this individual case significant disadvantages including adverse soil alterations cannot be induced.

4.5.3 Special Cases with Exceeded Trigger and Action Values

If the trigger and action values pursuant to 4.5.1 letter b), the additional load values pursuant to 4.5.2 letter a) aa) and the minor emission mass flows pursuant to 4.5.2 letter a) bb) are exceeded, it shall be checked by means of a special-case examination pursuant to 4.8 whether and to which extent, on the grounds of such exceeded trigger and action values, adverse soil alterations may prevail which have been caused by air pollutants. If adverse soil alterations are due to the natural characteristics of the soil or to effects other than caused by air pollutants, e.g. fertilization, legal measures to protect the soil shall be taken into account in order to avoid or reduce adverse soil alterations.

4.6 Determination of Immission Indicators

4.6.1 General

4.6.1.1 Determination during the Licensing Procedure

It is unnecessary to determine the immission indicators during the licensing procedure for the respective emitted pollutant if

a) the emissions disposed of pursuant to 5.5 (mass flows) do not exceed the minor mass flows listed in Table 7 and

b) the emissions disposed of pursuant to 5.5 (diffuse emissions) do not exceed 10 per cent of the minor mass flows listed in Table 7,

insofar as a special geographic situation or special circumstances do not require to proceed otherwise. The mass flow pursuant to letter a) is based upon averaging over the operating hours of one calendar week under operating conditions most unfavourable for clean-air maintenance during normal operation.

When determining the mass flow, the emissions contained in waste gas from the entire facility shall be taken into account; with a significant alteration, the emissions from the respective parts of the facility and from those parts of the facility which will be affected by the alteration shall be taken into account unless such additional emissions lead to the minor mass flows to be indicated in Table 7 to be exceeded for the first time. In this event, the emissions from the entire facility shall be taken into account.

Table 7: **Minor Mass Flows**

Pollutants	Minor mass flow kg/h
sulphur oxides (sulphur dioxide and sulphur trioxide), to be indicated as SO_2	20
nitrogen oxides (nitrogen monoxide and nitrogen dioxide), to be indicated as NO_2	20

Pollutants	Minor mass flow kg/h
benzene	0.05
tetrachloroethene	2.5
dust (regardless of dust contents)	1
lead and its compounds, to be indicated as Pb	0.025
hydrogen fluorides and inorganic gaseous compounds of fluorine, to be indicated as F	0.15
arsenic and its compounds, to be indicated as As	0.0025
cadmium and its compounds, to be indicated as Cd	0.0025
nickel and its compounds, to be indicated as Ni	0.025
mercury and its compounds, to be indicated as Hg	0.0025
thallium and its compounds, to be indicated as Tl	0.0025
benzo(a)pyrene* (as a main component of poly-aromatic hydrocarbons)	0.0025

4.6.1.2 Determination during the Monitoring Procedure

In order to determine the total load during the monitoring procedure, the same procedure shall be applied as in determining the existing load during the licensing procedure (cf. 4.6.2). If the possibility of imposing obligations on various polluters is considered, the immission proportions caused by each polluter shall be determined insofar as this is necessary in order to ensure due exercise of discretion. In this context, immissions shall be measured and the meteorological factors relevant to dispersion determined. The wind direction sectors and the location of the measuring parcels and model parcels shall be selected in a manner by which to ensure that the immissions measured and/or calculated can be allocated to the respective polluters.

The minor mass flow for this pollutant shall only be relevant when an immission value for poly-aromatic hydrocarbons is established pursuant to 4. At the latest, this will be the case with the introduction of a respective immission value pursuant to 4.2.1 para. 2.

4.6.2 Existing Load Determination

4.6.2.1 Criteria for the Need to Determine the Existing Load

With the competent authority's consent, it is not necessary to determine the existing load by carrying out individual measurements if it is established, subsequent to analysing the results obtained at measuring stations belonging to the immission measuring networks of the *Länder* and subsequent to an estimation or determination of the additional load or on the grounds of any other information, that the immission values for the respective pollutant can be observed at the maximum load point after the commissioning of the facility.

Moreover, notwithstanding para. 3, determination shall not be necessary if on the grounds of other information previously obtained, e.g. previous measuring, measuring results from similar areas, results of rough measuring or results of dispersion calculations or estimations, it can be established that, with regard to the respective pollutant, the following values apply at the maximum load point:

— the annual mean value is below 85 per cent of the concentration value,

— the maximum 24-hour value is below 95 per cent of the 24-hour concentration value (except for suspended particulate matter (mw 10)) and

— the maximum 1-hour value is below 95 per cent of the 1-hour concentration value,

— with regard to suspended particulate matter (mw 10), the 24-hour concentration value of 50 µg per m^3 of air, averaged over the past three years, is not exceeded more frequently than 15 times per year.

Para. 2 shall not apply if, due to significant emissions from diffuse sources or due to special conditions in terms of operation, topography or meteorology, exceeded immission values cannot be excluded.

4.6.2.2 Measurement Planning

Measuring shall occur in compliance with a measuring plan agreed upon with the competent authority; in such a plan, all evaluation parcels, test objects, measuring period, measuring method, measuring frequency, duration of individual measuring in relationship to the respective sources and/or heights of sources, while taking into account the meteorological situation, shall be established.

4.6.2.3 Measuring Height

As a rule, immissions shall be measured at a height of 1.5 to 4 metres above ground and at a lateral distance of 1.5 metres from buildings. In wooded areas, it may be necessary to define measuring points at larger heights, depending on the height of the timber.

4.6.2.4 Measuring Period

As a rule, measuring periods shall stretch over 1 year. A measuring period may be reduced up to a total duration of 6 months if this is to cover the season with the most immissions to be expected. In other respects, shorter measuring periods are possible if it becomes clear during a measuring process that the applicant may be exempted from the obligation of immission measuring pursuant to 4.6.2.1.

4.6.2.5 Evaluation Area

The evaluation area shall be the area which is perfectly located within a circle around the centre of emission drawn by a radius equal to 50 times the actual stack height and in which the additional load, with regard to a model parcel, exceeds 3.0 per cent of the long-time concentration value.

Para. 1 applies with a disposal height for emissions of less than 20 metres above ground provided that the radius equals or exceeds 1 kilometre.

4.6.2.6 Evaluation Parcel Determination

Within evaluation areas, evaluation parcels shall be determined, in compliance with the following paragraphs, in a manner by which it is ensured that, in the competent authority's view, an evaluation of the total load is facilitated at the points with the supposed maximum relevant load with regard to protected resources which are not only temporarily exposed to such load at this place. Measuring which can only represent a very small area shall be avoided. Therefore, when selecting the evaluation parcels, the load level, its relevance to assess the eligibility for licensing and the exposition shall be examined.

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Firstly, the model parcels with calculated maximum additional loads shall be carried over from the dispersion calculation carried out during the licensing procedure pursuant to Annex 3 and/or from a dispersion calculation carried out analogously during the monitoring procedure. As to pollutants for which only one immission value, a yearly mean value, has been established, only the calculated annual mean value shall be taken into account, as to pollutants with maximum daily or hourly values, such values shall be taken into account as well.

Secondly, the existing load of the evaluation area caused by other sources (including domestic fires and traffic) shall be assessed while taking into consideration the load structure. In particular, the possible influence of existing weak sources including roads shall be assessed. In doing so, information obtained previously shall be drawn upon. Additional determination in order to assess the existing load shall only occur insofar as the efforts needed to perform such determination are proportional.

Thirdly, the points with the highest total load to be expected shall be defined on the grounds of the determination pursuant to paras. 2 and 3. As a rule, two evaluation parcels shall be selected from the range of points thus obtained so that an evaluation of the supposed maximum risk due to long-term exposure and due to an exposure to peak loads is facilitated. If only an immission value regarding the annual impact is established for the pollutant in question, one evaluation parcel will, as a rule, suffice.

With a highly inhomogenous structure of the existing load (e.g. dissected areas, special meteorological conditions, evaluation areas influenced by several low polluters), the number of evaluation parcels may be required to exceed two. If it is revealed that the immission structures of short-term peak loads and long-term load are identical, one evaluation parcel may suffice.

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Evaluation parcels at which to check the immission values under 4.4.1 shall be defined in a way by which to ensure that they are located at a distance of more than 20 km from agglomerations or 5 km from other built-up areas, industrial facilities or roads.

The definition of evaluation parcels shall be explained in the measuring plan.

4.6.2.7 Measuring Method

As a rule, the existing load shall be determined continuously since intermittent measuring methods can only facilitate annual mean values to be derived with sufficient accuracy. Therefore, intermittent measuring methods shall only be considered if only an immission value for annual impact is established for the respective pollutant or if a determination of short-term peak load is dispensable.

Besides the methods which are described in Ordinances or Administrative Regulations pertaining to the Federal Immissions Control Act, in VDI Guidelines, DIN, CEN or ISO standards, any other method of proven identical accuracy may be applied.

4.6.2.8 Measuring Frequency

With continuous measuring, a minimum availability of 75 per cent shall be ensured as regards hourly mean values. If less than 90 per cent of the hourly mean values are available, the frequency of excess limit values (determined pursuant to 4.7.2 letter b) and 4.7.3 letter b)) shall be expanded in order to obtain 100 per cent. These requirements to availability also apply to daily mean values obtained in measuring suspended particles load.

With intermittent measuring, the number of measuring values per measuring point shall be no less than 52. Insofar as experience shows that the requirement of an EC Directive to the data quality of the annual mean value to be derived from 52 measuring values is not met, the number of measuring values shall be increased

accordingly. In order to assess the data quality of an annual mean value, DIN ISO 11222 (draft, April 2001 version) shall be drawn upon in connection with DIN V ENV 13005 (June 1999 version). The sampling periods shall be distributed evenly over the measuring period in order to ensure sampling results are representative of the whole period.

4.6.2.9 Measuring Values

The measuring values shall be determined in compliance with the time spans to which immission values are to refer, i.e. annual mean values, daily mean values and hourly mean values. With intermittent measuring methods, the sampling period shall, as a rule, be one hour.

4.6.2.10 Rough Measuring

Reducing the effort necessary for measuring pursuant to 4.6.2.7 and 4.6.2.8 shall be taken into consideration in order to

- secure an annual mean value of a size known from information previously obtained or
- provide proof, by means of rough measuring, that at sites where the load criteria pursuant to 4.6.2.1 are supposed to be met or exceeded, such criteria are met or exceeded. Subsequently, depending on the result, it may be necessary to carry out measuring pursuant to 4.6.2.7.

4.6.3 Existing Load Indicators

4.6.3.1 General

Immission measuring or similar determination of immission load may be drawn upon if such measuring or determination dates back no longer than 5 years and if the circumstances decisive for evaluation have not significantly changed over this period.

The existing load indicators shall be calculated on the basis of the hourly mean values obtained through continuous measuring and/or intermittent measuring methods at each evaluation parcel.

4.6.3.2 Determining the Existing Load Indicators

The indicator for annual existing immission load (AEIL) shall be the annual mean value derived from all hourly mean values.

The indicator for daily existing immission load (DEIL) shall be the excess frequency (number of days) by which the concentration value for 24-hour effective immission is exceeded.

The indicator for hourly existing immission load (HEIL) shall be the excess frequency (number of hours) by which the concentration value for 1-hour effective immission is exceeded.

4.6.3.3 Analysing the Measurement

The AEIL, DEIL and HEIL indicators shall be derived from all measuring values insofar as immission values are established for the respective pollutants and their annual, daily and hourly effect.

When indicating the DEIL and HEIL, the respective maximum daily and/or hourly mean value measured shall also be indicated.

4.6.4 Additional Load Indicators

4.6.4.1 General

The additional load indicators shall be derived from mathematical immission projections on the grounds of a mean annual frequency distribution or of a representative annual time series of wind direction, wind velocity and dispersion class. In this context, the calculating method pursuant to Annex 3 shall be applied.

4.6.4.2 Determining the Additional Load Indicators

The indicator for the annual additional immission load (AAIL) shall be the arithmetic mean derived from all individual proportions calculated for each model parcel.

The indicator for the daily additional immission load (DAIL) shall be

- ten times the AAIL arithmetic means calculated for each model parcel, if a mean annual frequency distribution of meteorological parameters is used, or
- the maximum daily mean value calculated for each model parcel, if a representative meteorological time sequence is used.

The indicator for the hourly additional immission load (HAIL) shall be the maximum hourly mean value calculated for each model parcel.

4.7 Observation of Immission Values

4.7.1 Annual Immission Value

The annual immission value for a pollutant is observed if the total of the existing load and the additional load measured at evaluation parcels is less than or equal to the annual immission value.

4.7.2 Daily Immission Value

a) In any event, the daily immission value is observed
   - if the AEIL existing load indicator does not exceed 90 per cent of the annual immission value and
   - if the DEIL indicator reaches, as a maximum, 80 per cent of the excess frequency of the daily immission value permissible and
   - if all DAIL daily values do not exceed the equivalent of the difference between the daily immission value (concentration) and the annual immission value.

b) In all other respects, the daily immission value is observed if the total load – determined by adding the yearly additional load to the daily existing load concentration values – is less than or equal to the immission concentration value for 24 hours or if an analysis shows that the permissible excess frequency is observed unless special circumstances of the individual case, e.g. rarely occurring high emission levels, require to evaluate otherwise.

4.7.3 Hourly Immission Value

a) In any event, the hourly immission value is observed
   - if the AEIL existing load indicator does not exceed 90 per cent of the annual immission value and
   - if the HEIL indicator reaches, as a maximum, 80 per cent of the excess frequency of the permissible hourly immission value and
   - if no HAIL hourly values calculated for all model parcels exceed the equivalent of the difference between the hourly immission value (concentration) and the annual immission value.

b) In all other respects, the hourly immission value is observed if the total load – determined by adding the yearly additional load to the hourly existing load concentration values – is less than or equal to the immission concentration value for 1 hour or if an analysis shows that the permissible excess frequency is observed unless special circumstances of the individual case, e.g. rarely occurring high emission levels, require to evaluate otherwise.

4.8 Determination without Established Immission Values and in Special Cases

With air pollutants for which no immission values are established under 4.2 to 4.5 and in those cases in which reference is made to 4.8 it is necessary to examine whether harmful effects on the environment may be induced if sufficient evidence speaks in favour of this.

Such examination shall serve the purpose of

a) establishing to which effects the air pollution originating from the facility leads in the evaluation area; type and extent of such establishment are governed by the principle of proportionality;

and

b) evaluating whether such effects are to be deemed as hazards, significant disadvantages or significant nuisances to the general public or the neighbourhood; such evaluation shall be based upon the best available techniques and general experience of life.

When evaluating whether a hazard, disadvantage or nuisance is significant, the following shall apply:

a) Hazards to human health shall always be considered significant. Whether hazards to animals and plants, soil, water, atmosphere as well as cultural and any other property shall be considered significant shall be evaluated in compliance with letters b) and c) hereof.

b) Disadvantages or nuisances shall be considered significant to the general public if they affect public welfare by their type, extent or duration.

c) Disadvantages or nuisances shall be considered significant to the neighbourhood if they are intolerable due to their type, extent or duration.

When evaluating pursuant to letters b) and c), special attention shall be paid to the following:

- the use of land established in land-use plans,
- identifications under aspects of land and technical planning,
- findings and decisions contained in clean air plans,
- possible imprints of the respective pollutant,
- the use of land with respect to the principle of mutual respect governing good neighbourly relations,
- restrictions for use agreed or imposed upon and
- remediation measures carried out or to be carried out at existing facilities of the applicant or third parties which are connected to the project.

When examining whether the protection against significant disadvantages due to damage or harm caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems is ensured, Annex 1Determining the M

Examination pursuant to 4.8 as to whether the protection against significant disadvantages due to damage or harm caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems is ensured

The provisions under 4.8 stipulate that it is considered evidence for the occurrence of significant disadvantages due to damage or harm caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems if the minimum distances given in Figure 4: Minimum Distance of Facilities from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages due to Damage or Harm Caused by the Effects of Ammonia on these Protected Resources will Occur if the Minimum Distances are not Observed

are not observed.

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As to facilities for farming or breeding of livestock the emission factors in Fehler! Verweisquelle konnte nicht gefunden werden. **shall be used to determine the yearly ammonia emissions expected for the respective facility under conditions most unfavourable according to species, production specialization, livestock housing and commercial fertilizer storage and according to the respective stocking density. In the event of different species and different types of farming and breeding the respective yearly ammonia emissions shall be added up. The yearly ammonia emission can be used to identify the minimum distance in Figure 4: Minimum Distance of Facilities from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages due to Damage or Harm Caused by the Effects of Ammonia on these Protected Resources will Occur if the Minimum Distances are not Observed**

. It is considered evidence for the occurrence of significant disadvantages if such a minimum distance is not observed.

Table 11: Ammonia Emission Factors for Facilities for Farming or Breeding of Livestock

Figure 4: Minimum Distance of Facilities from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages due to Damage or Harm Caused by the Effects of Ammonia on these Protected Resources will Occur if the Minimum Distances are not Observed

shall be drawn upon. In this context, it is considered evidence for the occurrence of significant disadvantages if minimum distances are not observed.

Moreover, if there is evidence speaking in favour of the protection against significant disadvantages due to nitrogen deposition causing harm or damage to sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems (e.g. heathland, moorland, forests) not being ensured, a supplementary examination shall be carried out. In this

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context, it shall be estimated, while taking into account the load structure, whether the facility contributes considerably to nitrogen deposition. When a livestock density of 2 livestock units per hectare of a rural district *(Landkreis)* is exceeded, this shall be deemed a point to be taken into consideration as evidence. During such examination, special attention shall be paid to the type of soil, the type of vegetation prevailing and the degree of nitrogen supply.

If evidence is obtained speaking in favour of the occurrence of significant disadvantages due to harm or damage caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems or caused by nitrogen deposition, the individual case shall be examined.

If a special-case examination pursuant to 4.5.2 letter d) is to be carried out, it shall, in particular, be examined whether and to which extent the deposition, with current or planned use (e.g. as a playground, as a residential area, as a park or leisure facility, as plots of land for industrial or commercial purposes and as cropland or grassland), may lead to harmful effects on the environment by indirectly affecting humans, animals, plants, foodstuffs and feedingstuffs. As a rule, the deposition values ensure the protection of playgrounds and residential areas. As to other areas, higher deposition values may be drawn upon. In this context, the deposition values listed in Table 8 shall serve as basic evidence for the occurrence of harmful environmental effects on cropland or grassland.

Table 8: **Deposition Values as Basic Evidence Speaking in favour of Special-Case Examination**

Substance/Group of Substances	**Croplands $\mu g/(m^2 \cdot d)$**	**Grassland $\mu g/(m^2 \cdot d)$**
arsenic	1,170	60
lead	185	1,900
cadmium	2.5	32
mercury	30	3
thallium	7	25

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5 Requirements to Provide Precautions against Harmful Effects on the Environment

5.1 General

5.1.1 Contents and Meaning

The following provisions contain

- emission standards which can be avoided by applying the best available techniques,
- requirements to emission reduction in compliance with the best available techniques,
- other requirements to provide precautions against harmful effects of air pollutants on the environment,
- methods to determine emissions and
- requirements to the disposal of waste gases.

The provisions of 5.2 in connection with 5.3 shall apply to all facilities. Insofar as divergent provisions are stipulated in 5.4, these provisions shall rank before the respective provisions of 5.2, 5.3 or 6.2. Insofar as soot levels, mass ratios, emission ratios, emission reduction ratios or turnover ratios are established for specific substances or groups of substances, the requirements to mass concentrations of these substances or substance groups under 5.2 shall not apply. In any other respects, the requirements under 5.2, 5.3 or 6.2 shall remain unaffected. Supplementary to this, the emission minimization principle pursuant to 5.2.7 shall be taken into account.

The provisions take into account possible shifts of adverse effects from one protected resource to another; they are intended to ensure a high level of environmental protection altogether.

Insofar as Reference Documents about Best Available Techniques (BAT Reference Documents) of the European Commission which are version the framework of information exchange pursuant to Art. 16 para. 2 of the Council Directive of 24 September 1996 concerning integrated pollution prevention and control (IPPC

Directive, 96/61/EC, OJ L 257 of 10 October 1996, p. 26) were available when this Administrative Regulation was issued, the information contained therein has been taken into account while drawing up the requirements under 5.2, 5.3, 5.4 and 6.2.

Insofar as new or revised BAT Reference Documents are published by the European Commission after issuance of this Administrative Regulation, the requirements stipulated in this Administrative Regulation are not annulled by this. An advisory committee established by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety which consists of expert representatives of the parties concerned pursuant to § 51 of the Federal Immissions Control Act shall examine to which extent the information contained in the BAT Reference Documents points to requirements to emission reduction which reach beyond or supplement the requirements stipulated in this Administrative Regulation. This committee shall comment upon the extent of the progress made concerning the best available techniques in respect to the provisions established in this Administrative Regulation or upon the extent by which the provisions established in this Administrative Regulation require to be supplemented. Insofar as the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has given notice about the progress achieved in respect of the best available techniques or about a necessary supplement pursuant to the procedure stipulated by § 31a para. (4) of the Federal Immissions Control Act, the authorities in charge of licensing and supervision shall no longer be obliged to publish the requirements of this Administrative Regulation conflicting with such publication. In these cases, the competent authorities shall take into account the progress achieved in respect of the best available techniques when taking decisions.

As to facilities which exist only at one German site, no respective provisions are stipulated under 5.4; in such a case, the competent authority shall have sole responsibility to evaluate the special technical features of such facility.

If requirements to take precautions against harmful effects of air pollution on the environment have already been issued for a facility subject to licensing on a case-to-case basis which exceed the requirements under 5.1 to 5.4, such requirements shall remain binding in respect of § 5 para. (1) no. 2 of the Federal Immissions Control Act.

Insofar as 5.2 or 5.4 do not contain any or only incomplete provisions regarding emission reduction, BAT Reference Documents or Guidelines or standards of the VDI/DIN Air Pollution Prevention Manual shall be used as a source of information when determining the best available techniques on a case-to-case basis.

5.1.2 Taking into Account the Requirements during the Licensing Procedure

The requirements in compliance with the provisions of 5 shall be established for each emission source and for each air pollutant substance or substance group in the licensing notice insofar as a relevant proportion of such substances or substance groups is contained in crude gas. If the waste gases from several parts of the facility are gathered (collector line or collector stack), the requirements to reduce emissions shall be established in a way to ensure that the emissions generated do not exceed an emission level of the respective gases where they are disposed of individually. A substance is contained in the crude gas of a facility to a relevant extent if it cannot be excluded that a requirement under 5 is exceeded due to the composition of the crude gas.

If the observation of a specific mass flow or of a specific mass concentration is stipulated in 5, either the mass flow or – with an exceeded permissible mass flow – the mass concentration shall be limited in the licensing notice unless 5.2 or 5.4 contain explicit provisions stipulating that both the mass flow and the mass concentration shall be limited.

Emission limits in compliance with the permissible mass concentrations or mass flows contained in 5.2 or 5.4 can be waived if permissible mass ratios (e.g. g/Mg of the product generated, g/kWh of fuel energy used) are established instead and if it is proved by comparative observations involving the best available process and waste gas purification cleaning techniques that higher emission mass flows do not occur.

Special arrangements shall be drawn up for start-up or shut-off processes during which values exceeding twice the established emission limit cannot be avoided. In particular, such processes include processes during which

- a waste-gas purification facility has to be avoided for safety reasons (danger of deflagration, clogging-up or corrosion),
- a waste-gas purification facility is not fully effective because of insufficient waste-gas throughput or
- waste gas collection and purification is not feasible or only insufficiently feasible as receptacles are charged or emptied during intermittent manufacturing processes.

Insofar as averaging periods other than those stipulated in 2.7 are required for emission limits for operational or metrological reasons (e.g. batch operation, relatively long calibration periods), these shall be established accordingly.

If waste gas from a facility is used as combustion air or as a charge material for another facility, special arrangements shall be drawn up.

The amounts of air fed to a component of the facility for waste-gas cooling or thinning shall not be considered in determining the mass concentration. Insofar as emission standards refer to the oxygen content of waste gas, the mass concentrations measured in the waste gas shall be converted in line with the following equation:

$$E_B = \frac{21 - O_B}{21 - O_M} \times E_M$$

The following definitions apply:

E_M mass concentration measured,

E_B mass concentration, as related to reference oxygen content,

O_M oxygen content measured,

O_B reference oxygen content.

If waste-gas purification facilities are used to reduce emissions downstream, conversion may occur with regard to the substances for which the waste-gas purification facility is operated only for those periods during which the oxygen content measured exceeds the reference oxygen content. With combustion processes involving pure oxygen or oxygen-enriched air, special arrangements shall be drawn up.

5.1.3 Basic Requirements for Integrated Pollution Prevention and Control

In order to ensure integrated emission prevention or minimization, techniques and measures shall be applied through which emission levels to air, water and soil are prevented or limited and through which a high level of environmental protection is achieved altogether; facilities safety, the impact of waste disposal on the environment and the economical and efficient use of energy shall be taken into account.

Unavoidable waste gases shall be collected at their place of origin insofar as the efforts necessary to achieve this are proportional. Any measures taken in order to limit emissions must be in compliance with the best available techniques. The requirements of this Administrative Regulation may not be met by applying measures by means of which environmental pollution is shifted to other media such as water or soil, despite better techniques available. These measures shall be targeted at both reducing the mass concentrations and the mass flows or mass ratios of the air pollutants originating from a facility. They shall be applied accordingly while the facility is in operation.

When establishing the requirements, special attention shall be paid to the following:
- selecting integrated process technologies with maximum product yields and minimum emission levels to the environment altogether,
- process optimisation, e.g. by optimising the use of charge materials and through coupled production,
- substituting carcinogenic, mutagenic or reproduction toxic charge materials,
- reducing the waste gas volume, e.g. by applying air circulation systems, while taking into account the requirements of health and safety legislation,

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- saving energy and reducing emissions of gases with an impact on climate, e.g. by applying energetics optimisation methods in planning, building and operating facilities, through facility-internal energy recovery systems, by applying heat-insulation measures,
- preventing or reducing emissions of ozone-depleting substances, supplementary to the measures stipulated by the Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 (OJ L 244/1 of 29 September 2000), e.g. by substituting these substances, casing the facilities, encapsulating parts of facilities, generating a depression in encapsulated spaces and preventing facilities leakage, recording the substances in waste processing, applying optimised waste gas purification technologies and due disposal of recovered substances and of waste,
- optimising start-up and shut-off processes and any other special conditions of operation,
- the requirements of animal protection and of the physiological conditions of animals.

If substances pursuant to 5.2.2 class I or II, 5.2.4 class I or II, 5.2.5 class I or 5.2.7 may be emitted, the charge materials (raw and auxiliary materials) shall be selected, if possible, in a way as to ensure that emissions are kept at a low level.

Process cycles which may lead to increased emissions of substances pursuant to 5.2.2 class I or II or pursuant to 5.2.7 due to accumulation shall, if possible, be avoided by applying technical or administrative measures. Insofar as these process cycles are necessary for operation, e.g. when reclaiming production residues in order to recover metals, measures shall be taken in order to avoid increased emission levels, e.g. by means of targeted outward transfer of substances or by installing highly effective waste gas purification facilities.

Operational processes which involve cut-offs or the omission of waste gas purification facilities shall be designed and operated with a view to low emission levels and be specially monitored by recording suitable process indicators. Measures shall be provided for possible breakdowns of emission-reducing devices so as to

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reduce emissions immediately as much as possible while taking into consideration the principle of proportionality.

5.2 General Requirements to Emission Limits

5.2.1 Total Dust, Including Micro Dust

The dust emissions contained in waste gas may not exceed a

mass flow of	0.20 kg/h
or a	
mass concentration of	20 mg/m^3

Even with a mass flow smaller than or equal to 0.20 kg/h, a mass concentration of 0.15 g/m^3 in the waste gas may not be exceeded.

Notwithstanding this, 5.2.5 para. 3 shall apply.

5.2.2 Inorganic Particle Matter

With regard to the inorganic particle matter listed hereunder, the following total mass concentrations or mass flows contained in waste gas may not be exceeded; notwithstanding this, the requirements for class I substances shall refer to individual substances:

Class I

- mercury and its compounds, to be indicated as Hg
- thallium and its compounds, to be indicated as Tl

mass flow, per substance	0.25 g/h
or	
mass concentration, per substance	0.05 mg/m^3;

Class II

- lead and its compounds, to be indicated as Pb
- cobalt and its compounds, to be indicated as Co

- nickel and its compounds, to be indicated as Ni
- selenium and its compounds, to be indicated as Se
- tellurium and its compounds, to be indicated as Te

mass flow	2.5 g/h
or	
mass concentration	0.5 mg/m^3;

Class III

- antimony and its compounds, to be indicated as Sb
- chromium and its compounds, to be indicated as Cr
- easily soluble cyanides (e.g. NaCN), to be indicated as CN
- easily soluble fluorides (e.g. NaF), to be indicated as F
- copper and its compounds, to be indicated as Cu
- manganese and its compounds, to be indicated as Mn
- vanadium and its compounds, to be indicated as V
- tin and its compounds, to be indicated as Sn

mass flow	5 g/h
or	
mass concentration	1 mg/m^3.

As to an occurrence of substances belonging to different classes, irrespective of para. 1, the total emission standards of class II may not be exceeded if substances of classes I and II occur simultaneously in waste gas and the emission standards of class III may not be exceeded if substances of classes I and III, of classes II and III or of classes I to III occur simultaneously in waste gas.

The inorganic particle matter not listed under names (substances of categories K3, M3, RE3 or RF3, risk phrases R 40, R 62 or R 63) for which there is good cause to believe it holds a potential of being carcinogenic, mutagenic or reproduction toxic shall be allocated to class III. In this context,

- the Index of Substances which can Cause Cancer, Genetic Changes or Limit Reproductive Capability (Technical Rules for Hazardous Substances 905) and

- Annex I of the Council Directive 67/548/EEC which corresponds to the list of hazardous substances pursuant to § 4a para. (1) of the Ordinance on Hazardous Substances (*Gefahrstoffverordnung, GefStoffV*)

shall be taken into account. In the event of classification differences among categories K, M or R, the stricter classification stipulated by the Technical Rules for Hazardous Substances or in the Ordinance on Hazardous Substances shall be binding.

As long as the Technical Rules for Hazardous Substances or the Ordinance on Hazardous Substances do not contain any classification or evaluation, assessments by recognized scientific panels may be drawn upon, e.g. the classification of the Senate Commission for the Investigation of Health Hazards of Chemical Substances in the Work Area of the *Deutsche Forschungsgemeinschaft*. Moreover, the classifications of § 4a para. (3) of the Ordinance on Hazardous Substances shall apply.

Insofar as preparations are subject to classification pursuant to § 4b of the Ordinance on Hazardous Substances, their components and the respective proportions thereof shall be determined and taken into account when establishing the requirements to limit the emission level.

If waste gas disposal ensues under physical conditions (pressure, temperature) under which substances may be liquid or gaseous, the mass concentrations or mass flows pursuant to para. 1 shall be observed with regard to the total amount of solid, liquid and gaseous emissions.

5.2.3 Dust Emissions Occurring in Loading, Storing or Working Solid Substances

5.2.3.1 General

Suitable requirements shall be made to emission reduction with regard to facilities at which solid substances are loaded or unloaded, hoisted, transported, worked, prepared or stored if these substances may cause dust emissions due to their density, grain size distribution, grain shape, surface condition, abrasion resistance, shearing resistance, resistance to fracture, composition or due to their low humidity content.

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While taking into account the principle of proportionality,

- the type and properties of solid substances and of their components (e.g. hazardousness and toxicity pursuant to § 4 of the Ordinance on Hazardous Substances, possible effects on soil and water, possible development of explosible mixtures of dust/air, dusting propensity, humidity),
- the loading equipment or the loading method,
- the mass flow and the period during which emissions occur,
- the meteorological conditions,
- the location of the loading site (e.g. distance to residential areas)

shall be taken into account in particular while establishing such requirements.

The measures shall be established while also taking into account their possible effects on water and soil.

5.2.3.2 Loading or Unloading

When establishing requirements to be made to loading or unloading, the following measures may be considered:

MEASURES REGARDING THE LOADING METHOD

- minimizing the falling distance when discharging (e.g. with chutes involving guiding panels or reeds),
- automated discharging height adjustment with changing bulk heights,
- equipment adjustable to the respective bulk material (e.g. avoiding excess loads and missed discharging points with grippers),
- smooth start of loaded grippers,
- empty grippers are closed while re-set,
- minimized trimming and cleaning operations,
- automated loading operations;

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MEASURES REGARDING THE LOADING EQUIPMENT

- regular equipment maintenance (e.g. testing gripper tips for tightness in order to reduce flow losses),
- grippers shut completely or to a large extent so as to avoid or reduce the effect of bulk materials being blown away at their surface,
- minimizing built-up (especially with grippers or, for example, when loading bellows which can be tightened are used on vertical loaders/telescopic chutes),
- chutes fitted with discharging tips and exhaust systems,
- vertical loaders fitted with cones and exhaust systems,
- reduced delivery speed with drop legs by installing special components or by using cascade chutes,
- thrower belt conveyors used outside closed rooms only to a very small extent,
- if possible, wheel loaders only used for humidified materials or materials not prone to dusting;

MEASURES REGARDING THE LOADING SITE

- facilities at which vehicles are loaded or unloaded (e.g. filling stations, chutes, trench bunkers and other discharging sites) cased completely or to a large extent (e.g. by applying gates or strip curtains at entrances and exits),
- funnels, points of receipt, different types of chutes equipped with exhaust systems (sufficient exhaust capacities allowed for in planning),
- improved exhaust efficiency (e.g. by using guiding panels),
- funnels (e.g. with reed valves, valve bottom, shuttle locks, lid),
- water atomisation at outlets and charging hoppers,
- windbreakers used during open-air loading and unloading processes,
- extended stand-by time of grippers after discharging at the discharging point,
- loading restrictions at high wind velocities,
- planning where to locate the loading site on the premises of the enterprise;

MEASURES REGARDING SOLID SUBSTANCES

- increased materials humidity, if necessary, by applying surface tension relaxation agents, insofar as humidity does not conflict with subsequent further processing, storage properties or the product quality of the materials loaded,

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- applying dust bonding agents,
- pelletisation,
- standardized grain size (finest-grain separation),
- avoiding blockages,
- reducing the amount of loading processes.

5.2.3.3 Shipment or Transport

If vehicles are used for transport, closed receptacles (silo vehicles, containers, tarpaulin) shall be applied. Moreover, when materials are shipped or transported on the premises of the enterprise, facilities which are enclosed completely or which are enclosed to a large extent (e.g. cased conveyor belts, bucket conveyors, worm conveyors, feed screws or pneumatic conveyors) shall be applied. As to pneumatic conveyors, conveyed air which contains dust shall be fed to a dedusting system or kept within a closed cycle. Open-air conveying/transporting facilities (e.g. conveyor belts) shall be encapsulated or cased if possible.

If closed transportation receptacles are loaded with solid substances, the displaced air shall be collected and fed to a dedusting system.

Open-air discharging points shall be humidified, insofar as such humidifying does not conflict with subsequent further processing, storage properties or the product quality of the materials loaded. Alternatively, the discharging points may be encapsulated; air containing dust shall be fed to a dedusting system.

Openings in rooms (e.g. gates, windows) in which solid substances are transported or handled freely shall be kept closed where possible. Gates may only be opened if this is required for vehicles arriving or departing.

If dust emissions may develop due to the use of roadways, such roadways shall be enhanced with a cover of asphalt concrete, concrete or similar materials, they shall be kept in good condition and cleaned depending upon the amount of dirt accumulated on them. It shall be ensured that dirt accumulated on roadways caused by vehicles

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shall be avoided or removed after departure from the facility area. For this purpose, a tyre wash, sweeping machines, tyre-cleaning grates, for example, or other suitable systems may be used. The first sentence does not apply to roadways within quarries and sites on which mineral resources are extracted.

5.2.3.4 Working or Preparation

Machines, equipment or other systems used to work solid substances (e.g. by breaking, grinding, sifting, screening, mixing, palletising, briquetting, heating, drying, cooling) shall be encapsulated or fitted with emission-reducing technologies of similar effect.

Charging points and discharging points shall be encapsulated; air containing dust shall be fed to a dedusting system. Alternatively, charging points and stacking points can be humidified, insofar as such humidifying does not conflict with subsequent further processing, storage properties or the product quality of the materials loaded.

Waste gas containing dust from the working units shall be collected and purified.

5.2.3.5 Storage

5.2.3.5.1 Enclosed Storage

When establishing the requirements for storage, enclosed construction systems (e.g. silos, bunkers, magazines, warehouses, containers) shall be preferred as an option. Insofar as storage facilities are not completely enclosed, the development of dust shall be minimized – especially in passable storage facilities – by using storage receptacles or storage sites which are designed appropriately in terms of dimensions and by using devices to shelve or pick products stored which are designed appropriately in terms of dimensions. Waste gases from charging or discharging units and displaced air from receptacles shall be collected and fed to a dedusting system. All charging devices shall be provided with an anti-overcharging mechanism. Silo and container discharging outlets may be emptied or sealed in a dust-tight manner, e.g. by applying bellows with an integrated exhaust system and a cone; likewise, it is

possible to use rotary valves combined with a discharging conveyor or pneumatic transport mechanism.

5.2.3.5.2 Open-Air Storage

When establishing requirements to be made for setting up or extracting piles or to operate open-air homogenisation facilities, the following measures may be considered:

- covering the surface (e.g. with mats),
- surface grassing,
- spraying the pile with dust-bonding agents while the pile is set up,
- surface solidification,
- piles, charging points and discharging points shall be humidified sufficiently, where necessary by applying surface tension relaxation agents, insofar as such humidifying does not conflict with subsequent further processing, storage properties or the product quality of the materials loaded.
- charging or extraction protected by earth banks,
- conveyor belts with adjustable height,
- plants as windbreakers,
- aligning the longitudinal axis of the pile with the main wind direction,
- limiting piles in height,
- refraining, to a large extent, from set-up or extraction work under weather conditions which favour emission formation (e.g. long-term aridity, freeze periods, high wind velocities).

By roofing, encapsulating or by applying a combination of both measures, such storage facilities, including peripheral facilities, may be converted – taking into account the provisions of 5.2.3.1 para. 2 – into partly or completely enclosed storage facilities.

5.2.3.6 Special Components

If solid substances contain substances pursuant to 5.2.2 class I or II, pursuant to 5.2.5 class I or pursuant to 5.2.7 or if such substances have been absorbed by solid substances, the most efficient measures in compliance with 5.2.3.2 to 5.2.3.5 shall be applied; storage shall occur pursuant to 5.2.3.5.1. The first sentence does not apply if the amount of special components contained in a rerun which can be separated from the materials and is obtained through sifting with a 5-millimetre mesh does not exceed the following values, all of which refer to dry mass:

- substances pursuant to 5.2.2 class I, 5.2.7.1.1 class I or 5.2.7.1.2 — 50 mg/kg,
- substances pursuant to 5.2.2 class II, 5.2.7.1.1 class II or 5.2.7.1.3 — 0.50 g/kg,
- substances pursuant to 5.2.7.1.1 class III — 5.0 g/kg.

5.2.4 Inorganic Gaseous Substances

The mass concentrations or mass flows of the inorganic gaseous substances listed hereunder shall not be exceeded, in terms of waste gas content:

Class I

- arsine
- cyanogen chloride
- phosgene
- phosphine

mass flow per substance 2.5 g/h

or

mass concentration per substance 0.5 mg/m^3;

Class II

- bromine and its gaseous compounds, to be indicated as hydrogen bromide
- chlorine
- hydrocyanic acid
- fluorine and its gaseous compounds, to be indicated as hydrogen fluoride
- hydrogen sulphide

mass flow per substance 15 g/h

or

mass concentration per substance 3 mg/m^3;

Class III

- ammonia
- gaseous inorganic compounds of chlorine, unless included in class I or class II, to be indicated as hydrogen chloride

mass flow per substance 0.15 kg/h

or

mass concentration per substance 30 mg/m^3;

Class IV

- sulphur oxides (sulphur dioxide and sulphur trioxide), to be indicated as sulphur dioxide
- nitrogen oxides (nitrogen monoxide and nitrogen dioxide), to be indicated as nitrogen dioxide

mass flow per substance 1.8 kg/h

or

mass concentration per substance 0.35 g/m^3.

In waste gases generated by thermal or catalytic post-combustion facilities, nitrogen monoxide and nitrogen dioxide emissions, to be indicated as nitrogen dioxide, may not exceed a mass concentration of 0.20 g/m^3; simultaneously, carbon monoxide emissions may not exceed a mass concentration of 0.10 g/m^3. Insofar as the gases fed to the post-combustion system contain concentrations of nitrogen oxides or other nitrogen compounds which are not low, case-to-case requirements shall be established; in this context, nitrogen monoxide and nitrogen dioxide emissions, to be indicated as nitrogen dioxide, may not exceed a mass flow of 1.8 kg/h or a mass concentration of 0.35 g/m^3.

5.2.5 Organic Substances

With regard to organic substances contained in waste gas, except organic particle matter,

a total mass flow of 0.50 kg/h

or

a total mass concentration of 50 mg/m³,

each of which to be indicated as total carbon,

may not be exceeded.

With regard to **existing facilities** with an annual mass flow of organic substances amounting to as much as 1.5 Mg/a, to be indicated as total carbon, the emissions of organic substances contained in waste gas may not exceed a mass flow of 1.5 kg/h, to be indicated as total carbon, notwithstanding para. 1. The amount of hours of operation during which mass flows ranging above 0.5 kg/h up to 1.5 kg/h shall not exceed 8 hours of operation per day.

With regard to organic particle matter, except for substances of class I, the requirements under 5.2.1 shall apply.

Within the mass flow or the mass concentration for total carbon, the organic substances allocated to classes I (substances pursuant to Annex 4) or II, even if several substances of identical class occur simultaneously, may not exceed the following mass concentrations or mass flows contained in waste gas, each of which to be indicated as mass of organic substances:

Class I

mass flow 0.10 kg/h

or

mass concentration 20 mg/m³;

Class II

- 1-bromo-3-chloropropane

- 1,1-dichloroethane
- 1,2-dichloroethylene, cis and trans
- ethanoic acid
- methyl formiate
- nitroethane
- nitromethane
- octamethylcyclotetrasiloxane
- 1,1,1-trichloroethane
- 1,3,5-trioxane

mass flow 0.50 kg/h

or

mass concentration 0.10 g/m³.

Supplementary to the requirements pursuant to the first sentence of para. 4, as to an occurrence of substances belonging to different classes, the total emission values of class II may not be exceeded if substances of classes I and II occur simultaneously in waste gas.

The organic substances or their secondary products not listed under their names in Annex 4 which comply with one of the following categories or meet one of the following criteria:

- there is good cause to believe they are carcinogenic or mutagenic (categories K3 or M3, risk phrase R 40),
- there is good cause to believe they are reproduction toxic (categories RE3 or RF3, risk phrases R 62 or R 63) while taking into account their effective strength,
- limit value for air at the workplace below 25 mg/m³ applicable,
- they are toxic or very toxic,
- may cause irreversible harm or damage,
- may cause sensitization when inhaled,
- they are highly odour-intensive,
- slowly degradable and accumulative,

shall, on principle, be allocated to class I. In this context,

- the Index of Limit Values relating to the Air at the Workplace (Technical Rules for Hazardous Substances 900), the Index of Substances which can Cause Cancer, Genetic Changes or Limit Reproductive Capability (Technical Rules for Hazardous Substances 905) and
- Annex I of the Council Directive 67/548/EEC which corresponds to the list of hazardous substances pursuant to § 4a para. (1) of the Ordinance on Hazardous Substances

shall be taken into account. In the event of classification differences among categories K, M or R, the stricter classification stipulated by the Technical Rules for Hazardous Substances or in the Ordinance on Hazardous Substances shall be binding. Insofar as the emission standards of class I cannot be observed with proportional efforts as regards organic substances which are allocated to class I on the grounds of the criteria mentioned above, emission limits shall be established on a case-to-case basis.

As long as the Technical Rules for Hazardous Substances or the Ordinance on Hazardous Substances do not contain any classification or evaluation, assessments by recognized scientific panels may be drawn upon, e.g. the classification of the Senate Commission for the Investigation of Health Hazards of Chemical Substances in the Work Area of the *Deutsche Forschungsgemeinschaft*. Moreover, the classifications of § 4a para. (3) of the Ordinance on Hazardous Substances shall apply.

Insofar as preparations are subject to classification pursuant to § 4b of the Ordinance on Hazardous Substances, the components of such preparations and the respective proportions of such components shall be determined and taken into account when establishing emission-limiting requirements.

5.2.6 Gaseous Emissions during the Processing, Hoisting, Decanting or Storage of Liquid Organic Substances

When processing, hoisting, decanting or storing liquid organic substances

a) whose steam pressure is equal to or greater than 1.3 kPa at a temperature of 293.15 K,

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b) with a mass content of more than 1 per cent of substances pursuant to 5.2.5 class I, 5.2.7.1.1 class II or III or 5.2.7.1.3,

c) with a mass content of more than 10 mg per kg of substances pursuant to 5.2.7.1.1 class I or 5.2.7.1.2 or

d) which contain substances pursuant to 5.2.7.2

the measures by which to avoid and reduce emissions pursuant to 5.2.6.1 to 5.2.6.7 shall be applied.

5.2.6.1 Pumps

Pumps technologically designed to be tight such as canned motor pumps, magnetic drive pumps, pumps with double-action mechanical seals and a sealing or locking medium, pumps fitted with double-action mechanical seals and seals dry to atmosphere, diaphragm pumps or bellow pumps.

Existing pumps for liquid organic substances pursuant to 5.2.6 letter a) which do not comply with any of the features listed under letters b) to d) and which do not meet the requirements pursuant to para. 1 may continue to be used until replaced by new pumps. After this Administrative Regulation has entered into force, the competent authority shall demand inventories to be drawn up and monitor the continuous replacement of pumps and the maintenance work done prior to such replacement in the framework of plant supervision.

5.2.6.2 Compressors

If gases or vapours which meet one of the criteria pursuant to 5.2.6 letters b) to d) are compressed, multiple sealing systems shall be used. If wet sealing systems are used, the sealing liquid applied on the compressor may not be de-aerated. If dry sealing systems are used, e.g. when feeding inert gas or exhausting the amount of materials to be conveyed leaking out, waste gases let out shall be collected and fed to a gas collecting system.

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5.2.6.3 Flanged Joints

As a rule, flanged joints shall only be used where they are necessary for reasons regarding process technology, safety or maintenance. In this event, technically tight-flanged joints in compliance with VDI Guideline 2440 (November 2000 version) shall be used.

When selecting the seal and designing the flanged joints, the characteristic sealing values pursuant to DIN 28090-1 (September 1995 version) or DIN V ENV 1591-2 (October 2001 version) shall apply.

The observation of a specific leakage ratio amounting to 10^{-5} kPa·l/(s·m) shall be proved by carrying out type testing in compliance with VDI Guideline 2440 (November 2000 version).

As to **existing flanged joints**, 5.2.6.1 para. 2 regarding the replacement of seals shall apply. With regard to existing flanged joints, inventories need not be drawn up.

5.2.6.4 Blockage and Control Devices

In order to seal spindle guides of blockage and control devices such as valves or gates,

- metal bellows with a high-grade seal and a downstream safety packing gland or
- sealing systems of similar effect

shall be used.

Sealing systems shall be deemed to be of similar effect if the temperature-specific leakage ratios can be kept during the proof procedure pursuant to VDI Guideline 2440 (November 2000 version).

As to existing blockage and control devices, 5.2.6.1 para. 2 shall be applied *mutatis mutandis*.

5.2.6.5 Sampling Points

Sampling points shall be encapsulated or fitted with blockage and control devices in a way to ensure that emissions may only occur when sampling; in sampling, the sealing medium shall either be re-fed or collected completely.

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5.2.6.6 Decanting

In decanting, it is a priority to take measures to avoid emissions, e.g. vapour recovery in connection with bottom loading or below-surface filling. Extracting and feeding the waste gas to a waste gas purification facility may be approved if vapour recovery is not a viable technical option or where the necessary efforts are disproportionate.

Vapour recovery systems shall be operated in a way to ensure that the flow of organic substances is only released when the vapour recovery system is connected and so that the vapour recovery system and the facilities connected to it may not let out gas to the atmosphere during the recovery process due to their design, except for emissions released for safety reasons.

5.2.6.7 Storage

In order to store liquid organic substances, fixed roof tanks connected to collector gas lines or connected to a waste gas purification facility shall be used.

Notwithstanding the first sentence, crude oil to be stored in storage tanks with a volume of more than 20,000 m³ may also be stored in floating roof tanks sealed effectively at their edges or in fixed roof tanks with an internal floating roof if emissions are reduced by at least 97 per cent as compared to fixed roof tanks without an internal floating roof.

Moreover, notwithstanding the first sentence, the tank need not be connected to collector gas lines or to a waste gas purification facility as regards liquid organic substances pursuant to 5.2.6 letter a) which do not meet any of the criteria of letters b) to d) and which are stored in fixed roof tanks with a volume below 300 m³.

Insofar as storage tanks are set up and operated above ground, the outer wall and the roof shall be covered with suitable paint whose total heat reflection ratio permanently amounts to a minimum of 70 per cent.

Gases and vapours let out from pressure relief fittings and discharging facilities shall be disposed of to the gas gathering system or fed to a waste gas purification facility insofar as this does not conflict with safety-related aspects.

Waste gases occurring during inspection or while the storage tanks are cleaned shall be fed to a post-combustion system or similar measures shall be applied to reduce emissions.

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5.2.7 Carcinogenic, Mutagenic or Reproduction Toxic Substances and Slowly Degradable, Accumulative and Highly Toxic Organic Substances

The emissions of carcinogenic, mutagenic or reproduction toxic substances or emissions of slowly degradable, accumulative and highly toxic organic substances which are contained in waste gas shall be limited as much as possible while taking into account the principle of proportionality (emissions minimization principle).

5.2.7.1 Carcinogenic, Mutagenic or Reproduction Toxic Substances

Substances shall be deemed carcinogenic, mutagenic or reproduction toxic if,
- in the Index of Substances which can Cause Cancer, Genetic Changes or Limit Reproductive Capability (*Technical Rules for Hazardous Substances 905*) or
- in Annex I of the Council Directive 67/548/EEC which corresponds to the list of hazardous substances pursuant to § 4a para. (1) of the Ordinance on Hazardous Substances,

they are allocated to one of the following categories: K1, K2, M1, M2, RE1, RE2, RF1 or RF2 (risk phrases R 45, R 46, R 49, R 60 or R 61). *In the event of* classification differences among categories K, M or R, the stricter classification stipulated by the Technical Rules for Hazardous Substances or in the Ordinance on Hazardous Substances shall be binding.

As long as the Technical Rules for Hazardous Substances or the Ordinance on Hazardous Substances do not contain any classification or evaluation, assessments by recognized scientific panels may be drawn upon, e.g. the classification of the Senate Commission for the Investigation of Health Hazards of Chemical Substances in the Work Area of the *Deutsche Forschungsgemeinschaft*. Moreover, the classifications of § 4a para. (3) of the Ordinance on Hazardous Substances shall apply.

Insofar as preparations are subject to classification pursuant to § 4b of the Ordinance on Hazardous Substances, the components of such preparations and the respective proportions of such components shall be determined and taken into account when establishing emission-limiting requirements.

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5.2.7.1.1 Carcinogenic Substances

With regard to the substances listed hereunder, the following total mass concentrations or mass flows contained in waste gas may not be exceeded as a minimum requirement, even where several substances of one class occur simultaneously:

Class I
- arsenic and its compounds (except for arsine), to be indicated as As
- benzo(a)pyrene
- cadmium and its compounds, to be indicated as Cd
- water-soluble compounds of cobalt, to be indicated as Co
- chromium(VI) compounds (except for barium chromate and lead chromate), to be indicated as Cr

mass flow	0.15 g/h
or	
mass concentration	0.05 mg/m³;

Class II
- acrylamide
- acrylonitrile
- dinitrotoluenes
- ethylene oxide
- nickel and its compounds (except for nickel metal, nickel alloys, nickel carbonate, nickel hydroxide, nickel tetracarbonyl), to be indicated as Ni
- 4-vinyl-1,2-cyclohexene-diepoxy

mass flow	1.5 g/h
or	
mass concentration	0.5 mg/m³;

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Class III

- benzene
- bromoethane
- 1,3-butadiene
- 1,2-dichloroethane
- 1,2-propylene oxide (1,2-epoxy propane)
- styrene oxide
- o-toluidine
- trichloroethene
- vinyl chloride

    mass flow 2.5 g/h

    or

    mass concentration 1 mg/m^3.

As to an occurrence of substances belonging to different classes, notwithstanding para. 1, the total emission standards of class II may not be exceeded if substances of classes I and II occur simultaneously in waste gas and the emission standards of class III may not be exceeded as a total if substances of classes I and III, of classes II and III or of classes I to III occur simultaneously in waste gas.

The carcinogenic substances not listed under their names shall be allocated to the classes of substances to which they are best comparable with regard to effective strength; in this context, an evaluation of effective strength shall be carried out on the grounds of a risk calculation, e.g. by applying the unit-risk approach. Insofar as emission standards pertaining to the class determined for carcinogenic substances which have been classified on the basis of the allocation system described above cannot be observed with proportional efforts, emission limits shall be determined on a case-to-case basis while taking into account the emissions minimization principle.

Fibres

The following fibre dust concentrations may not be exceeded with regard to emissions of the carcinogenic fibrous substances listed hereunder where they are contained in waste gas:

- asbestos fibres 1·10^4 fibres/m^3

  (e.g. chrysotile, crocidolite, amosite),
- biopersistent ceramic fibres 1.5·10^4 fibres/m^3

  (e.g. consisting of aluminium silicate, aluminium oxide, silicon carbide, potassium titanate), insofar as they are included in No. 2.3 of the Technical Rules for Hazardous Substances 905 as "man-made crystalline ceramic fibres" or comprised in Annex I of the Council Directive 67/548/EEC (which corresponds to the list of hazardous substances pursuant to § 4a para. (1) of the Ordinance on Hazardous Substance) under the entry "ceramic mineral fibres"
- biopersistent mineral fibres 5·10^4 fibres/m^3,

  insofar as they meet the criteria established for "inorganic fibre dusts (except for asbestos)" under No. 2.3 of the Technical Rules for Hazardous Substances 905 or for "biopersistent fibres" pursuant to Annex IV No. 22 of the Ordinance on Hazardous Substances.

In the event that criteria of the Technical Rules for Hazardous Substances and of the Ordinance on Hazardous Substances diverge from each other, the respective stricter criteria shall be binding.

In individual cases, the emissions of carcinogenic fibrous substances may be limited by determining a total dust emissions value while taking into account the emissions minimization principle.

5.2.7.1.2 Mutagenic Substances

Insofar as mutagenic substances or preparations are not covered by the requirements made to carcinogenic substances, a mass flow below 0.15 g/h or a mass concentration below 0.05 mg/m^3 shall be achieved with regard to emissions of mutagenic substances contained in waste gas. Insofar as these emission standards cannot be observed with proportional efforts, emissions of such substances contained in waste gas shall be limited while taking into account the emissions minimization principle.

5.2.7.1.3 Reproduction Toxic Substances

Insofar as reproduction toxic substances or preparations are not covered by the requirements made to carcinogenic or mutagenic substances, emissions of reproduction toxic substances contained in waste gas are to be limited while taking into account the emissions minimization principle and while taking into consideration the effective strength of the substance.

5.2.7.2 Slowly Degradable, Accumulative and Highly Toxic Organic Substances

The dioxins and furans listed in Annex 5, to be indicated as totals pursuant to the procedure established therein, may not exceed

a mass flow in waste gas of 0.25 µg/h

or

a mass concentration in waste gas of 0.1 ng/m³,

as a minimum requirement. The sampling period shall be at least 6 hours; it shall not exceed 8 hours.

As to further organic substances which are slowly degradable and accumulative and highly toxic at the same time or which, due to other highly harmful effects on the environment, may not be allocated to class I of 5.2.5 (e.g. polybrominated dibenzodioxins, polybrominated dibenzofurans or polyhalogenated biphenyles), emissions shall be limited while taking into account the emissions minimization principle.

5.2.8 Odour-Intensive Substances

Requirements shall be made to reduce emissions at facilities which may emit odour-intensive substances during normal operation or due to operational fault liability, including, for example, the casing of facilities, encapsulating parts of facilities,

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generating a depression in encapsulated spaces, appropriate storage of charge substances, products and wastes, process control.

As a rule, odour-intensive waste gases shall be fed to waste gas purification facilities or measures of similar effect shall be taken. Waste gases shall be disposed of as stipulated in 5.5.

When determining the extent of the requirements on a case-to-case basis, special attention shall be paid to the waste gas volume flow, the mass flow of odour-intensive substances, local dispersion conditions, the duration of emission and the distance between the facility and the next area of protected use (e.g. residential area) existing or such area established in a development plan. Insofar as the surroundings of the facility can be expected to be affected by odour, any options to further reduce emissions by applying best available techniques shall be used.

Insofar as it is not possible or not sufficient to limit emissions of individual substances or substance groups, e.g. with regard to amines, or of total carbon, the emission-reducing requirement shall be determined for facilities with waste gas purification facilities as an odour-reduction value to be determined olfactometrically or as an odorous substance concentration value.

5.2.9 Soil-Contaminating Substances

If the precautionary values for soil pursuant to Annex 2 of the Federal Soil Protection and Contaminated Sites Ordinance (*Bundes-Bodenschutz- und Altlastenverordnung*), the mass flows pursuant to Annex 2 and the additional load values pursuant to 4.5.2 letter a) aa) are exceeded, precautionary measures shall be identified by which to determine the obligations to take precautions in detail in compliance with the second sentence of § 3 para. (3) of the Federal Soil Protection and Contaminated Sites Ordinance, such measures reaching beyond the measures stipulated in 5 of this Administrative Regulation if the annual loads established in 5 of Annex 2 of the Federal Soil Protection and Contaminated Sites Ordinance are exceeded during the operation of the facility.

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5.3 Measuring and Monitoring Emissions

5.3.1 Measurement Sites

If a license is issued for a facility, measurement sites or sampling points shall be demanded to be provided for and they shall be determined in detail. Measurement sites shall be sufficiently large, easily passable, designed and selected in a way by which to facilitate that emission measuring will be representative of the emissions from the facility and that such measuring will be accurate from a metrological point of view. The recommendations of VDI Guideline 4200 (December 2000 version) shall be taken into account.

5.3.2 Individual Measurements

5.3.2.1 Initial and Recurrent Measurements

It shall be demanded that after construction, significant alteration and subsequently, the emissions levels of all air pollutants for which emissions limits are to be determined in compliance with the licensing notice pursuant to 5.1.2 shall be determined repeatedly through measurements carried out by an agency designated to do so pursuant to § 26 of the Federal Immissions Control Act.

Initial measurements to take place after construction or significant alteration shall be carried out when fault-free operation is reached, no earlier, however, than after three months of operation and no later than six months after commissioning.
Initial or recurrent measurements shall not be demanded if emissions are determined pursuant to 5.3.3 or 5.3.4.
Individual measurements pursuant to para. 1 need not be carried out if other tests, e.g. with regard to furnishing proof about the effectiveness of emission-reducing facilities, the composition of fuels or charge materials or process conditions, provide sufficiently reliable results to establish that emission limits are not exceeded.

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Recurrent measurements shall be demanded after expiry of three-year periods. As to facilities whose emissions are limited as a mass flow, such periods may be extended to five years.

5.3.2.2 Measuring Plans

Measurements by which to assess emissions shall be carried out in a way by which to ensure that the results will be representative of the emissions from the facility and that they will be comparable to each other in the event of comparable facilities and operating conditions. Measuring plans shall be in compliance with VDI Guideline 4200 (December 2000 version) and VDI Guideline 2448 Part 1 (April 1992 version). The competent authority may demand measuring plans to be previously agreed with it.

With regard to facilities where operating conditions remain unchanged to a great extent in terms of time, a minimum of 3 individual measurements shall be carried out during fault-free operation with a maximum emission level and a minimum of one measurement each shall be carried out for states of operation occurring regularly with a floating emission behaviour, e.g. for cleaning or regenerating work or during relatively long start-up or shut-off processes. With regard to facilities where operating conditions are subject to change in terms of time, a sufficient number of measurements shall be carried out, as a minimum, however, six measurements shall be carried out during states of operation which can cause maximum emission levels by experience.

As a rule, individual measurements shall be carried out over half an hour; the result of such individual measurement shall be determined and to be indicated as a half-hourly mean value. In special cases, e.g. with batch operation or low mass concentrations contained in waste gas, averaging periods shall be adapted accordingly.

With regard to substances which occur in various states of aggregation, special measures shall be taken while measuring in order to collect all respective proportions (e.g. in compliance with VDI Guideline 3868 Part 1, December 1994 version).

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5.3.2.3 Measuring Methods Selection

Measurements by which to assess emissions shall be carried out while applying measuring methods and measuring instruments representing the best techniques available in metrology. The detection limit for the measuring method should amount to less than one tenth of the emission limit to be monitored. Emission measurements shall occur while taking into consideration the guidelines and standards for measuring methods listed in the VDI/DIN Air Pollution Prevention Manual referred to in Annex 6. Sampling shall comply with VDI Guideline 4200 (December 2000 version). Moreover, measuring methods of guidelines on emission reduction contained in the VDI/DIN Air Pollution Prevention Manual shall be taken into account.

Total carbon shall be determined by means of suitable continuous measuring instruments (e.g. based upon the measuring principle of a flame ionisation detector). The measuring instruments used shall be calibrated while defined substances or substance mixtures containing such substances or other substance mixtures are emitted or calibration shall be carried out mathematically on the grounds of response factors to be defined on the basis of propane calibration. In the event of complex substance mixtures, a representative response factor shall be drawn upon. In cases justified as exceptions, total carbon may also be determined by determining the amount of carbon which can be retrieved through silica gel absorption.

5.3.2.4 Analysing and Evaluating the Measuring Results

A measurement report regarding the result of the measurements shall be demanded to be compiled and immediately submitted. The measurement report shall contain details about measuring plans, the result of each individual measurement, the measuring method applied and the operational conditions which are relevant to evaluate the individual values and the measuring results. It shall also include details about fuels and charge materials and about the state of operation of the facility and of the emission-reducing facilities; it shall comply with Annex B of VDI Guideline 4220 (September 1999 version).

In the event of initial measurements after construction, of measurements taken after significant alteration or of recurrent measurements the requirements shall in any event only be deemed observed if the result of each individual measurement, including measurement uncertainty, does not exceed the emissions limit established in the licensing notice.

If subsequent orders which are based upon the determination of emissions demand additional measures to reduce emissions, measurement uncertainty shall be taken into account to the operator's benefit.

An examination as to whether the measuring method complies with the best available techniques in metrology, especially with regard to its measuring uncertainty, shall be required in cases in which the measurement result, including measurement uncertainty, exceeds the established emission limit. In case of excess values, further examination (e.g. examining facility-specific reasons) shall be required.

5.3.2.5 Measuring Odour-Intensive Substances

If the emissions of odour-intensive substances are limited by determining an odour reduction value for a waste gas purification facility or as an odorous substances concentration when a facility is licensed, such limits shall be checked by carrying out olfactometric measurements.

5.3.3 Continuous Measuring

5.3.3.1 Measurement Programme

Emissions from relevant sources shall be monitored through continuous measuring, taking into consideration para. 4, if mass flows established in 5.3.3.2 are exceeded and respective emission limits are established. A source shall, as a rule, be considered relevant if its emissions constitute over 20 per cent of the entire mass flow of the facility. When mass flows are determined, the stipulations in the licensing notice shall prevail.

If it is to be expected that a facility will repeatedly exceed the emission standards established in the licensing notice, e.g. when changing its mode of operation, or due to the fault-liability of an emission reduction facility, continuous emission measuring may also be requested for lower mass flows than those established under 5.3.3.2. For facilities with emission reduction facilities which have to be repeatedly shut down during undisturbed operation for safety reasons, or the efficiency of which has to be reduced considerably, mass flows resulting from the remaining precipitation capacities shall be applied.

The requirement of continuous monitoring of a source shall be waived if it emits for less than 500 hours in any one year or is less than 10 % of the annual emission of the facility.

Insofar as air-polluting substances in waste gas are in constant relation to each other, continuous measuring may be restricted to a lead component. Continuous emission measuring may again be waived if attainment of emission standards may be adequately proven by applying other tests, e.g. continuous efficiency demonstrating the effectiveness of emission reduction facilities (e.g. by measuring the combustion chamber temperature in a thermal post-combustion facility instead of measuring the mass concentration of organic substances, or by determining the differential pressure in fabric filters instead of measuring the mass concentration of the particles in waste gas), composition of fuels or raw materials, or processing conditions.

5.3.3.2 Mass flow thresholds for continuous monitoring

Facilities with particles mass flows of 1 to 3 kg/h shall be equipped with measuring instruments at their relevant sources which are capable of continuously monitoring the functioning of the waste gas purification facility and the established emission limits (qualitative measuring instruments).

Facilities with particles mass flows of over 3 kg/h shall be equipped with measuring instruments at their relevant sources which continuously determine dust emission mass concentrations.

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Facilities with dust emissions of substances under 5.2.2 or 5.2.5 Class I or 5.2.7 shall be equipped with measuring instruments at their relevant sources which continuously determine the total particles concentrations if the emission mass flow is more than five times greater than one of the relevant mass flows.

At facilities emitting gaseous substances in excess of the following mass flows, relevant sources shall be equipped with measuring instruments which continuously determine the mass concentrations of the respective substances:

— sulphur dioxide	30 kg/h,
— nitrogen monoxide and nitrogen dioxide, to be indicated as nitrogen dioxide	30 kg/h,
— carbon monoxide as lead substance for evaluating the efficiency of combustion processes	5 kg/h,
— carbon monoxide, all other cases	100 kg/h,
— fluorine and gaseous inorganic fluorine compounds, to be indicated as hydrogen fluoride	0.3 kg/h,
— gaseous inorganic chlorine compounds, to be indicated as hydrogen chloride	1.5 kg/h,
— chlorine	0.3 kg/h,
— hydrogen sulphide	0.3 kg/h.

If sulphur dioxide mass concentrations are measured continuously, sulphur trioxide mass concentrations shall be determined during calibration and included in the calculation. If individual measurements show that nitrogen dioxide proportions in the nitrogen oxide emissions account for less than 10 per cent, continuous measuring of nitrogen dioxide shall be waived and its proportion be calculated.

Facilities with mass flows of organic substances, to be indicated as total carbon, exceeding for

— substances under 5.2.5 Class I	1 kg/h,
— substances under 5.2.5	2.5 kg/h

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shall be equipped with measuring instruments at their relevant sources which continuously determine the total carbon.

Facilities with mass flows of mercury and its compounds of over 2.5 g/h, to be indicated as Hg, shall be equipped with measuring instruments at their relevant sources which continuously determine mercury mass concentrations, unless it has been reliably proven that the mass concentrations are less than 20 per cent of those specified in 5.2.2 Class I.

The competent authority shall require facilities emitting substances listed under 5.2.2 Classes I and II or substances listed under 5.2.7 to be equipped with continuous measuring instruments to determine the mass concentrations if the mass flow exceeds one of the respective mass flows over five times and if suitable measuring instruments are available.

5.3.3.3 Reference Values

Facilities with emission mass concentrations requiring permanent monitoring shall be equipped with measuring and evaluation instruments to continuously determine and record operational parameters, e.g. waste gas temperature, waste gas volume flow, humidity content, pressure, oxygen content, each including relevant status signals, which allow the evaluation and assessment of continuous measuring.
The continuous measuring of operational parameters may be waived if these, from experience, show only slight deviations which are minor for emission evaluation, or may be determined by other methods with sufficient certainty.

5.3.3.4 Selecting Instruments to Determine Emission Levels

Continuous measuring shall be carried out by suitable measuring and evaluation instruments which allow permanent value determination and recording of the factors to be monitored according to 5.3.3.2, 5.3.3.3 or 5.3.4 as well as the assessment according to 5.3.3.5.

A requirement shall be that an agency which has been determined by the authority responsible under *Land* law certifies the correct installation of the continuous measuring instrument.

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety shall publish in the GMBl. [*Gemeinsames Ministerialblatt* – Joint Ministerial Gazette], after consultation with the competent Land authorities, guidelines for the qualification test, installation, calibration and maintenance of measuring instruments. The measuring instruments recognized as suitable by the *Länder* shall be published in the *Bundesanzeiger* (Federal Gazette) by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

5.3.3.5 Evaluating and Assessing Measurement Results

Measured values shall generally be used to derive half-hourly mean values for each successive half hour. If necessary, the half hourly mean values shall be converted to the respective reference values and kept on file with the relevant status signals. The evaluation shall be made using suitable emissions calculators whose installation and parameterisation has been inspected by a designated agency. The data shall be transmitted to the authority by telemetry upon request.

For each calendar day, a daily mean value, related to the daily operating time, shall be derived from the half-hourly mean values and kept on file.

The facility complies with requirements if the emission limits established in the licensing notice or in a subsequent order are not exceeded; if limits are exceeded, this shall be reported separately and the competent authority informed immediately.

The operator shall be required to draw up evaluations of the continuous measurement results in a calendar year which shall be submitted to the competent authority within three months after the end of each calendar year. Measurement results shall be kept on file by the operator for at least 5 years. The requirement to submit the evaluation shall not apply if the data are submitted to the competent authority by telemetry.

5.3.3.6 Calibration and Functional Testing of Instruments for Continuously Determining Emissions

It is a requirement for instruments for continuously determining emissions to be calibrated and tested with regard to their functioning by an agency determined by the competent *Land* authority for calibrations. The calibration shall be carried out pursuant to VDI Guideline 3950 Part I (December 1994 version). In special cases, e.g. during batch operation, for calibration periods exceeding half an hour, or for other averaging periods, the averaging period shall be adapted accordingly.

Calibrations of measuring instruments shall be repeated subsequent to a significant alteration, otherwise every 3 years. Reports on the outcome of the calibration and the functional tests shall be submitted to the competent authority within 8 weeks.

Functional testing of instruments for continuously determining emissions shall be repeated annually.

The operator shall be required to ensure regular maintenance and functional tests of the measuring instruments.

5.3.4 Continuous Determination of Special Substances

A requirement for facilities emitting substances according to 5.2.2, 5.2.5 Class I or 5.2.7 is daily determination of the mass concentration of these substances in waste gas, as a daily mean value in relation to the daily operating time if over ten times the mass flows established therein is exceeded.

If daily mean values vary only slightly, determining the daily mean value of the mass concentration of these substances in waste gas may also be carried out after longer periods of time, e.g. on a weekly, monthly or annual basis. Determining special substance emissions may be waived if other tests, e.g. continuous functional control of the waste gas purification facility, show with sufficient certainty that emission limits are not exceeded.

The observation of the requirements according to 5.2.7.2 shall be proven by permanently recording or determining suitable operational values or waste gas parameters if continuous emission monitoring cannot be requested due to missing measuring instruments.

The operator shall be required to draw up evaluations of the permanent monitoring of special substances emissions which shall be submitted to the competent authority within three months after the end of each calendar year. Measurement results shall be kept on file by the operator for at least 5 years.

5.3.5 Equivalency to VDI Guidelines

In addition to the procedures described in the VDI Guidelines referred to in 5.3, other procedures established as equivalent may also be applied.

5.4 Special Provisions for Certain Types of Facilities

The special requirements for certain types of facilities contained in 5.4 are arranged according to the Annex of the Ordinance on Installations Subject to Licensing (4. BImSchV) as promulgated on 14 March 1997 (BGBl. I, p. 504), as last amended by Article 4 of the Act of 27 July 2001 (BGBl. I, p. 1950), and apply only to those types which are particularly mentioned. Notwithstanding this, the provisions of 5.1.1, para. 2, shall apply.

5.4.1 Heat Production, Mining, Energy

5.4.1.2 Facilities under 1.2: Furnaces

5.4.1.2.1 Facilities for Generating Electricity, Steam, Hot Water, Process Heat or Heated Waste Gas in Furnaces Using Coal, Coke, including Petroleum Coke, Coal Briquettes, Peat Briquettes, Fuel Peat or Untreated Wood with a Firing Thermal Capacity of less than 50 MW

REFERENCE VALUES

Emission standards for furnaces using coal, coke, including petroleum coke, or coal briquettes shall refer to a volume content of oxygen in waste gas of 7 per cent and for furnaces using peat briquettes, fuel peat or untreated wood to a volume content of oxygen in waste gas of 11 per cent.

Mass Flows

The mass flows established in 5.2 shall not apply.

Total Dust

Dust emissions in waste gas shall not exceed the following mass concentrations:

a) for facilities with a firing thermal capacity of 5 MW or more 20 mg/m^3,

b) for facilities with a firing thermal capacity of less than 5 MW 50 mg/m^3,

c) for facilities with a firing thermal capacity of less than 2.5 MW, which exclusively use untreated wood, 100 mg/m^3.

Inorganic Particulate Matter

5.2.2 shall not apply, with the exception of furnaces using petroleum coke.

Carbon Monoxide

Carbon monoxide emissions in waste gas shall not exceed mass concentrations of 0.15 g/m^3.

For individual furnaces with a firing thermal capacity of less than 2.5 MW, the emission standard shall apply to nominal load operations only.

Nitrogen Oxides

Nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed the following mass concentrations:

a) for untreated wood 0.25 g/m^3,

b) for other fuels

  aa) for fluidised bed furnaces 0.30 g/m^3,

  bb) for other furnaces in facilities with a firing thermal capacity

    — of 10 MW or more 0.40 g/m^3,

    — of less than 10 MW 0.50 g/m^3.

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For fluidised bed furnaces using coal, dinitrogen oxide emissions in waste gas shall not exceed mass concentrations of 0.15 g/m^3.

Sulphur Oxides

When fossil fuels are used, the sulphur dioxide and sulphur trioxide emissions in waste gas, to be indicated as sulphur dioxide, shall not exceed the following mass concentrations:

a) for fluidised bed furnaces 0.35 g/m^3

  or, in case this mass concentration cannot be attained with proportional efforts, a sulphur emissions ratio of 25 per cent,

b) for other furnaces

  aa) for hard coal 1.3 g/m^3,

  bb) for other fuels 1.0 g/m^3.

When untreated wood is used, 5.2.4 shall not apply.

Halogen Compounds

5.2.4 shall not apply.

Organic Substances

When untreated wood is used, emissions of organic substances in waste gas, to be indicated as total carbon, shall not exceed a mass concentration of 10 mg/m^3. The requirements in 5.2.5 for emissions of organic substances of Classes I and II shall not apply.

Continuous Measuring

Individual furnaces with a firing thermal capacity of 5 to 25 MW shall be equipped with measuring instruments which continuously determine dust emission mass concentrations qualitatively.

Individual furnaces with a firing thermal capacity of over 25 MW shall be equipped with measuring instruments which continuously determine dust emission mass concentrations.

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Individual furnaces with a firing thermal capacity of 2.5 MW or over shall be equipped with measuring instruments which continuously determine carbon monoxide emission mass concentrations.

The second sentence of 5.3.3.1, para. 4, shall apply with respect to sulphur oxides insofar as the operator keeps a record of sulphur content, the lower calorific value of the fuel used, and of the added sorbents, keeps the record on file for five years and submits it, upon request, to the competent authority.

EXISTING FACILITIES

Existing facilities shall comply with requirements to restrict dust emissions and carbon monoxide and sulphur oxides emissions no later than eight years after the entry into force of this Administrative Regulation.

For individual furnaces with a firing thermal capacity of less than 2.5 MW, the carbon monoxide emissions in waste gas shall not exceed a mass concentration of 0.25 g/m^3; the emission standard shall apply to nominal load operations only.

CONTINUOUS MEASURING

The requirement to be equipped with a measuring instrument which continuously determines carbon monoxide emission mass concentrations shall not apply to existing individual furnaces with a firing thermal capacity of 2.5 to 25 MW.

5.4.1.2.2 Facilities for Generating Electricity, Steam, Hot Water, Process Heat or Heated Waste Gas in Furnaces using Heating Oils, Emulsified Natural Bitumen, Methanol, Ethanol, Untreated Vegetable Oils or Vegetable Oil Methyl Esters with a Firing Thermal Capacity of less than 50 MW

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen in waste gas of 3 per cent.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST

When heating oils listed in DIN 51603 Part 1 (March 1998 version), methanol, ethanol, untreated vegetable oils or vegetable oil methyl esters are used, 5.2.1 shall not apply. When these substances are used, the soot level shall not exceed the value 1. Waste gases shall be free of oil derivates if filter paper used for soot measuring does not show any visible marks of oil derivates.

When other liquid fuels are used, notwithstanding 5.2.1, a higher dust emission standard up to a maximum of 50 mg/m^3 may be approved, insofar as the emission standards of 5.2.2 and 5.2.7.1.1 are not exceeded.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed a mass concentration of 80 mg/m^3.

NITROGEN OXIDES

Nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed the following mass concentrations:

a) When heating oils defined in DIN 51603 Part 1 (March 1998 version), are used in boilers with a safety device setting value (e.g. safety temperature limiter, safety pressure valve) where the following values are exceeded
    aa) a temperature smaller than 110 °C or excess pressure smaller than 0.05 MPa 0.18 g/m^3,
    bb) a temperature of 110 to 210 °C or excess pressure smaller than 0.05 to 1.8 MPa 0.20 g/m^3,
    cc) a temperature greater than 210 °C or excess pressure greater than 1.8 MPa 0.25 g/m^3,

    with respect to the reference value for organically combined nitrogen of 140 mg/kg pursuant to Annex B of DIN EN 267 (November 1999 version),
b) for other liquid fuels 0.35 g/m^3.

when heating oils defined in DIN 51603 Part 1 (March 1998 version) are used, the organically combined nitrogen content of the fuel shall be determined pursuant to

ASTM 4629-91 (1991 version). The measured mass concentrations of nitrogen monoxide and nitrogen dioxide, to be indicated as nitrogen dioxide, shall be converted to the reference value for organically combined nitrogen, as well as to the reference conditions of 10 g/kg air humidity and 20 °C combustion air temperature.

Sulphur Oxides

When fluid fuels with a higher mass content of sulphur are used as light heating oil pursuant to the Ordinance on the Sulphur Content of Light Fuel Oil and Diesel Fuel (3. BImSchV) of 15 January 1975 (BGBl. I, p. 264), as last amended on 21 December 2000 (BGBl. I, p. 1956), as currently applicable, the sulphur dioxide and sulphur trioxide emissions in waste gas, to be indicated as sulphur dioxide, shall not exceed a mass concentration of 0.85 g/m^3.

Divergent to the first sentence, individual furnaces with a firing thermal capacity of up to 5 MW shall only use fluid fuels other than heating oils with a mass content of sulphur for light heating oil pursuant to the 3. BImSchV, as currently applicable, if it is ensured (e.g. by the sulphur content in the fuel or by desulphurisation facilities) that no higher sulphur dioxide emissions are generated than if a heating oil with a mass content of sulphur pursuant to the 3. BImSchV, as currently applicable, is used.

Individual Measurements

When heating oils listed in DIN 51603 Part 1 (March 1998 version), which do not exceed the approved sulphur mass content for light heating oil in the 3. BImSchV, as currently applicable, methanol, ethanol, untreated vegetable oils or vegetable oil methyl esters are used, 5.3.2.1 shall not apply to total dust and sulphur oxides.

Continuous Measuring

Individual furnaces with a firing thermal capacity of 10 MW or more using heating oils listed in DIN 51603 Part 1 (March 1998 version), methanol, ethanol, untreated vegetable oils or vegetable oil methyl esters which form part of a common facility with a firing thermal capacity of 20 MW or more, shall be equipped with measuring instruments which continuously determine the soot level pursuant to DIN 51402 Part 1 (October 1986 version) and the carbon monoxide mass concentrations in waste gas.

Individual furnaces with a firing thermal capacity of 20 MW or more using methanol or ethanol shall be equipped with a measuring instrument which continuously determines carbon monoxide emission mass concentrations in waste gas.

Individual furnaces with a firing thermal capacity of less than 20 MW using heating oils, with the exception of heating oils listed in DIN 51603 Part 1 (March 1998 version), or emulsified natural bitumen shall be equipped with a measuring instrument which continuously determines dust emission mass concentrations qualitatively; individual furnaces with a firing thermal capacity of 20 MW or more shall be equipped with measuring instruments which continuously determine mass concentrations of particles and carbon monoxide emissions in waste gas.

Existing Facilities

Existing facilities using heating oils with the exception of heating oils listed in DIN 51603 Part 1 (March 1998 version), which do not exceed the approved sulphur mass content for light heating oil in the 3. BImSchV, as currently applicable – shall comply with requirements to restrict dust emissions and sulphur oxides emissions no later than ten years after the entry into force of this Administrative Regulation.

5.4.1.2.3 Facilities for Generating Electricity, Steam, Hot Water, Process Heat or Heated Waste Gas in Furnaces Using Gaseous Fuels, particularly Coke Oven Gas, Mine Gas, Gas from Steel Mills, Refinery Gas, Synthesis Gas, Mineral Oil Gas from the Tertiary Mining of Mineral Oil, Sewer Gas, Biogas, Untreated Natural Gas, Liquid Gas, Gases from the Public Gas Supply or Hydrogen, with a Firing Thermal Capacity of less than 50 MW

Reference Values

Emission standards shall refer to a volume content of oxygen in waste gas of 3 per cent.

Mass Flows

The mass flows established in 5.2 shall not apply.

TOTAL DUST

Dust emissions in waste gas shall not exceed the following mass concentrations:

a) when gases from the public gas supply, liquid gas, hydrogen, refinery gas, sewer gas or bio gas are used 5 mg/m^3,

b) when other gases are used 10 mg/m^3.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed a mass concentration of 50 g/m^3 when gases from the public gas supply are used and 80 g/m^3 when other gases are used.

NITROGEN OXIDES

Nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed the following mass concentrations:

a) when heating oils from the public gas supply are used in boilers with a safety device setting value (e.g. safety temperature limiter, safety pressure valve) when the following values are exceeded
    aa) a temperature smaller than 110 °C or excess pressure smaller than 0.05 MPa 0.10 g/m^3,
    bb) a temperature of 110 to 210 °C or excess pressure smaller than 0.05 to 1.8 MPa 0.11 g/m^3,
    cc) a temperature greater than 210 °C or excess pressure greater than 1.8 MPa 0.15 g/m^3,

b) when other gases are used, with the exception of process gases containing nitrogen compounds, 0.20 g/m^3;

c) when process gases containing nitrogen compounds are used, nitrogen oxides emissions in waste gas shall be reduced using the best available techniques.

SULPHUR OXIDES

Sulphur dioxide and sulphur trioxide emissions in waste gas, to be indicated as sulphur dioxide, shall not exceed the following mass concentrations:

a) for liquid gas 5 mg/m^3,

b) for gases from the public gas supply 10 mg/m^3,

c) for coke oven gas or refinery gas 50 mg/m^3,

d) for biogas or sewer gas 0.35 g/m^3,

e) for mineral oil gas used as fuel for steam production during tertiary measures in mineral oil mining, 1.7 g/m^3,

f) for fuel gases commonly used by iron and steel plants and coking plants,
    aa) for blast furnace gas 0.20 g/m^3,
    bb) for coke oven gas 0.35 g/m^3,

g) for other fuels 35 mg/m^3.

5.4.1.2.4 Mixed Fuel and Multiple Fuel Furnaces with a Firing Thermal Capacity of less than 50 MW

MIXED FUEL FURNACES

For mixed fuel furnaces, the emission standards determined for the respective fuels shall be established by comparing the energy applied with each fuel to the total amount of applied energy. The emission standards relevant to each furnace may be reached by adding the values in such manner.

Divergent to para. 1, the provisions apply to the fuel for which the highest emission standard applies if, during the operation of the facility, this fuel accounts for at least 70 per cent of the total amount of applied energy and, in the case of facilities in mineral oil refineries, for at least 50 per cent. In plants using distillation and conversion residues of mineral oil treatment processes for their own purposes, the amount of the most relevant fuel may be lower if the emission concentration in waste gas which shall be attributed to this most relevant fuel does not exceed the value given for this fuel in the first sentence.

MULTIPLE FUEL FURNACES

For multiple fuel furnaces, those regulations shall be in effect which apply to the particular fuel; notwithstanding, the requirements for reducing dust emissions of solid fuels shall apply for a period of four hours after the conversion from solid to gaseous fuels or to heating oil listed in DIN 51603 Part 1 (March 1998 version).

FLUIDISED BED FURNACES

For fluidised bed furnaces operated as mixed fuel furnaces or multiple fuel furnaces, the dust emission standards of 5.4.1.2.1 shall apply.

5.4.1.2.5 Furnaces of Drying Facilities

The requirements under 5.4.1.2.1, 5.4.1.2.2 or 5.4.1.2.3 shall apply to furnaces whose waste gases or flames dry goods not in direct contact. The following requirements shall apply to furnaces where goods are dried in direct contact to their waste gases or flames.

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen in waste gas of 17 per cent; insofar as a volume content of oxygen in waste gas other than this is required for processing or product quality reasons, the reference oxygen content shall be defined on an individual basis.

FUELS

Furnaces shall be operated with the following fuels:

a) gaseous fuels,
b) liquid fuels which do not cause higher sulphur oxides emissions than heating oils listed in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light heating oil pursuant to the 3. BImSchV, as currently applicable, or
c) coals which do not cause higher sulphur oxides emissions than hard coal with a sulphur mass content of less than 1 per cent, as related to a lower calorific value of 29.3 MJ/kg; for individual processes during which other combustible materials are used, special arrangements shall be drawn up.

5.4.1.3 Facilities under 1.3: Facilities for Generating Electricity, Steam, Hot Water, Process Heat or Heated Waste Gas in Furnaces Using Solid or Liquid Fuels other than under 1.2

When straw or similar plant products (e.g. cereals, grasses, miscanthus) are used, the following requirements shall apply to furnaces with a firing thermal capacity of less than 50 MW:

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen in waste gas of 11 per cent.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST

Dust emissions in waste gas shall not exceed the following mass concentrations:

a)	for facilities with a firing thermal capacity of 1 MW or more	20 mg/m^3,
b)	for facilities with a firing thermal capacity of less than 1 MW	50 mg/m^3.

INORGANIC PARTICLE MATTER

5.2.2 shall not apply.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed a mass concentration of 0.25 mg/m^3.

For individual furnaces with a firing thermal capacity of less than 2.5 MW, the emission standard applies to nominal load operations only.

NITROGEN OXIDES

Nitrogen monoxide and nitrogen dioxide emissions in waste gas shall, to be indicated as nitrogen dioxide, not exceed the following mass concentrations:

a) for facilities with a firing thermal capacity equal to or greater than 1 MW 0.40 g/m^3,

b) for facilities with a firing thermal capacity smaller than 1 MW 0.50 g/m^3.

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that the requirements for emissions of organic substances pursuant to Classes I and II do not apply.

CONTINUOUS MEASURING

Individual furnaces with a firing thermal capacity of 5 to 25 MW shall be equipped with measuring instruments which continuously determine dust emission mass concentrations qualitatively.

Individual furnaces with a firing thermal capacity of more than 25 MW shall be equipped with measuring instruments which continuously determine dust emission mass concentrations.

Individual furnaces with a firing thermal capacity equal to or greater than 2.5 MW shall be equipped with measuring instruments which continuously determine carbon monoxide emission mass concentrations in waste gas.

EXISTING FACILITIES

TOTAL DUST

Existing facilities shall comply with requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

CONTINUOUS MEASURING

The requirement to be equipped with a measuring instrument which continuously determines carbon monoxide emission mass concentrations shall not apply to existing individual furnaces with a firing thermal capacity of 2.5 to 25 MW.

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5.4.1.4 Facilities under 1.4:

Internal Combustion Engines (including Internal Combustion Engines under 1.1 and 1.2)

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen in waste gas of 5 per cent.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST, INCLUDING THE CONTENT OF CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

Dust emissions in waste gas from compression ignition engines operated on liquid fuels shall not exceed the maximum mass concentrations of 20 mg/m^3.

Dust emissions in waste gas from internal combustion engines exclusively used during emergencies or operated for up to 300 hours per year during periods of peak load (e.g. for generating electricity, supplying gas or water) shall not exceed the maximum mass concentrations of 80 mg/m^3.

The best available techniques to further reduce emissions, particularly with respect to engine design, shall be applied.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed the following mass concentrations:

a) for compression ignition engines and spark ignition engines operated on liquid fuels, and for compression ignition engines (pilot injection engines) and spark ignition engines operated on gaseous fuels, with the exceptions of biogas, sewer gas or mine gas, 0.30 g/m^3,

b) for spark ignition engines operated on biogas or sewer gas with a firing thermal capacity of
    - aa) 3 MW or more 0.65 g/m^3,
    - bb) less than 3 MW 1.0 g/m^3,

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c) for spark ignition engines operated on mine gas, 0.65 g/m^3,

d) for pilot injection engines operated on biogas or sewer gas with a firing thermal capacity of
  - aa) 3 MW or more 0.65 g/m^3,
  - bb) less than 3 MW 2.0 g/m^3;

when biogas, sewer gas and mine gas are utilized, the best available techniques to further reduce carbon monoxide emissions, particularly with respect to engine design, shall be applied.

Carbon monoxide emission standards shall not apply to internal combustion engines exclusively used during emergencies or operated for up to 300 hours per year during periods of peak load (e.g. for generating electricity, supplying gas or water); all possible emission reduction measures with respect to engine design shall be applied.

NITROGEN OXIDES

Nitrogen monoxide and nitrogen dioxide emissions in waste gas shall not exceed the following mass concentrations, to be indicated as nitrogen dioxide:

a) for compression ignition engines operated on liquid fuels with a firing thermal capacity of
  - aa) 3 MW or more 0.50 g/m^3,
  - bb) less than 3 MW 1.0 g/m^3,

b) for gas-powered compression ignition engines (pilot injection engines) and spark ignition engines
  - aa) for pilot injection engines operated on biogas or sewer gas with a firing thermal capacity of
    - — 3 MW or more 0.50 g/m^3,
    - — less than 3 MW 1.0 g/m^3,
  - bb) for lean-burn engines and other four-stroke Otto engines operated on biogas or sewer gas, 0.50 g/m^3,
  - cc) for pilot injection engines and lean-burn engines operated on other gaseous fuels, 0.50 g/m^3,

c) for other four-stroke SI engines 0.25 g/m^3,

d) for two-stroke engines 0.80 g/m^3;

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when biogas, sewer gas and mine gas are utilized in pilot injection engines with a firing thermal capacity of less than 3 MW, all possible measures with respect to engine design to further reduce nitrogen oxides emissions shall be applied.

Nitrogen oxides emission standards shall not apply to internal combustion engines used exclusively during emergencies or operated for up to 300 hours per year during periods of peak load (e.g. for generating electricity, supplying gas or water).

SULPHUR OXIDES

When liquid mineral fuels are used, only heating oils listed in DIN 51603 Part 1 (version March 1998) with a sulphur mass content for light heating oil pursuant to the 3. BImSchV, as currently applicable, or diesel fuels with a sulphur mass content for light heating oil pursuant to the 3. BImSchV, as currently applicable, may be used, or equivalent measures shall be applied.

When gaseous fuels are used, the requirements under 5.4.1.2.3 shall apply, provided that a conversion is made to a reference oxygen content in waste gas of 5 per cent.

When biogas and sewer gas are utilized, the best available primary techniques to further reduce emissions (gas purification) shall be applied.

ORGANIC SUBSTANCES

Formaldehyde emissions in waste gas shall not exceed a mass concentration of 60 g/m^3. The requirements in 5.2.5 shall not apply to emissions of other organic substances.

The best available techniques to further reduce organic substances emissions shall be applied.

5.4.1.5 Facilities under 1.5:

Gas Turbines with a Firing Thermal Capacity of less than 50 MW (including Gas Turbines under 1.2)

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen in waste gas of 15 per cent.

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MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST

5.2.1 shall not apply.

When liquid fuels are used, the soot level shall not exceed the value 2 during continuous operation and the value 4 during start up.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed a mass concentration of 0.10 g/m³ during operation with a load of 70 per cent or more.

NITROGEN OXIDES

When natural gas is used, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 75 g/m³, to be indicated as nitrogen dioxide, during operation with a load of 70 per cent or more. For gas turbines operating solo with an efficiency of more than 32 per cent at 15 °C, 101.3 kPa and a relative air humidity of 60 per cent (ISO conditions), the emission standard of 75 mg/m³ shall be increased in line with the percentage improvement of efficiency.

When other gaseous or liquid fuels are used, emissions of nitrogen monoxide and nitrogen dioxide in the waste gas from gas turbines shall not exceed a mass concentration of 0.15 g/m³, to be indicated as nitrogen dioxide.

Emission standards for nitrogen oxides shall not apply to gas turbines used exclusively during emergencies or operated for up to 300 hours per year during periods of peak load for the gas supply.

SULPHUR OXIDES

When liquid fuels are used, only heating oils listed in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light heating oil pursuant to the 3. BImSchV, as currently applicable, or diesel fuels with a sulphur mass content for light heating oil pursuant to the 3. BImSchV, as currently applicable, may be used, or equivalent measures to reduce emissions shall be applied.

EXISTING FACILITIES

NITROGEN OXIDES

Existing facilities shall comply with requirements to restrict nitrogen dioxides emissions no later than ten years after the entry into force of this Administrative Regulation; the requirements for new facilities to restrict nitrogen oxides emissions shall not apply to existing individual aggregates with a mass flow of nitrogen oxides of up to 20 Mg/a, to be indicated as nitrogen dioxide.

5.4.1.9/10 Facilities under 1.9 and 1.10:

5.4.1.9.1 Facilities for Grinding or Drying Coal

5.4.1.10.1 Facilities for Briquetting Lignite and Hard Coal

TOTAL DUST

a) Hard coal

Dust emissions shall not exceed a mass concentration of 75 mg/m³ (f) in the clouds and vapours.

b) Lignite

Dust emissions in waste gas shall not exceed a mass concentration of 75 mg/m³ (f) during vapour dedusting, prop dedusting and prop jaw fog dispersals.

EXISTING FACILITIES

TOTAL DUST

Lignite

For existing facilities, dust emissions in waste gas shall not exceed a mass concentration of 75 mg/m³ during interior dedusting if, because of the risk of explosion, wet waste gas purification processes have to be used.

5.4.1.11 Facilities under 1.11:
Facilities for the Dry Distillation of Hard Coal (Coking Plants)

UNDERGRATE FIRING

a) Reference values

Emission standards for furnace waste gases shall refer to a volume content of oxygen in the waste gas of 5 per cent.

b) Dust

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m^3.

c) Nitrogen oxides

During the initial measurement, nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed 0.50 g/m^3; the best available techniques to reduce high emissions caused by aging, particularly with respect to improved combustion, shall be applied.

d) Fuel

The mass concentration of sulphur compounds in the undergrate gas, to be indicated as sulphur, shall not exceed 0.80 g/m^3.

CHARGING COKE OVENS

Dust emissions shall be avoided when drawing off coal from the coal bunker into the lorries.

Filling gases shall be collected. During bulk feeding operations, filling gases shall be fed into the crude gas. During compacting, filling gases shall be passed on to the crude gas or adjacent oven as far as this is feasible. Filling gases which may not be passed on shall be burned. Dust emissions in the combustion waste gas shall not exceed a mass concentration of 10 mg/m^3.

When the coal is graded, filling gas emissions shall be reduced and, as far as possible, prevented by sealing the grading opening.

FILLING HOLE LIDS

Emissions at filling hole lids shall be avoided as far as possible, e.g. by using filling hole lids with large sealing surfaces, by packing the filling hole lids after each charging of the oven, and by regular cleaning of filling hole frames and filling hole lids before closing the filling holes. Oven ceilings shall be freed from coal residues regularly.

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RISER PIPE LIDS

Riser pipe lids shall be equipped with water dip tanks or adequate systems in order to avoid emissions; riser pipes shall be cleaned regularly.

COKE OVEN OPERATING MACHINERY

The machinery for operating the coke oven shall be equipped with systems for cleaning the sealing surfaces on the oven door frames.

COKE OVEN DOORS

Coke oven doors with a technically gas-tight seal shall be used. The gaskets shall be pushed against the frame of the chamber exerting spring resistance or using other technology, which seals as efficiently. The sealing surfaces of the oven doors shall be cleaned regularly. The best available techniques to further reduce emissions, particularly with respect to single-chamber pressure regulation, exhaust systems and other technical features, shall be applied.

COKE PUSHING

Waste gases shall be collected during coke pushing operations and fed into a dedusting system; dust emissions shall not exceed a mass concentration of 5 mg/m^3 or the mass ratio of 5 g per Mg of coke.

COKE COOLING

Low-emission procedures shall be applied for coke cooling, e.g. dry coke cooling; dust emissions in waste gas from dry coke cooling shall not exceed a mass concentration of 15 mg/m^3 and dust emissions from wet coke cooling shall not exceed the mass ratio of 10 g per Mg of coke.

OPERATING MANUAL

The measures for emissions reduction in coke oven operations shall be established in an operating manual, particularly so as to guarantee properly sealed openings, ensure

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that only completely roasted coke is pushed out, and prevent the escape of unburned gases into the atmosphere.

COKING BY-PRODUCT PLANTS

The requirements under 5.4.4.1m.2, 5.4.4.1p.1 and 5.4.4.4 shall apply accordingly to facilities in the category of coking by-product plants. If the process gas also contains hydrogen sulphide in addition to ammonia, the waste gas shall be fed into a sulphuric acid or sulphur recovery system by means of post-combustion.

EXISTING FACILITIES

COKE COOLING

For existing facilities with a wet quenching installation for coke cooling, dust emissions from the quenching tower shall not exceed the mass ratio of 25 g per Mg of coke. In the event of a basic renewal of the coke cooling system, the requirements for new facilities shall be observed.

5.4.2 Rock and Soil, Glass, Ceramics and Building Materials

5.4.2.3 Facilities under 2.3: Facilities for the Production of Cement Clinkers or Cements, insofar as Fuels under 1.2 are Used Exclusively

STORAGE

Clinker materials shall be stored in silos or enclosed areas equipped with exhaust and dedusting systems.

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen in the waste gas of 10 per cent.

AMMONIA

The requirements in 5.2.4 shall not apply to ammonia emissions. If wastes with relevant quantities of substances containing ammonium are used as raw materials and their use is not regulated by the Ordinance on Incinerators for Waste and Similar Combustible Materials (17. BImSchV) of 23 November 1990 (BGBl. I, p. 2545), last amended by the Ordinance of 23 February 1999 (BGBl. I, p. 186), as currently applicable, the materials shall be put into the furnace entrance or the calcinator.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide in the waste gas from cement furnaces shall not exceed a mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide. The best available techniques to further reduce emissions, particularly by using improved combustion, shall be applied.

ORGANIC SUBSTANCES

The requirements under 5.2.5 shall not apply. Insofar as wastes containing relevant quantities of organic substances are used as raw materials and their use is not regulated by the 17. BImSchV, as currently applicable, the materials shall be put into the furnace entrance or the calcinator.

CARCINOGENIC SUBSTANCES

5.2.7.1.1 shall apply, provided that emissions of benzene in the waste gas from cement furnaces shall not exceed a mass concentration of 1 mg/m³ if possible, and shall not exceed a mass concentration of 5 mg/m³.

CONTINUOUS MEASURING

The requirements under 5.3.3.2 shall not apply to emissions of carbon monoxide, fluorine and inorganic gaseous fluorine compounds and inorganic gaseous chlorine compounds.

5.4.2.4 Facilities under 2.4: Facilities for Burning Limestone, Bauxite, Dolomite, Gypsum, Diatomite, Magnesite, Quarzite or Fire Clay

REFERENCE VALUES

Emission standards shall refer to moist waste gas for facilities for the production of hydrate lime or dolomite.

TOTAL DUST

When electrostatic precipitators are used, divergent to 2.7 a) bb), all half-hourly mean values shall not exceed a mass concentration of 50 mg/m^3.

NITROGEN OXIDES

Emissions of nitrogen dioxide and nitrogen monoxide in waste gas shall not exceed a mass concentration of 0.50 g/m^3, to be indicated as nitrogen dioxide. For the manufacture of hard quicklime or sintering dolomite in rotary furnaces, divergent to the first sentence, nitrogen dioxide and nitrogen monoxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed a mass concentration of 1.5 g/m^3; the best available techniques to further reduce emissions, particularly with respect to improved combustion, shall be applied.

WASTE GAS RECYCLING

For rotary furnaces for burning gypsum, a mass concentration of sulphur dioxide and sulphur trioxide, to be indicated as sulphur dioxide, and of nitrogen dioxide and nitrogen monoxide, to be indicated as nitrogen dioxide, determined for operation with waste gas recycling shall be converted to the waste volume flow for operation without waste gas recycling.

EXISTING FACILITIES

TOTAL DUST

Existing facilities for burning gypsum which equipped with electrostatic precipitators and using lignite dust as fuel shall comply with requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

Hydrogen Sulphide

For lime shaft furnaces with mixed fuels, hydrogen sulphide emissions in waste gas shall not exceed a mass concentration of 3 g/m^3 where possible; the best available primary and other techniques to further reduce hydrogen sulphide emissions shall be applied.

5.4.2.7 Facilities under 2.7:
Facilities for Bloating Perlite, Slate or Clay

REFERENCE VALUES

Emission standards shall refer to moist waste gas and to a volume content of oxygen in the waste gas of 14 per cent.

SULPHUR OXIDES

5.2.4 shall apply to facilities for bloating clay or slate, provided that emissions of sulphur dioxide and sulphur trioxide in waste gas, to be indicated as sulphur dioxide, shall not exceed a mass concentration of 0.75 g/m^3.

CARCINOGENIC SUBSTANCES

5.2.7.1.1 shall apply to facilities for bloating clay or slate, provided that emissions of Class III substances in waste gas shall not exceed a mass concentration of 1 mg/m^3 where possible, and shall not exceed a mass concentration of 3 mg/m^3.

5.4.2.8 Facilities under 2.8:
Facilities for the Production of Glass, insofar as it is Manufactured from Waste Glass, including Facilities for Producing Glass Fibres

REFERENCE VALUES

Emission standards are referenced for flame-heated glass melting furnaces to a volume content of oxygen in the waste gas of 8 per cent, as well as for flame-heated pot furnaces and day tanks to a volume content of oxygen in the waste gas of 13 per cent.

INORGANIC PARTICLE MATTER

If the use of lead or selenium is required for reasons of product quality, 5.2.2 shall apply, provided that emissions of Class II substances in waste gas do not exceed a mass concentration of 3 mg/m^3; if substances from several classes are present, irrespective of 5.2.2 para. 1, the mass concentration for coinciding Class II and III or coinciding Class I to III substances shall not exceed 4 mg/m^3. The use of lead or selenium shall be documented.

If foreign fragments are used for the production of container glass, 5.2.2 shall apply, provided that emissions of lead and its compounds in waste gas shall not exceed a mass concentration of 0.8 mg/m^3, to be indicated as Pb; if several Class II substances are present, the mass concentration for substances of this class shall not exceed a total of 1.3 mg/m^3. If substances from several classes are present, irrespective of 5.2.2 para. 1, the mass concentration for coinciding Class II and III or coinciding Class I to III substances shall not exceed 2.3 mg/m^3. The input of foreign fragments shall be documented.

Fluorine and its Inorganic Gaseous Compounds

5.2.4 shall apply, provided that emissions of fluorine and its inorganic gaseous compounds in waste gas, to be indicated as hydrogen fluoride, shall not exceed a mass concentration of 5 mg/m^3. Measures to reduce emissions of fluorine and its inorganic gaseous compounds by using raw materials with lower levels of fluorine compounds shall be applied; if the use of fluorides is required for reasons of product quality, the quantity used shall be restricted to that which is essential and documented.

Sulphur Oxides

Sulphur dioxide and sulphur trioxide emissions in waste gas, to be indicated as sulphur dioxide, shall not exceed the mass concentrations listed in Table 9:

Table 9: **Emission Standards for Sulphur Dioxide and Sulphur Trioxide, to be Indicated as Sulphur Dioxide, for Facilities under 2.8**

Facilities for the Production of Glass	Gas-fired (g/m^3)	Oil-fired (g/m^3)	Operating Conditions
container glass or sheet glass	0.40	0.80	
container glass	0.80	1.5	Near stoichiometric mode for primary NO$_X$ reduction, full recirculation of filter dust, sulphate purification as well as content of own and foreign fragments of more than 40 mass per cent, as related to the mixture.
sheet glass	0.80	1.5	Near stoichiometric mode for primary NO$_X$ reduction, full recirculation of filter dust and a sulphate content required for the quality of the glass of more than 0.45 mass per cent, as related to the mixture.
glass for consumer goods	0.20	0.50	
glass for consumer goods	0.50	1.4	Near stoichiometric mode for primary NO$_X$ reduction, full recirculation of filter dust and a sulphate content required for the quality of the glass of more than 0.45 mass per cent, as related to the mixture.
glass fibres	0.20	0.80	
glass fibres	0.80	1.4	Full recirculation of filter dust and a sulphate content required for the quality of the glass of more than 0.40 mass per cent, as related to the mixture.
glass wool	0.050	0.80	
glass wool	0.10	1.4	Content of own and foreign fragments of more than 40 mass per cent, as related to the mixture

Facilities for the Production of Glass	Gas-fired (g/m^3)	Oil-fired (g/m^3)	Operating Conditions
special glass	0.20	0.50	
special glass	0.40	1.0	full recirculation of filter dust
water glass	0.20	1.2	
frits	0.20	0.50	

In operating conditions other than those to be indicated for the maximum permissible emission standards for a glass product in Table 9, lower emission standards shall be defined on an individual basis if these operating conditions involve a lower sulphur input into the mixture or lower mass concentrations of sulphur oxides in the crude gas.

Emission limits for mixed fuel furnaces or multiple fuel furnaces shall be defined on a case-to-case basis.

The recirculation of filter dusts, the use of foreign fragments and the sulphate content in the mixture shall be documented.

Nitrogen Oxides

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.50 g/m^3, to be indicated as nitrogen dioxide. For horseshoe flame tanks and cross burner tanks with a waste gas volume flow of less than 50 000 m^3/h, divergent to the first sentence, nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed a mass concentration of 0.50 g/m^3 if possible, and shall not exceed a mass concentration of 0.80 g/m^3; the best available techniques to further reduce emissions, particularly using improved combustion, shall be applied.

If nitrate purification is required for reasons of product quality, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 1.0 g/m^3, to be indicated as nitrogen dioxide, during the nitrate purification process. The nitrate input shall be documented.

Carcinogenic Substances

5.2.7.1.1 shall apply to the production of container glass, provided that emissions of Class I substances in waste gas shall not exceed the maximum mass concentration of 0.5 mg/m^3.

If the use of arsenic compounds as purification agents is required for reasons of product quality, 5.2.7.1.1 shall apply, provided that emission standards for Class I substances, except arsenic and its compounds, shall apply; in this case, emissions of arsenic and its compounds in waste gas, to be indicated as As, shall not exceed the maximum mass flow of 1.8 g/h or the maximum mass concentration of 0.7 mg/m^3; measures to reduce high emissions of arsenic, e.g. by using purification processes without arsenic or antimony, shall be applied.

If the use of cadmium compounds is required for glass coloration for reasons of product quality, 5.2.7.1.1 shall apply, provided that emission standards for Class I substances, except cadmium and its compounds, shall apply; in this case, emissions of cadmium and its compounds in waste gas, to be indicated as Cd, shall not exceed the maximum mass flow of 0.5 g/h or the maximum mass concentration of 0.2 mg/m^3.

The input of arsenic and cadmium compounds shall be documented.

Special Provisions

Special provisions shall be made for glass melting tanks fired by oxygen fuel and electrically heated glass melting tanks. The specific energy consumption of comparable modern glass melting tanks fired by air fuel and the efficiency of waste gas purification facilities shall be used as criteria. Reference is made to Guideline VDI 2578 (November 1999 version).

Existing Facilities

Total Dust

For existing facilities equipped with electrostatic precipitators and meeting the requirements of 6.2.3.3, dust emissions in waste gas shall not exceed a mass concentration of 30 mg/m^3.

NITROGEN OXIDES

For existing facilities with horseshoe flame tanks or cross burner tanks, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.80 g/m^3, to be indicated as nitrogen dioxide; moreover, it shall be examined to what extent, with additional waste gas reduction measures, an emission standard of 0.50 g/m^3 may be requested.

These requirements to restrict nitrogen oxides shall be observed no later than eight years after the entry into force of this Administrative Regulation; during the specified period, at the end of each tank's lifetime, appropriate structural alterations to the melting tank shall be carried out, using the best available techniques to reduce nitrogen oxides emissions.

If nitrate purification is required for reasons of product quality, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the following mass concentrations, to be indicated as nitrogen dioxide, during the nitrate purification process:

a)	for a waste gas volume flow of 5 000 m^3/h or more	1.0 g/m^3,
b)	for a waste gas volume flow of less than 5 000 m^3/h	1.2 g/m^3.

The nitrate input shall be documented.

5.4.2.10 Facilities under 2.10: Facilities for Burning Ceramic Products

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen in the waste gas of 17 per cent.

TOTAL DUST

5.2.1 shall apply to the use of packed bed filters, provided that during the intermittent dosage or intermittent circulation of the sorption agent dust emissions in waste gas shall not exceed a mass concentration of 40 mg/m^3.

INORGANIC PARTICLE MATTER

5.2.2 shall apply to the use of enamels or matter containing lead, provided that emission standards for Class II substances, except lead and its compounds, shall apply. For emissions of lead and its compounds in waste gas, to be indicated as Pb, a mass flow of 2.5 g/h or a mass concentration of 0.5 mg/m^3 shall not be exceeded if possible and a mass concentration of 3 mg/m^3 shall not be exceeded. Measures to reduce high emissions of lead and its compounds by using lead-free enamels and matter shall be applied.

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FLUORINE AND ITS INORGANIC GASEOUS COMPOUNDS

5.2.4 shall apply, provided that emissions of fluorine and its inorganic gaseous compounds in waste gas, to be indicated as hydrogen fluoride, shall not exceed a mass concentration of 5 mg/m^3. For intermittently operated furnaces, divergent to the first sentence, emissions of fluorine and its inorganic gaseous compounds in waste gas shall not exceed a mass flow of 30 g/m^3 or a mass concentration of 10 mg/m^3.

The best available primary and secondary techniques to further reduce emissions of fluorine and its inorganic gaseous compounds, particularly the use of raw materials with lower levels of fluorine compounds, shall be applied.

SULPHUR OXIDES

Emissions of sulphur dioxide and sulphur monoxide in waste gas shall not exceed a mass concentration of 0.50 g/m^3, to be indicated as sulphur dioxide.

NITROGEN OXIDES

Emissions of nitrogen dioxide and nitrogen monoxide in waste gas shall not exceed a mass concentration of 0.50 g/m^3, to be indicated as nitrogen dioxide.

ORGANIC SUBSTANCES

If post-combustion takes place outside the furnace, emissions of organic substances in waste gas shall not exceed a mass concentration of 20 mg/m^3, to be indicated as total carbon; the requirements for emissions of Class I and II organic substances defined in 5.2.5 shall not apply.

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Carcinogenic Substances

5.2.7.1.1 shall apply to furnaces with no external post-combustion, provided that emissions of benzene in waste gas shall not exceed a mass concentration of 1 mg/m³ if possible, and shall not exceed a mass concentration of 3 mg/m³.

Existing Facilities

Total Dust

For existing facilities operated using a packed bed filter or without a dedusting system, dust emissions in waste gas shall not exceed a mass concentration of 40 mg/m³; the best available techniques to further reduce dust emissions shall be applied.

Sulphur Oxides

For existing facilities, emissions of sulphur dioxide and sulphur trioxide in waste gas, to be indicated as sulphur dioxide, shall not exceed a mass concentration of 750 mg/m³.

5.4.2.11 Facilities under 2.11: Facilities for Melting Mineral Substances, including Facilities for the Production of Mineral Fibres

Reference Values

Emission standards are referenced for facilities which are fired with fossil fuels to a volume content of oxygen in waste gas of 8 per cent.

Fluorine and its Inorganic Gaseous Compounds

5.2.4 shall apply, provided that emissions of fluorine and its inorganic gaseous compounds in waste gas, to be indicated as hydrogen fluoride, shall not exceed a mass concentration of 5 mg/m³. Measures to reduce emissions of fluorine and its inorganic gaseous compounds by using raw materials with low levels of fluorine compounds shall be applied; if the use of fluorides is required for reasons of product quality, the quantity used shall be restricted to that which is essential and documented.

Sulphur Oxides

For the production of rock wool, emissions of sulphur dioxide and sulphur trioxide in waste gas, to be indicated as sulphur dioxide, shall not exceed the following mass concentrations:

a) for only natural stones or a mixture 0.60 g/m³,
b) for a mass per cent of minerally combined bricks of less than 45, as related to the mixture, 1.1 g/m³,
c) for a mass per cent of minerally combined bricks of 45 or more, as related to the mixture, and with full recirculation of filter dust, 1.5 g/m³.

For other proportions of minerally combined bricks or when there is not full recirculation of filter dust, emission standards shall be defined on an individual basis.

Nitrogen Oxides

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide. For horseshoe flame tanks and cross burner tanks with a waste gas volume flow of less than 50 000 m³/h, divergent to the first sentence, nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed a mass concentration of 0.50 g/m³ if possible, and shall not exceed a mass concentration of 0.80 g/m³; the best available techniques to further reduce emissions, particularly with respect to improved combustion, shall be applied.

For cupola furnaces with thermal post-combustion, divergent to 5.2.4, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.35 g/m³, to be indicated as nitrogen dioxide.

Existing Facilities

Total Dust

For existing facilities equipped with electrostatic precipitators and meeting the requirements of 6.2.3.3, dust emissions in waste gas shall not exceed a mass concentration of 30 mg/m³.

Nitrogen Oxides

For existing facilities with horseshoe flame tanks or cross burner tanks, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.80 g/m^3, to be indicated as nitrogen dioxide; moreover, it shall be examined to what extent, with additional waste gas reduction measures, an emission standard of 0.50 g/m^3 may be requested.

These requirements to restrict nitrogen oxides shall be observed no later than eight years after the entry into force of this Administrative Regulation; during the specified period, at the end of each tank's lifetime, appropriate structural alterations to the melting tank shall be carried out using the best available techniques to reduce nitrogen oxides emissions.

If nitrate purification is required for reasons of product quality, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the following mass concentrations, to be indicated as nitrogen dioxide, during the nitrate purification process:

a) for a waste gas volume flow of 5 000 m^3/h or more 1.0 g/m^3,
b) for a waste gas volume flow of less than 5 000 m^3/h 1.2 g/m^3.

The nitrate input shall be documented.

5.4.2.15 Facilities under 2.15: Asphalt Mixing Plants

Reference Values

Emission standards are referenced to a volume content of oxygen in waste gas of 17 per cent, and, divergent to this, to a volume content of oxygen in waste gas of 13 per cent for thermal oil curing aggregates.

Building and Operational Requirements

Waste gases containing dust from the mineral rotary dryer, the asphalt granulate dryer (parallel dryer), the transport units for hot minerals, the washer and the mixer shall be collected and fed into a dedusting system.

Crushers for recycled asphalt shall be encapsulated and equipped with effective installations to reduce dust emissions, e.g. water sprinklers.

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The best available techniques to reduce the production temperature for asphalt, e.g. by means of additives or processing measures, shall be applied.

Carbon Monoxide

When gaseous or liquid fuels are used, carbon monoxide emissions in waste gas shall not exceed a mass concentration of 0.50 g/m^3. When solid fuels are used, carbon monoxide emissions in waste gas shall not exceed a mass concentration of 0.50 g/m^3 if possible, and shall not exceed a mass concentration of 1.0 g/m^3.

Organic Substances

Waste gases from the vicinity of the mixer outflow, the transfer points to the mixer, the transport units for the bituminous mixture and the transfer points to the loading silos which containing organic substances shall be collected and fed into a suitable waste gas purification facility (e.g. by feeding the waste gases into the mineral rotary dryer as combustion air).

Emissions of organic substances when the bitumen storage tanks are filled shall preferably be avoided by using the vapour recovery technique.

The requirements in 5.2.5 for emissions of Class I and II organic substances shall not apply.

Carcinogenic Substances

5.2.7.1.1 shall apply, provided that emissions of Class III substances in waste gas do not exceed a mass concentration of 1 mg/m^3 if possible, and do not exceed a mass concentration of 5 mg/m^3.

Existing Facilities

Organic Substances

For existing facilities, during the operation of an asphalt granulate dryer (parallel dryer), emissions of organic substances in waste gas, to be indicated as total carbon, shall not exceed a mass concentration of 50 mg/m^3 if possible, and shall not exceed a mass concentration of 0.10 g/m^3; the requirements for emissions of Class I and II organic substances defined in 5.2.5 shall not apply.

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For existing facilities, waste gases from the vicinity of the mixer outflow, transfer points to the mixer, transport units for the bituminous mixture and transfer points to the loading silos which contain organic substances shall be collected and fed into the waste gas stack; moreover, it shall be examined whether additional emission reduction measures, e.g. feeding the emissions into the mineral rotary dryer as combustion air, may be requested.

When the bitumen storage tanks are filled, less expensive measures may be used for existing facilities than for new facilities, e.g. feeding waste gases with organic substances into the transport units for hot minerals.

Collection of waste gases from the vicinity of the mixer outflow, transfer points to the mixer, transport units for the bituminous mixture and transfer points to the loading silos, as well as the use of the vapour recovery technique or a comparable waste gas purification facility, may be waived if, for facilities with an output of

a) 200 Mg per hour or more, there is a minimum distance of 500 m,
b) less than 200 Mg per hour, there is a minimum distance of 300 m

to the next residential area, existing or planned.

5.4.3 Steel, Iron and Other Metals, including their Processing

5.4.3.1 Facilities under 3.1:

Facilities for Roasting, Smelting or Sintering Ores

5.4.3.1.1 Iron Ore Sintering Plants

Building and Operational Requirements

Waste gases shall be collected warm at the point of origin, e.g. sintering belt, coke grinding equipment, mixing bunker, in the vicinity of sintering belt discharge, sinter cooling and sinter screening, and fed into a waste gas purification facility.

Filter dust shall be recycled as far as possible.

Inorganic Particle Matter

5.2.2 shall apply, provided that lead emissions in waste gas from the sintering belt shall not exceed a mass concentration of 1 mg/m^3.

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Standstills Caused by Malfunctions

The requirements for total dust and inorganic particle matter shall not apply during standstills of the sintering belt caused by malfunctions until normal operation is resumed; however, the dedusting system shall be operated at maximum precipitation capacity.

Sulphur Oxides

Emissions of sulphur dioxide and sulphur monoxide in waste gas from the sintering belt shall not exceed a mass concentration of 0.50 g/m^3, to be indicated as sulphur dioxide.

Nitrogen Oxides

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas from the sintering belt shall not exceed a mass concentration of 0.40 g/m^3, to be indicated as nitrogen dioxide.

Organic Substances

5.2.5 shall apply, provided that emissions of organic substances in waste gas from the sintering belt shall not exceed a mass concentration of 75 mg/m^3, to be indicated as total carbon.

Dioxins and Furans

5.2.7.2 shall apply, provided that emissions of dioxins and furans in waste gas shall not be exceed a mass concentration of 0.1 ng/m^3 if possible, and shall not exceed a mass concentration of 0.4 ng/m^3.

Existing Facilities

Total Dust

For existing facilities equipped with electrostatic precipitators, warm dust emissions in waste gas from the sintering belt and in the vicinity of sintering belt discharge, sinter cooling and sinter screening (area dedusting), shall not exceed a mass concentration of 50 mg/m^3.

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INORGANIC PARTICLE MATTER

For existing facilities equipped with electrostatic precipitators, 5.2.2 shall apply, provided that lead emissions in waste gas from the sintering belt shall not exceed a mass concentration of 2 mg/m³.

5.4.3.1.2 Facilities for Roasting, Smelting or Sintering Non-ferrous Metal Ores

5.4.3.1.1 shall apply accordingly.

5.4.3.2 Facilities under 3.2:

Facilities for Producing, Manufacturing or Smelting Pig Iron or Steel

5.4.3.2a Integrated Iron and Steel Plants

5.4.3.2a.1 Blast Furnace Operations

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases containing dust shall be collected at the point of origin, e.g. in the blast furnace pouring bay, at the point of blast furnace burdening, at the point of blast furnace charging, and fed into a waste gas purification facility; notwithstanding, their development may also be prevented during blast furnace tapping by extensive inert gas blanketing, e.g. a nitrogen atmosphere.

BLAST FURNACE TOP GAS

Blast furnace top gas shall be actively recycled; if blast furnace top gas cannot be recycled for safety reasons or in emergencies, it shall be fed into a flare.

REGENERATOR

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen in waste gas of 3 per cent.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

5.4.3.2a.2 Oxygen Steel Works

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases containing dust shall be collected at the point of origin, e.g. at the point of pig iron decanting, deslagging, desulphurisation, converter charging and emptying, crude steel treatment, and fed into a dedusting system; notwithstanding, their development may also be prevented during transfer of liquid pig iron by extensive inert gas blanketing, e.g. a carbon dioxide atmosphere.

Filter dust shall be recycled as far as possible.

CONVERTER GAS

Converter gas shall be actively recycled. If converter gas cannot be recycled for safety reasons or in emergencies, it shall be fed into a flare.

EXISTING FACILITIES

TOTAL DUST

Existing secondary dedusting systems equipped with electrostatic precipitators shall comply with requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

CONVERTER GAS

Converter gas in existing facilities shall be recycled as actively as possible. If converter gas cannot be recycled, it shall be fed into a flare; in this event, the dust content in the flare gas after dedusting shall not exceed a mass concentration of 50 mg/m³.

5.4.3.2b Facilities for Manufacturing or Smelting Pig Iron or Steel including Continuous Casting

5.4.3.2b.1 Electric Steel Works

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. for electric arc furnaces primarily using extraction facilities at the hole in the furnace roof and secondarily using suction or hooding for the process stages of charging, smelting and tapping, and fed into a waste gas purification facility.
Filter dust shall be recycled as far as possible.

TOTAL DUST

Dust emissions in waste gas from steel works with electric arc furnaces shall not exceed a mass concentration of 5 mg/m^3; divergent to 2.7 a) bb), all half-hourly mean values shall not exceed three times this mass concentration.

EXISTING FACILITIES

TOTAL DUST

Dust emissions in waste gas from electric arc furnaces, to be indicated as the daily mean value, shall not exceed a mass concentration of 10 mg/m^3.

5.4.3.2b.2 Electroslag Remelting Plants

FLUORINE AND ITS INORGANIC GASEOUS COMPOUNDS

Emissions of fluorine and its inorganic gaseous compounds in waste gas shall not exceed a mass concentration of 1 mg/m^3, to be indicated as hydrogen fluoride.

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5.4.3.3 Facilities under 3.3:
Facilities for the Production of Non-ferrous Unrefined Metals

5.4.3.3.1 Facilities for the Production of Non-ferrous Unrefined Metals except Aluminium and Ferro-alloys

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. at the point of loading, smelting, refining and casting, and fed into a waste gas purification facility.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 5 mg/m^3.

INORGANIC PARTICLE MATTER

5.2.5 shall apply, provided that emissions of inorganic particle matter in waste gas shall not exceed the following mass concentrations:

a) Class II substances in total a mass concentration of 1 mg/m^3, in lead works a mass concentration of 2 mg/m^3,
b) Class III substances in total a mass concentration of 2 mg/m^3.

SULPHUR OXIDES

5.4.4.1m.2 shall apply accordingly to waste gases with a high content of sulphur dioxide.

MEASUREMENT AND MONITORING OF SULPHUR OXIDES EMISSIONS

For facilities with operating conditions which primarily remain constant with time, the duration of the averaging period shall correspond to the batch duration, but not exceed 24 hours; for continuous measuring, divergent to 2.7 a) bb), all half-hourly mean values shall not exceed three times the mass concentrations established.

FUELS

When liquid or solid fuels are used, the sulphur mass content in the fuel shall not exceed 1 per cent, as related to a lower calorific value of 29.3 MJ/kg for solid fuels, unless an equivalent emission standard for sulphur oxides is achieved by means of a

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waste gas purification facility; when coals are used, only coals which do not cause higher sulphur oxides emissions than hard coal with a sulphur mass content of less than 1 per cent, as related to a lower calorific value of 29.3 MJ/kg, shall be used.

CARCINOGENIC SUBSTANCES

In copper smelters, 5.2.7.1.1 shall apply, provided that emission standards for Class I substances, except arsenic and its compounds, shall apply. Emissions of arsenic and its compounds (except arsine), to be indicated as As, in waste gas shall not exceed the maximum mass flow of 0.4 g/h or the maximum mass concentration of 0.15 mg/m^3; notwithstanding, in waste gas from anode furnaces, these emissions shall not exceed the maximum mass concentration of 0.4 mg/m^3.

DIOXINS AND FURANS

5.2.7.2 shall apply, provided that emissions of dioxins and furans in waste gas do not exceed a mass concentration of 0.1 ng/m^3 if possible, and do exceed a mass concentration of 0.4 ng/m^3.

EXISTING FACILITIES

SULPHUR OXIDES

For existing facilities, emissions of sulphur dioxide and sulphur trioxide in waste gas – except process waste gases fed into facilities pursuant to 5.4.4.1m.2 – shall not exceed a mass concentration of 0.50 g/m^3, to be indicated as sulphur dioxide.

5.4.3.3.2 Facilities for the Production of Ferro-alloys in Electrothermal or Metallothermal Processes

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 5 mg/m^3.

5.4.3.3.3 Facilities for the Production of Aluminium from Ores in Electrolytic Processes with Preburnt Discontinuous Anodes

BUILDING AND OPERATIONAL REQUIREMENTS

Electrolytic furnaces shall be built as enclosed constructions. Opening of the furnaces and the frequency of the anode effect shall be limited to an extent necessary for operational requirements; the mode of operation of the electrolytic furnaces shall be automated as far as possible.

Filter dust shall be recycled as far as possible.

TOTAL DUST

Dust emissions in waste gas

a) of the electrolytic furnaces shall not exceed the mass ratio of
   10 mg/m^3
   and
b) of the electrolytic furnaces including waste gases discharged from the furnace house shall not exceed the mass ratio of
   2 kg per Mg of Al.

FLUORINE AND ITS INORGANIC GASEOUS COMPOUNDS

Emissions of fluorine and its inorganic gaseous compounds, to be indicated as hydrogen fluoride, in waste gas

a) of the electrolytic furnaces shall not exceed the mass ratio of
   1 mg/m^3
   and
b) of the electrolytic furnaces including waste gases discharged from the furnace house shall not exceed the mass ratio of
   0.5 kg per Mg of Al.

5.4.3.3.4 Facilities for the Production of Aluminium from Secondary Raw Materials

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. at the point of loading, smelting, refining, alloying and casting.

Hexachlorethane shall not be used for smelting.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m^3.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide, to be indicated as nitrogen dioxide, in waste gas from rotary drum furnaces operated on oxygen fuel shall not exceed a mass concentration of 0.50 g/m^3.

FUELS

When liquid fuels are used, only liquid fuels that do not cause higher sulphur oxides emissions than heating oils defined in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light heating oil pursuant to the 3. BImSchV, as currently applicable, shall be used.

5.4.3.4 Facilities under 3.4:

Facilities for Melting, Alloying or Refining Non-ferrous Metals

5.4.3.4.1 Facilities for Melting, Alloying or Refining Non-ferrous Metals except Aluminium

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. at the point of loading, smelting, refining, alloying and casting.

Hexachlorethane shall not be used for smelting.

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TOTAL DUST

Dust emissions in waste gas shall not exceed a mass flow of 50 g/h or a mass concentration of 5 mg/m^3.

INORGANIC PARTICLE MATTER

5.2.2 shall apply, provided that emissions of dust particles of Class II substances in waste gas from lead refining facilities shall not exceed a mass concentration of 1 mg/m^3.

FUELS

When liquid fuels are used, only liquid fuels that do not cause higher sulphur oxides emissions than heating oils defined in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light heating oil pursuant to the 3. BImSchV, as currently applicable, shall be used.

DIOXINS AND FURANS

5.2.7.2 shall apply, provided that emissions of dioxins and furans in waste gas from copper shaft furnaces shall not be exceed a mass concentration of 0.1 ng/m^3 if possible, and shall not exceed a mass concentration of 0.4 ng/m^3.

5.4.3.4.2 Smelting Facilities for Aluminium

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. at the point of loading, smelting, refining, alloying and casting.

Hexachlorethane shall not be used for smelting.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m^3.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide, to be indicated as nitrogen dioxide, in waste gas from rotary drum furnaces operated on oxygen fuel burners shall not exceed a mass concentration of 0.50 g/m^3.

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FUELS

When liquid fuels are used, only liquid fuels that do not cause higher sulphur oxides emissions than heating oils defined in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light heating oil pursuant to the 3. BImSchV, as currently applicable, shall be used.

5.4.3.6 Facilities under 3.6: Rolling mills

5.4.3.6.1 Thermal and Thermal Treatment Furnaces

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen in waste gas of 5 per cent.

NITROGEN OXIDES

For heating furnaces, e.g. pusher furnaces and walking beam furnaces, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.50 g/m^3, to be indicated as nitrogen dioxide.

ORGANIC SUBSTANCES

For thermal treatment furnaces for tinfoils, the requirements in 5.2.5 shall not apply to emissions of organic substances. The best available techniques to further reduce emissions of organic substances, particularly with respect to technical features, shall be applied.

5.4.3.7/8 Facilities under 3.7 and 3.8: Foundries

5.4.3.7.1 Iron, Malleable Iron and Steel Foundries

5.4.3.8.1 Foundries for Non-ferrous Metals

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin as far as possible, e.g. in the vicinity of sand reprocessing, moulding, casting, cooling, pouring, core moulding and

cleaning of castings, with the exception of iron, malleable iron and steel foundries with an output of less than 20 Mg cast parts per day and foundries for non-ferrous metals with an output of less than 4 Mg per day for lead and cadmium, or less than 20 Mg per day for other non-ferrous metals; this exemption shall also apply to facilities for smelting non-ferrous metals. Waste gases from the smelting facilities for iron, malleable iron and steel foundries shall be collected irrespective of the output.

In principle, hexachlorethane shall not be used for smelting. Insofar as the use of hexachlorethane is required for smelting in the manufacture of cast products from aluminium alloys with high standards of quality and safety, and for grain refining in the production of the magnesium alloys AZ81, AZ91 and AZ92, the consumption of hexachlorethane shall not exceed 1.5 kg per day. The input of hexachlorethane shall be documented.

CARBON MONOXIDE

Waste gases containing carbon monoxide in cupola furnaces with lower blast furnace gas extraction shall be collected and post-combusted. Carbon monoxide emissions in waste gas shall not exceed 0.15 g/m^3.

SULPHUR OXIDES

Emissions of sulphur dioxide and sulphur monoxide in waste gas shall not exceed a mass concentration of 0.50 g/m^3, to be indicated as sulphur dioxide.

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that amine emissions in waste gas shall not exceed a mass flow of 25 g/h or a mass concentration of 5 mg/m^3. The requirements under 5.2.5 para. 1 shall not apply to total carbon.

BENZENE

5.2.7.1.1 shall apply, provided that benzene emissions in waste gas shall not exceed a mass flow of 5 g/h or a mass concentration of 5 mg/m^3. The best available techniques to further reduce benzene emissions, particularly with respect to technical features, shall be applied, e.g. making changes to the feedstocks for core production and casting, blasting air into shell casting facilities, using waste gases containing benzene as combustion air in cupola furnaces.

EXISTING FACILITIES

TOTAL DUST

Existing facilities equipped with wet type precipitators shall comply with requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

CARBON MONOXIDE

Existing cupola furnaces with lower blast furnace gas extraction shall comply with requirements to restrict carbon monoxide emissions no later than eight years after the entry into force of this Administrative Regulation.

ORGANIC SUBSTANCES

Existing facilities shall comply with requirements to restrict amine emissions no later than eight years after the entry into force of this Administrative Regulation.

5.4.3.9 Facilities under 3.9: Facilities for Applying Metallic Protective Layers

5.4.3.9.1 Facilities for Applying Metallic Protective Layers to Metal Surfaces Using Molten Baths and Fluxing Agents

BUILDING AND OPERATIONAL REQUIREMENTS

In galvanizing facilities, waste gases from the galvanizing kettle shall be collected e.g. using housing or exhaust hoods, and fed into a waste gas purification facility.

TOTAL DUST

Dust emissions in waste gas from the galvanizing kettle shall not exceed a mass concentration of 5 mg/m^3.

The result of an individual measurement shall be established over several dips; the measuring period corresponds to the total of the individual dipping periods and shall normally be half an hour. The dipping period equals the time span between the first and last contact of the object to be galvanized and the galvanizing bath.

INORGANIC CHLORINE COMPOUNDS

Galvanizing facilities shall be constructed and operated so that through sufficient pickling capacities and the observation of the pickling parameters of temperature and acid concentration, emissions of inorganic gaseous chlorine compounds from the pickling bath in waste gas are minimized and a mass concentration of 10 mg/m^3, to be indicated as hydrogen chloride, is not exceeded. The existence of sufficient pickling capacities and the observation of the pickling parameters shall be documented.

If a chlorine concentration in waste gas of 10 mg/m^3 may be exceeded owing to the pickling parameters of temperature and acid concentration, the waste gases shall be collected and fed into a waste gas purification facility. Emissions of gaseous inorganic chlorine compounds in waste gas shall not exceed a mass concentration of 10 mg/m^3, to be indicated as hydrogen chloride.

5.4.3.10 Facilities under 3.10: Facilities for the Surface Treatment of Metals by Pickling or Burning Using Hydrofluoric or Nitric Acid

EXISTING FACILITIES

NITROGEN OXIDES

For existing facilities for the continuous pickling of high-grade steels with mixed caustics containing nitric acid, nitrogen monoxide and nitrogen dioxide emissions, to be indicated as nitrogen dioxide, in waste gas shall not exceed a mass concentration of 0.35 g/m^3 if possible and shall not exceed a mass concentration of 0.70 g/m^3.

5.4.3.21 Facilities under 3.21:
Facilities for the Production of Lead Accumulators

SULPHURIC ACID FUMES

Sulphuric acid fumes occurring during forming shall be collected and fed into a waste gas purification facility; emissions of sulphuric acid in waste gas shall not exceed a mass concentration of 1 mg/m^3.

5.4.4 Chemical Products, Drugs, Refining and Processing of Mineral Oil

5.4.4.1 Facilities under 4.1:
Facilities for Manufacturing of Substances or Groups of Substances Using Chemical Transformation

EXISTING FACILITIES

TOTAL DUST

5.2.1 shall apply, provided that emissions of dust particles in waste gas from existing facilities operating discontinuously or quasi-continuously which do not emit more annually than facilities with a mass flow of 0.20 kg/h when operating continuously shall not exceed a mass concentration of 50 mg/m^3.

5.4.4.1b Facilities for the Production of Oxygenic Hydrocarbons

5.4.4.1b.1 Facilities for Cyclohexane Oxidation

BENZENE

Benzene emissions in waste gas shall not exceed a maximum mass concentration of 3 mg/m^3.

5.4.4.1d Facilities for the Production of Nitrogenous Hydrocarbons

5.4.4.1d.1 Facilities for the Production of Acrylonitrile

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases from the reaction system and the absorber shall be fed into a combustion system. Waste gases resulting from the cleaning of reaction products (distillation) as well as refilling processes shall be fed into a waste gas scrubbing system.

ACRYLONITRILE

Acrylonitrile emissions in waste gas from the combustion facility shall not exceed the maximum mass concentration of 0.2 mg/m^3.

5.4.4.1d.2 Facilities for the Production of Caprolactam

CAPROLACTAM

Caprolactam emissions in waste gas shall not exceed a mass concentration of 0.10 g/m^3.

5.4.4.1h Facilities for the Production of Basic Plastic Materials

5.4.4.1h.1 Facilities for the Production of Polyvinyl Chloride (PVC)

BUILDING AND OPERATIONAL REQUIREMENTS

Dryer waste gas shall be used as combustion air in furnaces if possible.

MONOMERIC RESIDUES

Vinyl chloride (VC) residues contained in the polymer shall be kept as low as possible at transition points between the closed system and treatment or drying within the open system; the following maximum monthly mean values shall not be exceeded:

a)	suspension PVC	80 mg of VC per kg of PVC,
b)	emulsion PVC and microsuspension PVC	0.50 g of VC per kg of PVC.

The best available primary techniques (e.g. multi-stage de-aerating) or other techniques to further reduce vinyl chloride (VC) residues shall be applied.

5.4.4.1h.2 Facilities for the Production of Viscose Products

Hydrogen Sulphide and Carbon Disulphide

In the total waste gas, including the extracted indoor air and air extracted by an auxiliary machine

a) for the manufacture of textile rayons
  - aa) hydrogen sulphide emissions shall not exceed a mass concentration of $50 mg/m^3$
  - bb) and carbon disulphide emissions shall not exceed a mass concentration of $0.15 g/m^3$,

b) for the manufacture of artificial sausage skin and sponge cloth
  - aa) hydrogen sulphide emissions shall not exceed the mass concentration of $50 mg/m^3$
  - bb) and carbon disulphide emissions shall not exceed the mass concentration of $0.40 g/m^3$

2.7 a) bb) shall not apply.

The best available techniques to reduce high emissions of hydrogen sulphide and carbon disulphide shall be applied, particularly encapsulating the machines with waste gas collection and purification.

5.4.4.1h.3 Facilities for the Production of Polyurethane Foams, except Facilities under 5.11

Building and Operational Requirements

Waste gases shall be collected at the point of origin as far as possible.

Organic Substances

The requirements under 5.2.5 shall not apply to facilities for the manufacture of thermally insulating polyurethane foams powered by pure hydrocarbons (e.g. pentane) as fuel gas. .

5.4.4.1h.4 Facilities for the Production of Polyacrylonitrile Fibres

Existing Facilities

Building and Operational Requirements

In existing facilities, dryer waste gas shall be used as combustion air in furnaces if possible.

Acrylonitrile

Acrylonitrile emissions in waste gas from the dryer shall not exceed the maximum mass concentration of $15 mg/m^3$. Acrylonitrilic waste gases caused by reaction boilers, intensive de-aerating, suspension collectors and washing filters shall be subject to waste gas scrubbing or absorption; acrylonitrile emissions in waste gas shall not exceed the maximum mass concentration of $5 mg/m^3$.

In existing facilities, when polymers are spun into fibres, waste gases with an acrylonitrile content of more than $5 mg/m^3$ shall be fed into a waste gas purification facility. Acrylonitrile emissions in waste gas from the washers during wet spinning shall not exceed the maximum mass concentration of $5 mg/m^3$.

The best available primary techniques (e.g. reduction of the monomeric residues) or other techniques to further reduce acrylonitrile emissions shall be applied.

5.4.4.1h.5 Facilities for the Production of Polyethylene Using Polymerisation under High Pressure

Existing Facilities

Organic Substances

In existing facilities emissions of organic substances in waste gas from the granulate de-aerating system shall not exceed a mass concentration of $80 mg/m^3$, to be indicated as total carbon. The requirements under 2.5 for emissions of Class II organic substances and I shall not apply.

5.4.4.1l Facilities for the Production of Gases

5.4.4.1n Facilities for the Production of Bases

5.4.4.1l.1/5.4.4.1n.1 Facilities for the Production of Chlorine or Alkali Lye

BUILDING AND OPERATIONAL REQUIREMENTS

Facilities for the production of chlorine or alkali lye shall not be constructed for the diaphragm process using asbestos or for the amalgam process.

CHLORINE

Chlorine emissions in waste gas shall not exceed a mass concentration of 1 mg/m^3; notwithstanding, in facilities for the production of chlorine with complete liquefaction, chlorine emissions in waste gas shall not exceed a mass concentration of 3 mg/m^3.

EXISTING FACILITIES

MERCURY

In existing facilities for alkali chloride electrolysis using the amalgam process, mercury emissions in the cell hall waste air shall not exceed an annual average mass ratio of 1.0 g per Mg of permitted chlorine produced.

If alkali lye and dithionite or alcoholates are produced simultaneously in one facility, mercury emissions in the cell hall waste air shall not exceed an annual average mass ratio of 1.2 g per Mg of permitted chlorine produced.

The best available techniques to further reduce mercury emissions from alkali chloride electrolysis in the amalgam process shall be applied.

5.4.4.1m Facilities for the Production of Acids

5.4.4.1m.1 Facilities for the Production of Nitric Acid

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.20 g/m^3, to be indicated as nitrogen dioxide.

Dinitrogen oxide emissions in waste gas shall not exceed a mass concentration of 0.80 g/m^3

EXISTING FACILITIES

NITROGEN OXIDES

Existing facilities shall comply with requirements to restrict emissions of nitrogen monoxide, nitrogen dioxide and dinitrogen oxide no later than eight years after the entry into force of this Administrative Regulation.

5.4.4.1m.2 Facilities for the Production of Sulphur Dioxide, Sulphur Trioxide, Sulphuric *Acid and Oleum*

SULPHURIC ACID

The formation of sulphuric acid aerosols shall be restricted as much as possible during handling of sulphuric acid or oleum.

SULPHUR DIOXIDE

a) Waste gas feed

In facilities producing pure sulphur dioxide by liquefaction, the waste gas shall be fed into a sulphuric acid production facility or another treatment facility.

b) Conversion factors

  aa) When the dual-contact process is used, a conversion factor of at least 99.8 per cent shall be maintained or, if a conversion factor of only 99.6 per cent is maintained, sulphur dioxide and sulphur trioxide emissions shall be further reduced by using downstream emission reduction technology, a fifth hurdle or equivalent measures.

  Divergent to these requirements, when the mean volume content of SO_2 is less than 8 per cent, with varying SO_2 feed concentrations and varying volume flows of the feed gas, a conversion factor of at least 99.5 per cent shall be maintained.

  bb) When the contact process without intermediate absorption is used and

    (i) for a volume content of sulphur dioxide in the feed gas of 6 per cent or more, a conversion factor of at least 98.5 per cent, or

    (ii) for a volume content of sulphur dioxide of less than 6 per cent in the feed gas, a conversion factor of at least 97.5 per cent shall be maintained.

Sulphur dioxide and sulphur trioxide emissions in waste gas shall be further reduced in this type of process using downstream emission reduction technology.

cc) When wet catalysis is used, a conversion factor of at least 98 per cent shall be maintained.

SULPHUR TRIOXIDE

Sulphur trioxide emissions in waste gas shall not exceed a mass concentration of 60 mg/m^3.

5.4.4.1o Facilities for the Production of Salts such as Ammonium Chloride, Potassium Chlorate, Potassium Carbonate, Sodium Carbonate, Perborate and Silver Nitrate

5.4.4.1o.1 Facilities for the Production of Sodium Carbonate

EXISTING FACILITIES

AMMONIA

Ammonia emissions in waste gas shall not exceed a mass concentration of 50 mg/m^3.

5.4.4.1p Facilities for the Production of Inorganic Compounds

5.4.4.1p.1 Facilities for the Production of Sulphur

SULPHUR EMISSIONS RATIO

a) In Claus systems with a sulphur production capacity of up to 20 Mg of sulphur per day, a sulphur emissions factor of 3 per cent shall not be exceeded.

b) In Claus systems with a sulphur production capacity of between 20 Mg and 50 Mg of sulphur per day, a sulphur emissions factor of 2 per cent shall not be exceeded.

c) In Claus systems with a sulphur production capacity of over 50 Mg of sulphur per day, a sulphur emissions factor of 0.2 per cent shall not be exceeded.

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SULPHUR OXIDES

The requirements under 5.2.4 shall not apply to emissions of sulphur oxides.

CARBON OXYSULPHIDE AND CARBON DISULPHIDE

Waste gases shall be fed into a post-combustion facility; emissions of carbon oxysulphide (COS) and carbon disulphide (CS_2) in waste gas shall not exceed a total mass concentration of 3 mg/m^3, to be indicated as sulphur.

The first sentence shall not apply to Claus systems for processing natural gas.

HYDROGEN SULPHIDE

In Claus systems for processing natural gas, divergent to 5.2.4, hydrogen sulphide emissions shall not exceed a mass concentration of 10 mg/m^3.

EXISTING FACILITIES

SULPHUR EMISSIONS FACTOR

For existing facilities, the following sulphur emissions factors shall not be exceeded:

a) for Claus systems with a sulphur production capacity of up to 20 Mg of sulphur per day 3 %,

b) for Claus systems with a sulphur production capacity of between 20 Mg and 50 Mg of sulphur per day 2 %,

c) for Claus systems with a sulphur production capacity of over 50 Mg of sulphur per day

   aa) for Claus systems with an integrated MODOP process, 0.6 %,

   bb) for Claus systems with an integrated Sulfreen process, 0.5 %,

   cc) for Claus systems with an integrated Scott process, 0.2 %,

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5.4.4.1q Facilities for the Production of Fertilizers Containing Phosphorous, Nitrogen or Potassium (Single-nutrient or Multi-nutrient Fertilizers) including Ammonium Nitrate and Urea

Existing Facilities

Total Dust

For existing facilities, during prilling, granulation and drying, dust emissions in waste gas shall not exceed a mass concentration of 50 mg/m^3.

Ammonia

For existing facilities, during prilling, ammonia emissions in waste gas shall not exceed a mass concentration of 60 mg/m^3.

For existing facilities, during granulation and drying, ammonia emissions in waste gas shall not exceed a mass concentration of 50 mg/m^3.

5.4.4.1r Facilities for the Production of Basic Materials for Pesticides and of Biocides

Total Dust, including Slowly Degradable, Accumulative and Highly Toxic Organic Substances

Dust emissions in waste gas shall not exceed a maximum mass flow of 5 g/h or a maximum mass concentration of 2 mg/m^3.

5.4.4.2 Facilities under 4.2:

Facilities in which Pesticides or their Active Ingredients are Ground or Mechanically Mixed, Packed or Transferred

Total Dust, including Slowly Degradable, Accumulative and Highly Toxic Organic Substances

Waste gases containing dust shall be collected at the place of origin and fed into a dedusting system. Dust emissions in waste gas shall not exceed a maximum mass flow of 5 g/h or a maximum mass concentration of 5 mg/m^3. Dust emissions with a composition of very toxic substances or preparations of 10 per cent or more shall not exceed a maximum mass concentration in waste gas of 2 mg/m^3.

5.4.4.4 Facilities under 4.4:

Mineral Oil Refineries

Pressure Relief Fittings and Blow-down Systems

Gases and vapours of organic substances such as hydrogen and hydrogen sulphide which escape from pressure relief fittings and blow-down systems shall be fed into a gas collecting system. The collected cases shall be combusted in process furnaces if this is feasible. If this is not possible, the gases shall be fed into a torch.

Waste Gas Feed

Waste gases continually produced by processing systems and waste gases occurring during the regeneration of catalysts, inspections and cleaning operations shall be fed into a post-combustion facility, or equivalent measures to reduce emissions shall be applied.

Start-up and Shut-off Processes

Gases produced during start up or shut off of the facility, shall, as far as possible, be fed back into the process using a gas collecting system or be combusting in process furnaces. If this is not possible, the gases shall be fed into a torch. The torches shall at least meet the requirements for torches for the combustion of gases due to breakdowns and safety valves.

Hydrogen Sulphide

Gases produced by desulphurisation plants or other sources with a hydrogen sulphide content of over 0.4 per cent and a hydrogen sulphide mass flow of over 2 Mg/d shall be further processed. Gases which are not further processed shall be fed into a post-combustion facility. Water containing hydrogen sulphide shall only be conducted in such a way that gaseous emissions into the atmosphere are prevented.

Process Water and Ballast Water

Process water and surplus ballast water shall only be passed into an open system after de-aerating; the gases shall be fed into a waste gas purification facility.

CATALYTIC CRACKING

Dust emissions and sulphur oxides emissions in waste gas from facilities for catalytic cracking in the fluidised bed process shall not exceed the following mass concentrations when the catalyst is regenerated:

a) dust 30 mg/m^3,

b) sulphur dioxide and sulphur trioxide, to be indicated as sulphur dioxide, 1.2 g/m^3.

Technical measures to further reduce sulphur oxides emissions shall be applied.

CALCINATION

Dust emissions in waste gas from calcinating facilities shall not exceed a mass concentration of 30 mg/m^3.

ORGANIC SUBSTANCES

The requirements for organic substances under 5.4.9.2 shall apply accordingly to the storage of combustible fluids.

GASEOUS EMISSIONS

The requirements for gaseous emissions in 5.4.9.2 shall apply accordingly to new and existing facilities during processing, extraction, transfer or storage.

EXISTING FACILITIES

CATALYTIC CRACKING

Dust emissions in waste gas from existing facilities for catalytic cracking in the fluidised bed process shall not exceed a mass concentration of 40 mg/m^3 when the catalyst is regenerated.

CALCINATION

Dust emissions in waste gas from calcinating facilities shall not exceed a mass concentration of 40 mg/m^3.

The requirements under 5.2.4, Class IV, first indent, (sulphur oxides) shall be observed by ten years after the entry into force of this Administrative Regulation at the latest.

5.4.4.6 Facilities under 4.6:
Facilities for the Production of Soot

5.4.4.6.1 Facilities for the Production of Industrial Soot

BUILDING AND OPERATIONAL REQUIREMENTS

Process gases from facilities producing furnace and flame soot shall be fed into a post-combustion facility and be actively recycled.

REFERENCE VALUES

Emission standards for waste gases or the post-combustion of the steam-generating or electricity-generating systems of facilities producing furnace and flame soot shall refer to a volume content of oxygen in waste gas of 3 per cent.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas from facilities producing gas soot shall not exceed a mass concentration of 0.50 g/m^3.

NITROGEN OXIDES

For facilities producing furnace and flame soot, divergent to 5.2.4, emissions of nitrogen monoxide and nitrogen dioxide in waste gas from the post-combustion facility shall not exceed a mass concentration of 0.6 g/m^3, to be indicated as nitrogen dioxide. Measures to further reduce emissions by using improved combustion techniques shall be applied.

SULPHUR OXIDES

For facilities producing furnace and flame soot, emissions of sulphur dioxide and sulphur trioxide in waste gas from the post-combustion facility shall not exceed a mass concentration of 0.85 g/m^3, to be indicated as sulphur dioxide.

ORGANIC SUBSTANCES

For facilities producing gas soot, emissions of organic gaseous substances shall not exceed a mass concentration of 0.10 g/m^3, to be indicated as total carbon.

BENZENE

For facilities producing gas soot, benzene emissions shall not exceed a maximum mass concentration of 5 g/m³.

5.4.4.7 Facilities under 4.7:

Facilities for the Production of Carbon (Woody Lignite) or Electro graphite by Firing or Graphitisation

EXISTING FACILITIES

FIRING

For existing facilities producing malleable carbon, emissions of organic gaseous substances in waste gas from ring furnaces with electrostatic precipitators, dry sorption facilities, or a combination of both waste gas purification facilities, shall not exceed a mass concentration of 0.15 g/m³, to be indicated as total carbon, and benzene emissions shall not exceed the maximum mass concentration of 3 mg/m³.

5.4.4.10 Facilities under 4.10:

Facilities for the Production of Coating Materials (Varnishes, Veneer, Lacquers, Dispersion Dyes) or Printing Inks

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

5.4.5 Surface Treatment with Organic Substances, Production of Strip-type Plastic Materials, Processing Resins and Plastics

5.4.5.1 Facilities under 5.1:

Facilities for Treating the Surfaces of Materials, Objects or Products including Drying Facilities Using Organic Solvents

TOTAL DUST

Dust emissions in waste gas (particles of lacquer) shall not exceed a mass flow of 15 g/h or a mass concentration of 3 mg/m³.

5.4.5.2 Facilities under 5.2:

Facilities for Coating, Impregnating, Laminating, Lacquering or Saturating Objects. Glass or Mineral Fibres or Strip-type or Plate-type Materials, including Drying Facilities with Synthetic Resins

5.4.5.2.1 Facilities for Coating, Impregnating, Laminating, Lacquering or Saturating Glass or Mineral Fibres

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the place of origin, e.g. at the smelting tanks, cupola furnaces, collection chambers, hardening furnaces, sawing and packaging points, and fed into a waste gas purification plant.

AMMONIA

5.2.4 shall apply to impregnating and drying glass wool or rock wool, provided that ammonia emissions in waste gas do not exceed a mass concentration of 65 g/m³. If organic emissions are reduced using a thermal post-combustion facility, ammonia emissions in waste gas shall not exceed a mass concentration of 0.10 g/m³.

5.2.4 shall apply to coating glass fibre or mineral fibre fabric, provided that ammonia emissions in waste gas do not exceed a mass concentration of 80 mg/m³.

Nitrogen Oxides

When a thermal post-combustion facility is used, divergent to 5.2.4, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.35 g/m³, to be indicated as nitrogen dioxide.

Existing Facilities

Total Dust

For existing facilities, except for packaging and hardening furnaces – insofar as waste gases are collected and treated separately, dust emissions in waste gas shall not exceed a mass concentration of 80 mg/m³; moreover, it is to be examined whether, with the use additional waste gas reduction measures, an emission standard of 50 mg/m³ may be requested.

New facilities shall comply with requirements to restrict dust emissions by eight years after the entry into force of this Administrative Regulation at the latest.

Phenol and Formaldehyde

During impregnating and drying of mineral fibres, phenol and formaldehyde emissions in waste gas, to be indicated as sulphur dioxide, shall not exceed a total mass concentration of 30 mg/m³.

5.4.5.4 Facilities under 5.4:

Facilities for Saturating or Covering Materials or Objects with Tar, Tar Oil or Hot Bitumen

Building and Operational Requirements

Facilities shall be constructed and operated so that pollutants cannot penetrate into the soil and groundwater. The entry of water shall be minimized (e.g. using covering or roofing) to prevent the leaching of pollutants or the development of organic emissions through conversion processes.

Organic Substances

Emissions of organic substances in waste gas shall not exceed a mass concentration of 20 mg/m³, to be indicated as total carbon. The requirements under 5.2.5 for emissions of Class I and II organic substances shall not apply.

5.4.5.5 Facilities under 5.5:

Facilities for Insulating Wires Using Wire Enamels Containing Phenol and Cresol

Existing Facilities

Carbon Monoxide

5.2.4 shall apply, provided that emissions of carbon monoxide in waste gas do not exceed a mass concentration of 0.50 g/m³; the best available primary or other techniques to further reduce carbon monoxide emissions shall be applied.

5.4.5.7 Facilities under 5.7:

Facilities for Processing Liquid Unsaturated Polyester Resins with Styrene Additive or Liquid Epoxy Resin with Amines

Organic Substances

5.2.5 shall apply, provided that emissions of organic substances in waste gas shall not exceed a mass concentration of 85 mg/m³, to be indicated as total carbon. The best available primary techniques to further reduce styrene emissions, e.g. by using low-styrene or styrene-free resins, shall be applied.

5.4.5.8 Facilities under 5.8:

Facilities for the Production of Objects Using Aminoplasts or Phenoplasts such as Furan, Urea, Phenol or Xylene Resins by means of Thermal Treatment

Ammonia

Ammonia emissions in waste gas shall not exceed a mass concentration of 50 mg/m³.

5.4.5.11 Facilities under 5.11: Facilities for the Production of Polyurethane Preforms, Prefabricated Parts Using Polyurethane, Box Type Polyurethane Blocks or for Foaming Cavities with Polyurethane

ORGANIC SUBSTANCES

The requirements under 5.2.5 shall not apply to facilities for the production of thermally insulating polyurethane foams powered by pure hydrocarbons (e.g. pentane) as fuel gas.

5.4.6 Timber, Cellulose

5.4.6.1 Facilities under 6.1: Facilities for the Recovery of Cellulose from Timber, Straw or Similar Fibrous Materials

STOCKYARDS

The requirements under 5.2.3.5 and 5.2.3.6 shall not apply to the storage of undressed timber or lumpy timber.

5.4.6.2 Facilities under 6.2: 5.4.4.11.1/5.4.4.1n.1 Facilities for the Production of Paper, Cardboard or Paper Board

BUILDING AND OPERATIONAL REQUIREMENTS

When dust emissions may occur during the filling process, waste gases from containers and silos shall be collected and fed into a dedusting system.

Waste gases from the production of groundwood pulp and from the TMP (Thermo-Mechanical Pulp) facilities shall be collected and fed into a furnace as combustion air if possible.

ORGANIC SUBSTANCES

Emissions of organic substances in waste gas shall be minimized by using low-emission feedstocks, e.g. synthetic resins or elastomeric compounds with low monomeric residue content.

For facilities with directly fired drying aggregates, emissions of organic substances in waste gas shall be minimized, e.g. by optimising combustion in the drying aggregates fired by natural gas with respect to emissions and adapting to changing loads; the requirements under 5.4.1.2.5 with respect to reference values for the volume content of oxygen in waste gas shall not apply.

Start-up and shut-off process shall be optimised with respect to low emissions.

The requirements under 5.2.5 shall not apply to the production of ground wood pulp or TMP facilities.

The best available primary or other techniques to further reduce emissions of organic substances shall be applied, e.g. for TMP facilities using condensation in heat recovery.

ODOUR-INTENSIVE SUBSTANCES

Through good planning and construction, as well as optimisation of process technology and plant management, emissions of odour-intensive substances shall be prevented as far as possible, e.g. from waste paper stock, waste paper treatment, interim storage and transportation of waste from waste paper treatment, process water cycles, the water treatment plant and sludge dewatering. If odour impacts are to be expected in the vicinity of a facility, the best available more extensive techniques to reduce odours shall be used, e.g. enclosure of the facility components, collection of waste gases and feeding them to a waste gas purification facility.

5.4.6.3 Facilities under 6.3: Facilities for the Production of Particle Boards, Wood Fibre Slabs or Wood Fibre Mats

STOCKYARDS

The requirements under 5.2.3.5 and 5.2.3.6 shall not apply to the storage of undressed timber or lumpy timber.

When industrial scrap wood may create dust in a dry state (e.g. milling chips, wood shavings, sawdust), or when the separable fraction of timber with a maximum mesh size of 5 mm during sifting exceeds the value of 5.0 g/kg (as related to the dry mass), operational and technical measures shall be used to ensure that unloading takes place exclusively in closed material delivery stations and the silo works; waste gases shall be collected and fed into a dedusting system.

TOTAL DUST, INCLUDING THE CONTENT OF CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

Dust emissions in waste gas shall not exceed the following maximum mass concentrations:

a)	for grinders	5 mg/m³,
b)	for indirectly fired chip dryers	10 mg/m³ (f),
c)	for other dryers	15 mg/m³ (f).

FUELS

When liquid or solid fuels are used in chip dryers or fibre dryers, the sulphur mass content in the fuel shall not exceed 1 per cent, as related to a lower calorific value of 29.3 MJ/kg for solid fuels, unless an equivalent emission standard for sulphur oxides is achieved by means of a waste gas purification facility; when coals are used, only coals which do not cause higher sulphur oxides emissions than hard coal with a sulphur mass content of less than 1 per cent, as related to a lower calorific value of 29.3 MJ/kg, shall be used.

ORGANIC SUBSTANCES

For dryers, emissions of organic substances in waste gas, to be indicated as total carbon, shall not exceed a mass concentration of 300 mg/m^3 (f). For fibre dryers in air-circulating mode, emissions of Class I organic substances under 5.2.5 shall not exceed a mass concentration defined in 5.2.5 if the mass flow per hour is less than or equal to that which would be reached without circulating air in compliance with a mass concentration defined in 5.2.5.

For presses, emissions of Class I organic substances under 5.2.5 in waste gas shall not exceed a mass concentration of 0.06 kg per cubic metre of slabs produced.

The best available primary techniques to further reduce emissions of organic substances, e.g. by using low-emission binding agents, particularly low-formaldehyde or formaldehyde-free binding agents, or other techniques shall be applied.

5.4.7 Foodstuffs, Luxury Products and Feedingstuffs, Agricultural Products

5.4.7.1 Facilities under 7.1:
Facilities for Farming or Breeding of Livestock

MINIMUM DISTANCE

Facilities shall be constructed at a minimum distance from the nearest residential area, existing or planned, as shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**, taking into consideration the individual animal mass pursuant to Table 10.

The minimum distance may be less if emissions of odorous substances are reduced by means of primary measures, or odorous waste gas is treated in a waste gas purification facility. A possible reduction of the minimum distance by reducing emissions of odorous substances shall be determined using an adequate olfactometric measurement model, and its suitability shall be established by the competent authorities.

The minimum distance for facilities for keeping or breeding species other than those in Table 10, or when they are kept in different conditions, shall be defined on an individual basis.

Figure 1: **Minimum Distance Curve**

(The top curve shows the minimum distance for poultry and the bottom curve shows the minimum distance for pigs.)

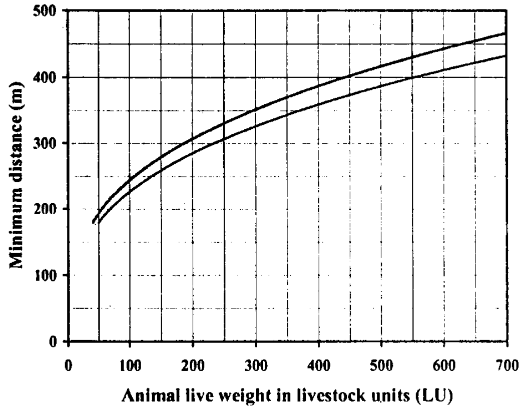

Table 10: **Factors for the Conversion of Stocking Density into Animal Live Weight, to be Indicated as Livestock Units***

(1 livestock unit (LU) = 500 kg of animal live weight)

Species	Mean Individual Animal Mass (LU/Animal)
Pigs	
sows during early pregnancy and barren sows, boars	0.30
sows with piglets up to 10 kg	0.40
raising piglet (up to 25 kg)	0.03
gilts (up to 90 kg)	0.12
fattening pigs (up to 110 kg)	0.13
fattening pigs (up to 120 kg)	0.15

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* For production processes which vary considerably from those listed in this table, the mean individual animal's mass (in LU/animal) may be determined on an individual basis.

Species	Mean Individual Animal Mass (LU/Animal)
Poultry	
laying hens	0.0034
chickens (up to 18 weeks)	0.0014
fryers up to 35 days	0.0015
fryers up to 49 days	0.0024
breeding Peking ducks (up to 3 weeks)	0.0013
fattening Peking ducks (up to 7 weeks)	0.0038
breeding muscovy ducks (up to 3 weeks)	0.0012
fattening muscovy ducks (up to 10 weeks)	0.0050
breeding muscovy ducks (up to 3 weeks)	0.0022
fattening turkeys, hens (up to 16 weeks)	0.0125
fattening turkeys, roosters (up to 21 weeks)	0.0222

When facilities are erected, a minimum distance of 150 m from plants sensitive to nitrogen (e.g. tree nurseries, cultivated plants) and ecosystems (e.g. heath, moor, forests) shall not normally be exceeded.

BUILDING AND OPERATIONAL REQUIREMENTS

The following building and operational requirements shall normally be applied:

a) Highest possible level of cleanliness and dryness in the stall

This includes keeping the feeding racks, areas for droppings, running and lying, the aisles, the installations and the areas around the stall clean and dry. Waste of drinking water shall be avoided by using water-saving technology.

b) The amount of fodder put down shall be measured so that there is little as possible left over; leftovers shall be removed from the stall regularly. Rotten or inedible fodder or leftovers shall not be stored in the open. If odour-intensive feedstuffs (e.g. waste food, whey) are used as fodder, they shall be stored in closed containers or covered.

c) Feeding adapted to the nutritional requirements of the animals shall be ensured.

d) Optimum climate in the stall

For stalls with forced ventilation, DIN 18910 (1992 version) shall be observed.

The type of waste air conduction shall be geared to the conditions of each particular location.

If possible, naturally ventilated stalls shall be aligned with a ridge axis perpendicular to the main wind direction allowing air to flow freely and have additional apertures for ventilation in the gable ends.

e) When a solid manure system is used, sufficient bedding shall be spread to reduce odorous emissions. The bedding must be dry and clean.

Dung yards for storage of solid manure with a dry mass content of less than 25 per cent shall be erected on an impermeable concrete slab pursuant to DIN 1045 (1988 version) or an equally suitable sealing material. The liquid manure accumulated shall be fed into containers with no drainage pipe. In order to reduce wind-induced emissions, the stockyard shall be walled in on three sides and cover as small a surface as possible.

f) In order to reduce odorous emissions from the stall, when liquid manure systems are used, droppings and urine accumulated shall be transferred to the storage site for liquid manure continuously or at short intervals. A stench trap shall be installed between the stall and liquid manure channels and containers outside the stall.

g) Facilities for storing and handling commercial liquid fertilizer shall be erected pursuant to DIN 11622 (1994 version) and DIN 1045 (1988 version).

For interim storage of liquid manure in the stall (in the cellar for liquid manure), the capacity shall be measured so that when under-floor suction is being carried out, the maximum level is 50 cm below the slatted floor; otherwise, 10 cm are sufficient.

When under-floor suction is being carried out, air from the stall shall be sucked out directly under the slatted floor at low speed (maximum 3 m/s).

h) Liquid manure shall be stored (outside the stall) in closed containers, or equivalent emission reduction measures achieving an emissions reduction ratio, as related to the open uncovered container, of at least 80 per cent of emissions of odour-intensive substances and ammonia shall be applied.

Artificial floating scum shall after being disturbed by stirring or to be applied on land shall subsequently be immediately restored to its functional state.

When liquid cattle manure is stored, no additional cover is required if a natural floating roof is formed.

i) The storage capacity of commercial liquid fertilizer to use as fertilizer for own purposes shall be measured so that it is sufficient for at least 6 months, plus a supplement for accumulated precipitation water and cleaning water; the supplement for precipitation water may be waived if a suitable cover ensures that no rainwater penetrates the containers. For commercial liquid fertilizer, which is passed on to third parties for further recycling, correct storage and recycling shall be secured by contract.

The following supplementary requirements shall apply to facilities for keeping or breeding poultry:

j) In cage rearing, drying or ventilation of the dropping belt is obligatory (drying rate at least 60 per cent). Dried poultry droppings shall be stored so that rehumidification (e.g. through rainwater) in the vicinity of the facility shall be excluded.

When the poultry are free-range, the facility and adjacent runs shall be planned and designed so that nutritional depositions in the droppings do not lead to environmental impacts, particularly with respect to soil and water conservation.

The following supplementary requirements shall apply to facilities for breeding fur-bearing animals:

k) Fresh feed for carnivorous fur-bearing animals shall be delivered daily in the summer months and at least three times a week in winter. The feedingstuffs shall be stored in closed thermos containers (storage temperature of the feedingstuff 4 °C or less). If, notwithstanding, a longer storage period or feedingstuffs deliveries at longer intervals are necessary, the feedingstuffs shall be stored sealed and frozen.

l) Sufficient bedding shall be spread under the cages in order to reduce emissions of odour-intensive substances.

m) Manure under the cages shall be removed at least once a week.

n) Storage of excrements is only permissible in closed rooms or containers.

Building and operational requirements shall be weighed up against the requirements of animal husbandry appropriate to the species, if this form of animal husbandry leads to higher emissions.

BACTERIA

The best available techniques to further reduce organic substances emissions of bacteria and endotoxins shall be applied.

5.4.7.2 Facilities under 7.2: Facilities for Slaughtering Animals

MINIMUM DISTANCE

When facilities are erected, there shall be a minimum distance of 350 m to the next residential area, existing or planned, if possible. The minimum distance may be less if emissions of odorous substances are reduced by means of primary measures, or odorous waste gas is treated in a waste gas purification facility. A potential decrease in the minimum distance by reducing emissions of odorous substances shall be determined with the aid of a suitable model for odour dispersion calculations, the suitability of which shall be established by the competent authorities. The minimum distance may also be decreased if the capacity of the abattoir does not exceed 250 h/a; in this case, a special evaluation shall be required.

BUILDING AND OPERATIONAL REQUIREMENTS

The following building and operational requirements shall normally be applied:

a) Unloading shall always be carried out with the site gates closed.
   Livestock housing, slaughter and dressing lines, facilities for processing offal and other by-products shall be accommodated in closed rooms. Open interim storage shall be avoided.
b) Blood leaking from cattle and pigs shall be stored at temperatures of less than 10 °C. Coagulation of blood shall be avoided by regular pumping. The vapour recovery technique shall be applied for emptying the blood tank. The blood tank shall be cleaned regularly.
c) Slaughtering waste and by-products shall be stored in closed containers or rooms. The temperature of offal and other by-products shall be less than 10 °C or they shall always be kept in rooms with a room temperature of less than 5 °C or be removed daily. Decanting for removal to the facility for the disposal of carcasses must be carried out in covered containers.

d) Waste gases from production facilities and installations for processing and storing offal and other by-products shall be collected and fed into a waste gas purification facility, or equivalent emissions reduction measures shall be applied.

The following additional requirements shall apply to slaughter of poultry and other animals of more than 10 Mg live weight per day:

e) As soon as the vehicles have been emptied, straw and droppings from the vehicles shall be stored at the manure dump. The vehicles used shall be cleaned with hydraulic equipment at a washing bay near the manure dump. Boxes shall be cleared out as soon as they have been emptied, and sprayed clean. Equipment shall be provided to spray the pigs with water in the livestock housing.
f) When the blood tank is filled, the displaced air shall be collected and fed to a waste gas purification facility (e.g. activated carbon filter).
g) Incinerators used in pig slaughtering shall be designed so that the retention period of the waste gases in the reaction zone is 1 second if possible, or at least 0.5 seconds. The temperature in the reaction zone shall be between 600 °C and 700 °C. Low-emission operation of the incinerators shall be ensured through careful setting of the gas/air mixture. Furnaces shall only be operated on natural gas.
h) Supplementary to c), the temperature of offal and other by-products shall be less than 10 °C or they shall always be kept in rooms with a room temperature of less than 5 °C or be removed daily. Offal and other by-products shall be transported to the facility for the disposal of carcasses on the day of slaughter, or to another approved facility.

5.4.7.3/4 Facilities under 7.3 and 7.4:

5.4.7.3.1 Facilities for the Production of Edible Fats from Animal Raw Materials or for Melting Animal Fats

5.4.7.4.1 Facilities for the Production of Animal or Vegetable Preservatives of Facilities for the Mass Production of Feedingstuffs by Heating up Animal Ingredients

BUILDING AND OPERATIONAL REQUIREMENTS

The following building and operational requirements shall apply:

a) The dry melting process shall be chiefly used as process engineering in Facilities for the production of edible fats from animal raw materials or for melting animal fats.

b) Unloading shall always be carried out with the warehouse doors closed. Process facilities, including the stockyard, shall be accommodated in closed rooms.

c) Waste gases from the process facilities as well as the stockyard shall be collected; waste gases with odour-intensive substances shall be fed into a waste gas purification facility, or equivalent emissions reduction measures shall be applied.

d) Raw and intermediate products shall be stored in closed containers or rooms at temperatures of less than 10 °C. Open interim storage shall be avoided.

5.4.7.5 Facilities under 7.5:

Facilities for Smoking Meat or Fish Products

BUILDING AND OPERATIONAL REQUIREMENTS

The following building and operational requirements shall be applied:

a) Smoking installations shall be erected and operated so that
   - the release of smoking gas from the smoking chamber shall only be possible if the waste gas purification facility has effectively complied with emission standards,
   - waste occurring shall be stored in closed containers.

Furthermore, the smoking chambers shall not be opened during the smoking process; this shall not apply to cold-smokers or to facilities with low pressure or where fumes cannot escape when the smoking chamber door is opened.

b) Waste gases shall be collected at the point of origin (e.g. smoking chambers) and fed into a waste gas purification facility, or equivalent emissions reduction measures shall be applied.

c) Production waste shall be stored in closed containers at temperatures of less than 10 °C.

d) Fish products shall be stored in closed, ventilated rooms.

5.4.7.8 – 12 Facilities under 7.8 to 7.12:

5.4.7.8.1 Facilities for the Production of Gelatine, Hide Glue, Leather Glue or Bone Glue

5.4.7.9.1 Facilities for the Production of Feedingstuffs or Fertilizers or Technical Fats from the By-products of Slaughtering, Bones, Animal Hair, Feathers, Horns, Claws or Blood

5.4.7.10.1 Facilities for Storing or Processing Untreated Animal Hair

5.4.7.11.1 Facilities for Storing Untreated Bones

5.4.7.12.1 Animal Carcass Disposal Facilities and Facilities in which Animal Carcasses, Parts of Animal Carcasses, or Animal Waste Products are Collected or Stored for Disposal in the Animal Carcass Disposal Facilities

BUILDING AND OPERATIONAL REQUIREMENTS

The following building and operational requirements shall be applied:

a) Unloading shall always be carried out with the site gates closed.
Process facilities, including the storage facility, shall be accommodated in closed rooms.

b) Waste gases from the process facilities as well as the storage facility shall be collected; waste gases with odour-intensive substances shall be fed into a waste gas purification facility or equivalent emissions reduction measures shall be applied.

c) Raw and intermediate products shall be stored in closed containers or rooms and always kept cool. Open interim storage shall be avoided.

d) Contaminated transport containers shall only be stored and cleaned in closed rooms.

5.4.7.15 Facilities under 7.15:
Manure Drying Facilities

Minimum Distance

When facilities are erected, there shall be a minimum distance of 500 m to the next residential area, existing or planned, if possible.

Building and Operational Requirements

Process facilities, including the storage facility, shall be accommodated in closed rooms. Waste gases containing dust shall be collected at the point of origin and fed into a waste gas purification facility.

Bacteria

The best available techniques to further reduce organic substances emissions of bacteria and endotoxins shall be examined.

5.4.7.21 Facilities under 7.21:
Mills for Foodstuffs or Feedingstuffs

Building and Operational Requirements

Waste gases shall be collected at the point of origin, e.g. at the cereal delivery point and fed into a waste gas purification facility.

5.4.7.22 Facilities under 7.22:
Facilities for the Production of Yeast or Starch Flour

5.4.7.22.1 Facilities for the Production of Yeast

Organic Substances

5.2.5 shall apply, provided that emissions of organic substances in waste gas shall not exceed a mass concentration of 80 mg/m³, to be indicated as total carbon. The best available primary and other techniques to further reduce organic substances emissions shall be applied.

5.4.7.23 Facilities under 7.23:
Facilities for the Production of Oils or Fats from Vegetable Products

Building and Operational Requirements

Waste gases shall be collected at the point of origin, e.g. seed silo, seed treatment, toasting, cooling, groats silo, pelletisation, groats loading, and fed into a waste gas purification facility, or equivalent emissions reduction measures shall be applied.

Hydrogen Sulphide

If a biofilter is used to reduce odours, 5.2.4 shall apply, provided that the requirements for hydrogen sulphide emissions do not apply.

Existing Facilities

Total Dust

If emissions of moist dusts occur, e.g. during seed conditioning, seed treatment, in the dryer sections of toasters and coolers, during groats drying and cooling, during pelletisation, existing facilities shall comply with requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

5.4.7.24 Facilities under 7.24:
Facilities for Producing or Refining Sugar

5.4.7.24.1 Beet-pulp Dryers

Building and Operational Requirements

Facilities for drying beet-pulp shall be constructed for indirect drying (steam drying) processes, or equivalent emission reduction measures shall be applied. In the event of a major alteration to the facility in the drying area or the energy centre, it shall be examined whether indirect drying (steam drying) processes may be requested, taking into consideration the principle of proportionality.

Organic Substances

5.2.5 shall apply, provided that emissions of organic substances in waste gas do not exceed a mass flow of 0.65 kg/h, to be indicated as total carbon. The requirements under 5.2.5 for emissions of Class I and II organic substances shall not apply.
The best available primary or other techniques to further reduce emissions of organic substances shall be applied.

Existing Facilities

The following requirements refer to existing facilities using the direct drying process.

Building and Operational Requirements

In order to reduce odour emissions, the drum feed temperature shall not exceed 750 °C.

Reference Values

5.4.1.2.5 shall apply, provided that emission standards relate to the volume content of oxygen in waste gas of 12 per cent.

Total Dust

Dust emissions in waste gas shall not exceed a mass concentration of 60 mg/m³ (f).

Fuels

5.4.1.2.5 shall apply, provided that fuels other than those referred to in b) may also be used.

Sulphur Oxides

When liquid fuels other than heating oil with a mass content of sulphur for light heating oil pursuant to the 3. BImSchV, as currently applicable, are used, emissions of sulphur dioxide and trioxide in waste gas shall not exceed a mass concentration of 0.85 g/m³, to be indicated as sulphur dioxide; 5.1.2.8 shall apply, provided that, irrespective of whether or not a downstream exhaust purification facility is used, the calculation only covers periods when the measured oxygen content is above the reference oxygen content.

Divergent to 6.2.3.3, facilities shall comply with requirements to restrict sulphur oxides emissions no later than eight years after the entry into force of this Administrative Regulation.

Nitrogen Oxides

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.40 g/m³, to be indicated as nitrogen dioxide; 5.1.2 para. 8 shall apply, provided the calculation is only for periods when the measured oxygen content is more than the reference oxygen content, irrespective of whether a downstream waste gas facility is used.

Organic Substances

Emissions of organic substances, to be indicated as total carbon, shall not exceed the total mass ratio of 0.08 kg per Mg of processed beets. This emission standard refers to organic substances, to be indicated as total carbon, which may be collected by means of adsorption of silica gel; if measurement is carried out using a flame ionisation detector, a corresponding conversion shall be made.
The best available primary or other techniques to further reduce emissions of organic substances shall be applied; as far as is technically possible, existing facilities shall switch to indirect drying methods (steam drying). The requirements under 5.2.5 for emissions of Class I and II organic substances shall not apply.
Facilities shall comply with requirements to restrict sulphur oxide emissions no later than eight years after the entry into force of this Administrative Regulation.

5.4.7.25 Facilities under 7.25:
Facilities for Drying Green Fodder

Minimum Distance

Facilities shall be constructed at a minimum distance of 500 m from the nearest residential area, existing or planned. The minimum distance may be less if emissions of odorous substances are reduced using primary measures, or the odorous waste gas is treated in a waste gas purification facility. A possible decrease in the minimum distance by reducing odorous substances may be determined using an appropriate olfactometric measurement model, and its suitability shall be established by the competent authorities.

Building and Operational Requirements

The possibility of constructing facilities using indirect drying techniques in at least one stage of the process shall be examined.

The dryer shall be operated, e.g. by adjusting it to the drying feed temperature, so that the reference value for CO is not exceeded.

Total Dust

Dust emissions in waste gas shall not exceed a mass concentration of 75 mg/m³ (f).

Organic Substances

The requirements under 5.2.5 shall not apply. Specific emissions of organic substances, to be indicated as total carbon, shall not exceed 0.25 kg per Mg of water vapour and of formaldehyde, acetaldehyde, acrolein and furfural, shall not exceed 0.10 kg per Mg of water vapour in total.

Continuous Measuring of Carbon Monoxide

Facilities shall be equipped with a measuring unit that continuously monitors the mass concentration of carbon monoxide emissions.

On the basis of emission measuring, the maximum carbon monoxide concentration in waste gas shall be established so that specific emissions of organic substances and aldehydes in waste gas are not exceeded (reference value for CO).

5.4.7.29/30 Facilities under 7.29 to 7.30:

5.4.7.29.1 Facilities for Roasting and Grinding Coffee or Packaging Ground Coffee

5.4.7.30.1 Facilities for Roasting and Grinding Coffee Substitutes, Grain, Cocoa Beans or Nuts

Building and Operational Requirements

The following building and operational measures shall be applied:

a) Unloading shall only take place when the warehouse doors are closed.
   Processing facilities, including storage, shall be accommodated in closed rooms. Temporary open storage shall be avoided.

b) Waste gases shall be collected at the place of origin, e.g. roasting facilities including cooling air, the vacuum facility, the central aspiration for ground coffee, the silo facility; waste gases with odour-intensive substances shall be fed into a waste gas purification facility, or equivalent measures for reducing emissions shall be applied.
   It shall be endeavoured to recover roasting waste gases in the combustion chamber, insofar as this does not affect safety conditions.

Nitrogen Oxides

5.2.4 shall apply, provided that nitrogen monoxide and nitrogen dioxide emissions in the waste gas, to be indicated as nitrogen dioxide, do not exceed a mass flow of 1.8 kg/h or a mass concentration of 0.35 g/m³ if possible; the best available techniques to further reduce emissions shall be applied.

Existing Facilities

Nitrogen Oxides

Requirements to restrict nitrogen oxides emissions shall not apply to existing facilities with a production capacity of less than 250 kg of roasted coffee per hour.

5.4.8 Facilities for Recycling and Disposing of Waste Products and other Substances

5.4.8.1 Facilities under 8.1:
Facilities for Recycling or Disposing of Solid Wastes, Liquid Wastes or Gaseous Wastes Collected in Containers, or Landfill Gas with Combustible Components, Using Thermal Processes

5.4.8.1a Facilities under 8.1a:
Facilities for Recycling or Disposing of Solid Wastes, Liquid Wastes or Gaseous Wastes Collected in Containers, or Landfill Gas with Combustible Components, Using Thermal Processes or Facilities for the Burn-off of Landfill Gas and Other Combustible Gaseous Substances

5.4.8.1a.1 Facilities for Recycling or Disposing of Landfill Gas with Combustible Components Using Thermal Processes

When landfill gas is used in furnaces, the requirements under 5.4.1.2.3 shall not apply to biogas or sewer gas.

5.4.8.1a.2 Facilities for the Burn-off of Landfill Gas or other Combustible Gaseous Substances

Provisions under 5.4.8.1a.2 shall not apply to burn-off of torch gases due to breakdowns or safety valves; emission-limiting requirements shall be determined on an individual basis.

5.4.8.1a.2.1 Facilities for the Burn-off of Landfill Gas or other Combustible Gaseous Substances from Waste Treatment Facilities

Building and Operational Requirements

If collected landfill gases or other combustible gaseous substances (e.g. sewer gas, biogas) are not to be burned by firing or in systems with internal combustion engines with energy utilization, but instead burnt without energy utilization due to poor gas quality, or due to low quantities of gas or the unavoidable standstill of the energy utilization facility, these gases shall be subject to ground burn-off (isolated high temperature torches or muffle furnaces).

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The waste gas temperature from the flame tip shall measure at least 1,000 °C and the retention period of hot waste gases in the combustion chamber shall be a minimum of 0.3 seconds from the flame tip.

Reference Values

Emission standards shall refer to a volume content of oxygen in the waste gas of 3 per cent.

Mass Flows

The mass flows established in 5.2 shall not apply.

Organic Substances

The requirements under 5.2.5 shall not apply.

Measuring

In order to monitor combustion, facilities shall be equipped with measuring instruments that continuously determine and register the temperature in the combustion chamber; measuring shall be carried out at the end of the retention period.

5.4.8.1a.2.2 Facilities for the Burn-off of Landfill Gas or other Combustible Gaseous Substances that are not Derived from Waste Treatment Facilities

Building and Operational Requirements

Combustible gaseous substances that are not burned in furnaces or internal combustion engines with energy utilization shall instead be burned without energy utilization, either for safety reasons or special operational requirements and shall be fed into a waste gas purification facility with thermal or catalytic post-combustion if possible. If this is not possible (e.g. as a result of discontinuous and irregular quantities of gas occurring only for short periods of time, or if due to the hazardous nature of the gases, a waste gas purification facility cannot be operated efficiently

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without great expense, even using a gas buffer), these combustible gaseous substances shall be subjected to a torch. Halogenated combustible gaseous substances shall not be subjected to these torches.
The minimum temperature of the torch flame shall be 850 °C.

Sulphurous Oxides, Nitrogen Oxides and Carbon Monoxide
The requirements under 5.2.4 shall not apply.

Organic Substances
The requirements under 5.2.5 shall not apply. The minimum emission reduction ratio for organic substances is 99.9 per cent, as related to total carbon, and a mass concentration of 20 mg/m³, as related to total carbon, shall not be exceeded; notwithstanding, the minimum emission reduction ratio for the burn-off of torch gases arising from breakdowns and security valves is 99 per cent (as related to total carbon).

Measuring
In order to monitor the burn-off temperature, facilities shall be equipped with measuring units that shall continuously establish and register the temperature at an appropriate location in the combustion chamber; if this is not possible, appropriate proof of compliance with requirements for burn-off must be provided to the competent authorities.
The observation of reduced emission standards for organic substances shall be demonstrated to the competent authorities; special arrangements shall be drawn up.

5.4.8.1b Facilities under 8.1b: Internal Combustion Engines Using Waste Oil or Landfill Gas

5.4.8.1b.1 Internal Combustion Engines Using Waste Oil or Landfill Gas

When landfill gas is used, the requirements under 5.4.1.4 for biogas and sewer gas shall apply; notwithstanding, emissions of carbon monoxide in waste gas shall not exceed a mass concentration of 0.65 g/m³, and emissions of nitrogen oxides in waste gas shall not exceed a mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide. When landfill gas is used, the best available techniques to further reduce carbon monoxide emissions shall be applied, particularly with respect to engine design.

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5.4.8.2 Facilities under 8.2:

Facilities for the Generating Electricity, Steam, Warm Water, Processing Heat or Heated Waste Gas Using

a) Painted, Lacquered or Coated Wood, as well as all Resultant Remnants, if no Wood Protecting Agents have been Applied, nor Treatments or Coatings not Consisting of Halogenated Organic Compounds,

b) Plywood, Chipboards, Fibreboard or other Glued Wood and all Resultant Scraps, if no Wood Protecting Agents have been Applied, nor Treatments or Coatings not Consisting of Halogenated Organic Compounds,

with a Firing Heat Capacity of less than 50 MW

The requirements under 5.4.1.2.1 for the use of natural wood, including requirements for existing facilities, shall apply with the following exceptions:

Total Dust
Dust emissions in waste gas in facilities with a firing heat capacity of less than 2.5 MW shall not exceed a mass concentration of 50 mg/m³.

Nitrogen Oxides
Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.40 g/m³, to be indicated as nitrogen dioxide.

Existing Facilities

Nitrogen Oxides
In existing facilities, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide.

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5.4.8.4 Facilities under 8.4:

Facilities where Household Substances or Waste Derived from Household Refuse, subject to the Provisions of the Closed Substance Cycle and Waste Management Act, are Sorted and Recovered for the Production Cycle

BUILDING AND OPERATIONAL REQUIREMENTS

Facilities shall be constructed and operated so that for the duration of the treatment process, including delivery and removal, dust emissions shall be prevented as far as possible.

Waste gases shall be collected at the place of origin and fed into a waste gas purification facility.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

5.4.8.5 Facilities under 8.5:

Facilities for the Production of Compost from Organic Waste

MINIMUM DISTANCE

Facilities with an annual throughput of 3 000 Mg or more shall be constructed at a minimum distance

a) for closed facilities (bunkers, compost heaps and maturing facilities) of 300 m,

b) for open facilities (clamp composting) of 500 m

from the nearest residential area, existing or planned. The minimum distance may be less if emissions of odorous substances are reduced using primary measures, or if odorous waste gas is treated in a waste gas purification facility. A possible decrease in the minimum distance through reducing odorous substances may be determined using an appropriate olfactometric measurement model, and its suitability shall be established by the competent authorities.

BUILDING AND OPERATIONAL REQUIREMENTS

The following building and operational requirements shall apply:

a) On the basis of estimated monthly utilization, adequate dimensioning, particularly of storage space, shall be undertaken.

b) Feed bunkers shall be closed and constructed with a vehicle sluice; in open warehouses and during unloading of waste vehicles, the bunker waste gases shall be removed by suction and fed into a waste gas purification facility.

c) Facilities shall be closed during processing as far as possible. This shall apply particularly to facilities with odour-intensive moisture or easily biodegradable biowaste (e.g. kitchen or canteen waste) or facilities processing sludge. Facilities (bunkers, compost heaps) with an annual throughput of 10,000 Mg per year or more shall be kept closed during processing.

d) Condensed water vapours occurring during airing of the silos and accumulated seepage water shall be used in open composting only to moisten the compost, and only if olfactory nuisances may be avoided and the hygienic process is not impaired.

e) In closed facilities or open facilities with an exhaust system, waste gases containing dust shall be collected at the place of origin, e.g. crushing, straining or transfer point.

   Waste gases from reactors and ventilated silos shall be subject to a biofilter or similar waste gas purification facility. The efficiency of biofilters shall be regularly checked in order to guarantee that they comply with purification standards; this may be done by carrying out a compliance audit at least once annually to ensure that the odorous substance concentration of 500 GE/m³ in the waste gas is not exceeded.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

In facilities with an annual throughput of 10,000 Mg or more, emissions of odour-intensive substances in waste gas shall not exceed an odorous substance concentration of 500 GE/m³.

BACTERIA

The best available techniques to further reduce emissions of bacteria and endotoxins shall be examined.

5.4.8.6 Facilities under 8.6: Facilities for the Treatment of Waste Products

5.4.8.6.1 Facilities for the Fermentation of Bio Waste and Facilities Processing Bio Waste in Co-fermentation Facilities

MINIMUM DISTANCE

Facilities with a throughput of 10 Mg of waste per day or more shall be constructed at a minimum distance

a) for closed facilities (bunkers, fermenting and maturing facilities) of 300 m,

b) for open facilities of 500 m

from the nearest residential area, existing or planned. The minimum distance may be less if emissions of odorous substances are reduced using primary measures or the odorous waste gas is treated in a waste gas purification facility. A possible decrease in the minimum distance through reducing odorous substances may be determined using an appropriate olfactometric measurement model, the suitability of which shall be established by the competent authorities.

BUILDING AND OPERATIONAL REQUIREMENTS

The following building and operational requirements shall apply:

a) On the basis of estimated monthly utilization, adequate dimensioning, particularly of the storage space, shall be undertaken.
Facilities shall be constructed and operated so that the entry of sewage water into the soil is prevented.

b) Feed bunkers shall be closed and constructed with a vehicle sluice; in open warehouses and during unloading of waste vehicles, the bunker waste gas shall be removed by suction and fed into a waste gas purification facility.

c) Processing water is to be retained and put to internal use.

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d) The condensed water vapours arising from ventilation of the clamps (maturing process) and the accumulated seepage water shall be used in open composting only to moisten the compost, and only if odour irritations may be avoided.

e) In closed facilities or open facilities with an exhaust system, waste gases containing dust shall be collected at the place of origin, e.g. during, sifting or transfer.

f) Waste gases from the maturing process in ventilated clamps shall be fed into a biofilter or equivalent waste gas purification facility. The efficiency of biofilters shall be regularly checked in order to guarantee that they comply with purification standards; this may be done by carrying out a compliance audit at least once annually to ensure that the odorous substance concentration of 500 GE/m^3 in the waste gas is not exceeded.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m^3.

ODOUR-INTENSIVE SUBSTANCES

For facilities with a daily throughput of 30 Mg or more, emissions of odour-intensive substances in waste gas shall not exceed an odorous substance concentration of 500 GE/m^3.

BACTERIA

The best available techniques to reduce emissions of bacteria and endotoxins shall be examined.

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5.4.8.10/11 Facilities under 8.10 to 8.11: Waste Treatment Facilities

5.4.8.10 Facilities under 8.10:
Facilities for Physical and Chemical Treatment of Waste

5.4.8.11 Facilities under 8.11:
Facilities for other Treatment of Waste Products

5.4.8.10.1 Facilities for Drying Waste Products

Minimum Distance

The facilities shall be constructed at a minimum distance of 300 m from the nearest residential area, existing or planned.

Building and Operational Requirements

The following building and operational requirements shall apply:

a) For dumping sites, feeding and discharge bunkers as well as other installations for delivery, transport and loading of feedstocks, closed rooms with sluice gates shall be constructed, where the air pressure is kept lower than atmospheric pressure by pumping in the sluice area or in the loading and unloading areas. Waste gas shall be fed into a waste gas purification facility.

b) Waste gases shall be collected at the place of origin, e.g. directly at the dryer or at the point of emission from the hood and fed into a waste gas purification plant.

c) Waste gases from facilities for drying waste shall be discharged through stacks in such a way that adequate dilution and undisturbed removal with free air flow occurs; this is normally achieved if the requirements under 5.5.2 para. 1 are observed when determining the stack height.

d) The best available techniques to further reduce organic substances emissions shall be applied, e.g. by minimizing the amount of waste gas and multiple use of the waste gas (if necessary, after reducing the humidity level) as process air for drying, or other best available emission reduction techniques shall be applied.

Total Dust

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

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Ammonia

Ammonia emissions in waste gas shall not exceed a mass flow of 0.10 kg/h or a mass concentration of 20 mg/m³.

Inorganic Gaseous Chlorine Compounds

Emissions of inorganic gaseous chloride compounds under 5.2.4 Class III, to be indicated as hydrogen chloride, shall not exceed a waste gas mass flow of 0.10 kg/h or a mass concentration of 20 mg/m³.

Organic Substances

The minimum emissions reduction ratio for emissions of organic substances in the waste gas is 90 per cent, as related to total carbon; if an emission reduction ratio of 90 per cent is observed, emissions of organic substances in waste gas, to be indicated as total carbon, shall still not exceed a mass concentration of 20 mg/m³.

The requirements under 5.2.5 for emissions of Class I and II organic substances shall not apply.

Odour-intensive Substances

Emissions of odour-intensive substances in waste gas shall not exceed an odour-intensive concentration of 500 GE/m³.

Bacteria

The best available techniques to further reduce emissions of bacteria and endotoxins shall be examined.

5.4.8.10.2 Facilities for Drying Sludge

Building and Operational Requirements

Waste gases shall be collected at the place of origin, e.g. directly at the dryer or at the point of emission from the hood and fed into a waste gas purification facility.

Total Dust

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

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Ammonia

Dust emissions in waste gas shall not exceed the mass flow of 0,10 kg/h or the mass concentration of 20 mg/m³.

Inorganic Gaseous Chlorine Compounds

Emissions of inorganic gaseous chloride compounds under 5.2.4 Class III, to be indicated as hydrogen chloride, shall not exceed a waste gas mass flow 0.10 kg/h or a mass concentration of 20 mg/m³.

Organic Substances

Emissions of organic substances in waste gas shall not exceed a mass concentration of 20 mg/m³, to be indicated as total carbon.

The requirements under 5.2.5 for emissions of Class I and II organic substances shall not apply.

Odour-Intensive Substances

Emissions of odour-intensive substances in waste gas shall not exceed an odour-intensive concentration of 500 GE/m³.

5.4.8.11.1 Purification Plants for the Mechanical Treatment of Mixed Domestic Refuse and Similar Waste Products

Building and Operational Requirements

The following building and operational requirements shall apply:

a) For dumping sites, feeding and discharge bunkers as well as other installations for delivery, transport and loading of the feedstocks, closed rooms with sluice gates shall be constructed, where the air pressure is kept lower than atmospheric pressure by pumping in the sluice area or in the loading and unloading areas. Waste gas shall be fed into a waste gas purification facility.

b) Machines, appliances and other installations necessary for mechanical treatment or physical separation of feedstock or accumulated waste products (e.g. by communition, grading, sorting, mixing, homogenizing, dehydrating, drying, polarization, pressing) shall be accommodated in closed rooms. The waste gas flow in these facilities shall be collected and fed into a waste gas purification facility.

c) Waste gases from facilities for the mechanical treatment of waste products shall be discharged through stacks so that adequate dilution and unhindered transmission with the free air flow may occur; this is normally achieved if the requirements under 5.5.2 para. 1 are observed when determining the stack height.

d) The best available techniques to further reduce organic substances emissions shall be applied, e.g. by direct access to relevant emission sources, separate treatment of heavily polluted exhaust air flows.

Total Dust

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

Inorganic Gaseous Chlorine Compounds

Emissions of inorganic gaseous chloride compounds under 5.2.4 Class III, to be indicated as hydrogen chloride, shall not exceed a waste gas mass flow 0.10 kg/h or a mass concentration of 20 mg/m³.

Organic Substances

Emissions of organic substances in waste gas shall not exceed a mass concentration of 20 mg/m³, to be indicated as total carbon.

The requirements under 5.2.5 for emissions of Class I and II organic substances shall not apply.

Odour-Intensive Substances

Emissions of odour-intensive substances in waste gas shall not exceed an odour-intensive concentration of 500 GE/m³.

5.4.8.11.2 Facilities for the Treatment of Waste Products

BUILDING AND OPERATIONAL REQUIREMENTS

Facilities shall be constructed and operated so that for the duration of the treatment process, including delivery and removal, dust emissions are prevented as far as possible.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

ORGANIC SUBSTANCES

Emissions of organic substances in waste gas shall not exceed a mass concentration of 20 mg/m³, to be indicated as total carbon.

The requirements under 5.2.5 for emissions of Class I and II organic substances shall not apply to facilities treating waste not requiring special monitoring.

5.4.8.10.3/5.4.8.11.3 Facilities for the Disposal of Cooling Units or Facilities Containing Chlorofluorocarbons (CFCs)

BUILDING AND OPERATIONAL REQUIREMENTS

The following building and operational measures shall be applied to facilities where cooling appliances or installations containing CFCs shall be disposed of, pursuant to Annex I of Regulation (EC) No. 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer (OJ L 244/1 of 29 September 2000):

a) Facilities shall be constructed and operated so that entry of sewage water into the soil is prevented as far as possible.

b) Appliances or installations with coolants containing CFCs or ammonia shall be treated so that coolants and refrigerator lubricant can be removed from the cooling circuit without any loss and completely removed from the closed system and recovered (drainage). CFCs shall be entirely removed from refrigerator lubricant. All the coolants shall be collected and properly disposed of.

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c) When appliances and installations are treated with other coolants, e.g. hydrocarbons such as butane, pentane or carbon-foamed insulation material, e.g. inert gas blanketing of the pulverization level.

d) The reliability of the drying process shall be tested by a competent agency approved by the *Land* authority; coolants containing CFCs shall be removed and collected from a minimum of 100 appliances with intact cooling systems. The sum of collected CFC coolant amounts shall be less than 90 wt. % of the sum of the amount of CFC coolants as to be indicated on the identification plates of the appliances and installations. The quantity of CFCs in the de-aerated refrigerator lubricants shall not exceed 2 g of the total halogen/kg.

e) When CFCs are released from insulation materials, CFC emissions shall be prevented as far as possible, e.g. by taking the following measures:
  - The drained appliances or units shall be encapsulated during treatment, which insures against CFC loss e.g. via sluice systems upon entry or removal.
  - The transfer points for insulation material fractions containing CFCs shall be technically impermeable to gas emission.
  - Waste gases containing CFCs shall be collected at the point of origin, (e.g. during pressing of the insulation material) and fed into a waste gas purification facility which shall properly dispose of the recovered CFCs.

f) By carrying out appropriate monitoring measures, e.g. smoke candles, the appliances or facilities shall be regularly checked to ensure there are no leaks: the result shall be documented. Annual checks to establish whether appliances are leakproof and on internal monitoring documentation proving shall be conducted by an officially recognized state authority.

g) In areas of the facility releasing CFCs from insulation material, the isolation material substances adhering to the mature fractions (such as metals and plastics) shall be avoided as far as is technically possible; these substances adhering to mature metal and plastic fractions shall not exceed 0.5 wt. %.
The CFCs content of insulation material fractions for material processing shall not exceed 0.2 wt. %. Insulation material fractions with a higher CFCs content shall be subjected to a thermal waste treatment facility (combustion facility for waste) or to another waste treatment facility with an equivalent break-down

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efficiency for CFCs; in the latter case, proof of the equivalent break-down efficiency shall be demonstrated to the competent authority.

Chlorofluorocarbons

CFC emissions in the waste gas from recovered CFCs shall not exceed a mass flow of 10 g/h and a mass concentration of 20 mg/m3; the best available techniques to further reduce emissions shall be applied.

Continuous Measuring

The mass concentration of CFC emissions in waste gas shall be continuously determined, or it shall be proven by other continuous tests on the efficiency of the waste gas purification facility that the established emission limit is not exceeded.

Existing Facilities

Fluorochlorohydrocarbons

For existing facilities, CFC emissions in the waste gas from recovered CFC shall not exceed a mass flow of 25 g/h and a mass concentration of 50 mg/m^3; the best available techniques to further reduce organic substances emissions shall be applied.

5.4.8.12 – 14 Facilities under 8.12 to 8.14: Waste Storage Plants

5.4.8.12.1 Facilities for the Temporary Storage of Waste Products, to which the Provisions of the Closed Substance Cycle and Waste Management Act shall Apply

5.4.8.13.1 Facilities for the Temporary Storage of Sludge

5.4.8.14.1 Facilities for the Storage of Waste Products, to which the Provisions of the Closed Substance Cycle and Waste Management Act Apply and, in these Facilities, Waste that is Stored for a Period of more than one Year before it is Disposed of or Recycled

Building and Operational Requirements

Facilities shall be constructed and operated so that pollutants cannot penetrate into the soil and groundwater. The entry of water shall be minimized (e.g. using covering or roofing) to prevent the leaching of pollutants or the development of organic emissions through conversion processes.

5.4.9 Storage, Loading and Unloading of Materials and Preparations

5.4.9.2 Facilities under 9.2:
Facilities for Storing Combustible Fluids

Organic Substances

For products containing mineral oil with a steam pressure of less than 1.3 kPa at 293.15 K, the mass flow of 3 kg/h applies to organic substances under 5.2.5, first sentence, the mass flow 3kg/h and to continuous measuring pursuant to 5.3.3.2, para. 6, second indent. The requirements under 5.2.5 for Class I organic substances shall not apply to gas oils identified as R 40 and to diesel fuel pursuant to DIN 590 (February 2000 version), heating oils pursuant to DIN 51603 Part 1 (March 1998 version) and homogeneous products.

Gaseous Emissions

Insofar as safety conditions are not affected and combustible liquids do not demonstrate the characteristics defined in 5.2.6 b) to d) or a boiling point of 150 °C or less, divergent to 5.2.6.3, technically tight soft seals pursuant to Guideline VDI 2440 (November 2000 version) cannot be used for flanges with a gasket up to a maximum nominal pressure of 2.5 MPa.

Existing Facilities

Gaseous Emissions

Existing facilities in which gas oils identified as R 40 and as well as diesel fuel pursuant to DIN EN 590 (February 2002 version), heating oils pursuant to DIN 51063 Part 1 (March 1998 version) or similar products are extracted, decanted or stored, which do not comply with the requirements under 5.2.6.1, 5.2.6.3 or 5.2.6.4, may continue operating until they have been replaced by new sealing systems or aggregates. After this Administrative Regulation enters into force, the competent authority shall demand inventory for pumps and shutoff devices and follow up on the continuous replacement of sealing units or aggregates as well as the completion of maintenance work until their replacement within the framework of plant supervision.

5.2.6.7, first sentence, shall apply to existing facilities storing combustible fluids pursuant to 5.2.6 a), which do not fulfil any of the specifications referred to in b) to d), provided that the fluid organic products may be stored in floating roof tanks with an efficient flange gasket or in stationary roof tanks with an inner floating roof if emission reduction of at least 97 per cent is achieved for fixed roof tanks without an inner floating roof. This shall apply accordingly to the storage of products containing mineral oil, with a benzene content of less than 1 per cent.

Facilities

a) in which combustible fluids fulfilling one of the specifications under 5.2.6 a) to d) are extracted or decanted,

b) in which combustible fluids fulfilling one of the specifications under 5.2.6 a) to d) are extracted or decanted,

shall comply with requirements under 5.2.6. no later than twelve years after the entry into force of this Administrative Regulation.

5.4.9.36 Facilities under 9.36: Facilities for the Storage of Liquid Manure which are Operated Irrespective of 7.1

MINIMUM DISTANCE

Facilities shall be constructed a minimum distance of 300 m from the nearest residential area, existing or planned. The minimum distance may be less if emissions of odorous substances are reduced by means of primary measures, or odorous waste gas is treated in a waste gas purification facility. A possible decrease in the minimum distance by reducing emissions of odorous substances shall be determined with the aid of a suitable model for olfactometric measuring, the suitability of which is to be established by the competent specialist authorities.

BUILDING AND OPERATIONAL REQUIREMENTS

The following building and operational requirements shall apply:

a) Facilities for storing and handling commercial liquid fertilizer shall be erected pursuant to DIN 11622 (1994 version) and DIN 1045 (1988 version).

b) Liquid manure shall be stored (outside the stall) in closed containers, or equivalent emission reduction measures achieving an emissions reduction ratio, as related to the open uncovered container, of at least 80 per cent of emissions of odour-intensive substances and ammonia shall be applied.

After being disturbed by stirring or for application on land, artificial floating scum shall subsequently be immediately restored to its functional state.

c) For commercial liquid fertilizer, which is passed on to third parties for further recycling, proof correct storage and recycling commercial liquid fertilizer shall be furnished.

5.4.10 Other

5.4.10.7 Facilities under 10.7: Facilities for the Vulcanisation of Natural and Synthetic Rubber

BUILDING AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the place of origin and fed into a waste gas purification plant.

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that emissions of organic substances in waste gas do not exceed a mass concentration of 80 mg/m^3, to be indicated as total carbon.

5.4.10.8 Facilities under 10.8: Facilities for the Production of Building Protective Agents, Cleaning Agents or Wood Preservatives and Facilities for the Production of Adhesives

TOTAL DUST

When building protective agents, cleaning agents or wood preservatives are produced, dust emissions in waste gas shall not exceed a mass concentration of 5 mg/m^3.

When adhesives are produced, dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m^3.

5.4.10.15 Facilities under 10.15: Test Benches

5.4.10.15.1 Test Benches for or with Combustion Engines

Total Dust, including the Content of Carcinogenic, Mutagenic or Reproduction Toxic Substances

For test benches for or with mass-manufactured engines with a firing capacity of less than 2 MW of the individual aggregate operated on diesel fuel, not exceeding the permissible mass content of sulphur pursuant to the 3. BImSchV, as currently applicable, waste gases shall be subject to a soot filter or emissions shall be reduced using an equivalent method.

For test benches for or with other engines operated on diesel fuel, which does not exceed the permissible mass content of sulphur pursuant to the 3. BImSchV, as currently applicable, special regulations to reduce dust emissions shall be established. The best available techniques to further reduce dust emissions, particularly with respect to engine design, shall be applied.

If engines operating in compliance with regulations are operated on residual oils or comparable propellants, special regulations to reduce dust emissions and sulphur dioxide emissions shall be established. The best available techniques to further reduce dust emissions, particularly with respect to engine design, shall be applied.

Nitrogen Oxides

5.2.4 shall not apply. The best available techniques to further reduce emissions, particularly with respect to engine design shall be applied to test benches with compression ignition engines operated on liquid fuels.

Organic Substances

5.2.5 shall not apply. The best available techniques to further reduce emissions of organic substances, particularly with respect to engine design, shall be applied.

5.4.10.20 Facilities under 10.20: Facilities for Cleaning Tools, Appliances or other Metal Objects Using Thermal Processes

Reference Values

Emission standards shall refer to a volume content of oxygen in waste gas of 11 per cent, with the exception of catalytic post-combustion facilities.

Organic Substances

5.2.7.1.1 shall apply, provided that emissions of organic substances in waste gas do not exceed a mass flow of 0.10 kg/h or a mass concentration of 20 mg/m^3, to be indicated as total carbon. The requirements in 5.2.5 for emissions of Class I and II organic substances shall not apply.

5.4.10.21 Facilities under 10.21: Facilities for Internal Cleaning of Railway Tank Wagons, Street Tank Vehicles, Tank Ships or Tank Containers and Facilities for Automated Cleaning of Barrels if Containers of Organic Substances are Cleaned

5.4.10.21.1 Facilities for Internal Cleaning of Railway Tank Wagons, Street Tank Vehicles, Tank Ships or Tank Containers

Building and Operational Requirements

Facilities shall be constructed and operated with waste gas collection and purification, waste water collection and treatment and sufficient storage areas for waste products. A suitable existing treatment facility may also be used for the treatment of waste water.

Operating instructions for the stages of treatment, e.g. removal of residues, de-aerating, purification, waste gas collection and purification, waste product collection and classification shall be laid down with reference to the groups of substances. The stages of treatment shall be executed so that emissions are minimized. In order to reduce the development of emissions, substances demonstrating a steam pressure of 10 Pa or more at a temperature of 293.15 K shall be rinsed with a cold detergent

solution before washing. Direct treatment of volatile substances with steam or hot water is not permissible.

ORGANIC SUBSTANCES

Emissions of organic substances in waste gas, to be indicated as total carbon, shall not exceed a mass flow of 0.10 kg/h or a mass concentration of 20 mg/m^3. The requirements under 5.2.5 for emissions of Class I and II organic substances shall not apply.

CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

Emissions of organic substances under 5.2.7.1 shall not exceed a maximum total mass flow of 2.5 kg/h or a maximum total mass concentration of 5 mg/m^3.

5.4.10.21.2 Facilities for Automated Cleaning of Barrels or Comparable Containers (e.g. Tank Pallets) including Reprocessing Facilities

BUILDING AND OPERATIONAL REQUIREMENTS

The washing area shall be contained. Waste gases emitted during opening of containers, removal of residues, scrapping (e.g. pressing), non-recyclable barrels or during transport of open uncleaned barrels and containers shall be collected. Storage containers for residues remaining after containers have been emptied, recycling of wash water, waste water treatment and associated storage containers shall be designed as closed systems as far as possible and operated as such.

Prior to the washing process, containers shall be emptied as much as possible (removal of residues).

While operating the keg or container cleaning facilities, it should be noted that kegs or containers that have been contaminated with substances under 5.2.2 Class I or substances under 5.2.7.1 shall be discarded and exchanged for kegs or containers contaminated with less dangerous substances. Operating instructions to this effect shall be drawn up and an operator's log maintained.

CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

For facilities where kegs or containers contaminated with substances under 5.2.5 Class I or substances under 5.2.7.1 are cleaned emissions of organic substances under

5.2.5 in waste gas, to be indicated as total carbon, shall not exceed a total mass flow of 0.10 kg/h or a total mass concentration of 20 mg/m^3. Further requirements shall be determined on an individual basis for facilities for cleaning mainly kegs or containers which have been contaminated with organic substances under 5.2.7.1.

For facilities where kegs or containers not contaminated with organic substances under 5.2.5 Class I or substances under 5.2.7.1 are cleaned, emissions of organic substances under 5.2.5 in waste gas shall not exceed a total mass flow of 0.10 kg/h or a total mass concentration of 20 mg/m^3, to be indicated as total carbon, if possible.

The requirements in 5.2.5 for emissions of Class I and II organic substances shall not apply.

5.4.10.23 Facilities under 10.23: Facilities for Textile Finishing

5.4.10.23.1 Facilities for Textile Finishing by Means of Thermofixing, Thermoinsulating, Coating, Impregnating or Dressing, including Associated Drying Facilities

Insofar as facilities must meet the requirements of to restrict emissions of volatile organic compounds pursuant to the Ordinance on the Curbing of Emissions of Volatile Organic Compounds when using Organic Solvents (31. BImSchV) of 21 August 2001 (BGBl. I, p 2180), as currently applicable, the following requirements for organic substances shall specify and supplement the provisions of Annex IV C No 5 of this Ordinance.

BUILDING AND OPERATIONAL REQUIREMENTS

The content of emissions-relevant substances in or on the goods to be finished (e.g. monomeric residues, preparations such as spinning oils, softeners, slashing products) shall be reduced as far as possible. One or several of the following measures shall be implemented in particular:

a) use of thermostable preparations
b) reduction of the order quantity,
c) preliminary treatment of the goods to be finished e.g. pre-washing,
d) optimisation of pretreatment (e.g. increasing washing efficiency).

REFERENCE VALUES

The mass concentrations shall refer to an air-goods-ratio of 20 m^3/kg; the air-goods-ratio is the quotient of total waste gas volume flow (in m^3/h) of a thermal treatment aggregate during a process (finishing stage) and the throughput of the textiles to be finished (in kg/h). Multiplying the permissible mass concentration of established substances by the reference air-goods ratio of 20 m^3/kg gives the permissible specific emissions factor (masses of emitted substances (in g) per masses of textiles to finish (in kg)).

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that

a) emissions of organic substances in waste gas, to be indicated as total carbon, do not exceed a mass flow of 0.80 kg/h or a mass concentration of 40 mg/m^3;

b) an additional mass concentration of no more than 20 mg/m^3, to be indicated as total carbon, is emitted from carry-overs and residues of preparations;

c) if, for processing reasons, one or more of the finishing stages recorded in 10.23 of the Annex of the 4. BImSchV is carried out at in the same treatment aggregate and at the same time as a finishing stage not recorded there, the process shall be optimised so that a total mass concentration of 40 mg/m^3 for emissions of organic substances in the waste gas, to be indicated as total carbon, shall not be exceeded if possible. If facilities subject to the requirements of the 31. BImSchV, as currently applicable, coat and print simultaneously, emissions of organic substances in waste gas shall, pursuant to this Ordinance, not exceed a mass concentration of 40 mg/m^3, to be indicated as total carbon.

If the requirements under a) to c) are fulfilled, total emissions of organic substances in waste gas shall still not exceed a total mass concentration of 80 mg/m^3, to be indicated as total carbon; if facilities subject to the requirements of the 31. BImSchV, as currently applicable, coat and print simultaneously, – divergent to the first part of the sentence and pursuant to this Ordinance – emissions of organic substances in waste gas shall not exceed a mass concentration of 60 mg/m^3, to be indicated as total carbon.

The requirements for emissions of Class I and II organic substances shall not apply.

In exceptional cases, e.g. for coatings and technical textiles, these regulations may be waived; in such case 5.2.5 shall apply unamended.

CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

Supplementary to 5.2.7.1, substances and preparations defined in 5.2.7.1 shall immediately be replaced by less harmful substances and preparations.

MEASURING

In order to determine the operating conditions (recipes), which lead to the highest emissions, emission calculations may be made on the basis of substance emission factors insofar as these substance emission factors are established using a scientifically acknowledged method.

Divergent to 5.3.2.2 para. 2, second sentence, up to three individual measurements may be substituted by calculating emissions on the basis of substance emission factors, insofar as, within the framework of initial and repeated emission measuring, substance emission factors for at least three prescription components are technically established by a measurement office recognized pursuant to Article 26.

EVALUATION OF MEASUREMENTS

The actual air-goods-relation shall be determined and documented.

Emission standards shall also be considered to be observed with if specific emission factors established by the air-goods ratio determined and the mass concentrations measured do not exceed the permissible specific emission factors.

EXISTING FACILITIES

ORGANIC SUBSTANCES

A supplementary stipulation shall apply to existing facilities stating that for directly fired treatment aggregates, emissions of organic substances resulting from combustion up to a maximum mass concentration of 20 mg/m³, to be indicated as total carbon, shall be disregarded; the best available techniques to further reduce emissions, particularly with respect to improved combustion, e.g. optimising combustion, carrying out maintenance at least once annually, shall be applied. Insofar as the operator can prove, e.g. with an expert appraisal by the manufacturer of the burner or the stenter frame, that emissions of organic substances from combustion cannot comply with a maximum mass concentration of 20 mg/m³, to be indicated as total carbon and these emissions cannot be further reduced by primary measures, the emission limit shall be determined on an individual basis.

5.5 Waste Gas Disposal

5.5.1 General

Waste gases shall be disposed of in a way by which to facilitate smooth removal together with the free flow of air. As a rule, they shall be disposed of through stacks the height of which shall be determined pursuant to 5.5.2 to 5.5.4, notwithstanding any other information.

5.5.2 Disposal through Stacks

Stacks shall have a minimum height of 10 m above ground level and project 3 m, as a minimum, above the ridge of the roof. In case of a roof with a slope of less than 20°, the height of the ridge shall be calculated on the grounds of a 20° sloop; notwithstanding this, the height of stacks shall not exceed twice the height of the building.

In case of several stacks of approximately equal height with similar emissions, it shall be checked in how far these emissions are to be combined in determining the height of the stacks. This shall apply in particular if the horizontal distance between stacks does not exceed 1.4 times the height of the stacks and insofar as different stack heights are required in order to avoid a superimposition of waste gas plumes.

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If the total load indicator to be determined (4.7) by applying the measuring and evaluation procedure (4.6) exceeds the immission value for a calendar year (4.2 to 4.5), emission reduction shall first be attempted. Where this is not possible, the height of the stacks shall be increased to an extent by which to ensure that the immission value for a calendar year cannot be exceeded.

The height of stacks pursuant to 5.5.3 shall, notwithstanding any other provisions, not exceed 250 m; with stacks higher than 200 m, further measures to reduce emissions shall be applied.

Para. 1 shall neither be applied to facilities other than furnaces with low emission mass flows nor in cases in which waste gases are emitted only over few hours of a year for safety reasons; in these cases, the requirements pursuant to VDI Guideline 3781 Part 4 (November 1980 version) or pursuant to VDI Guideline 2280 Section 3 (August 1977 version) shall be applied *mutatis mutandis* in order to ensure sufficient thinning and smooth removal of waste gases together with the free flow of air.

5.5.3 Stack Height Determination Nomogram

The height of stacks shall be determined pursuant to Figure 2.

Explanation:

H' in m	stack height as in nomogram;
d in m	inside diameter of the stack o equivalent inside diameter of cross section;
t in °C	temperature of waste gas at stack mouth;
R in m³/h	volume flow of waste gas under standard conditions after subtraction of the humidity content of steam;
Q in kg/h	emission mass flow of the air pollutant emitted from the emission source; as to fibres, the quantity of fibres emitted per time unit shall be converted into a mass flow;

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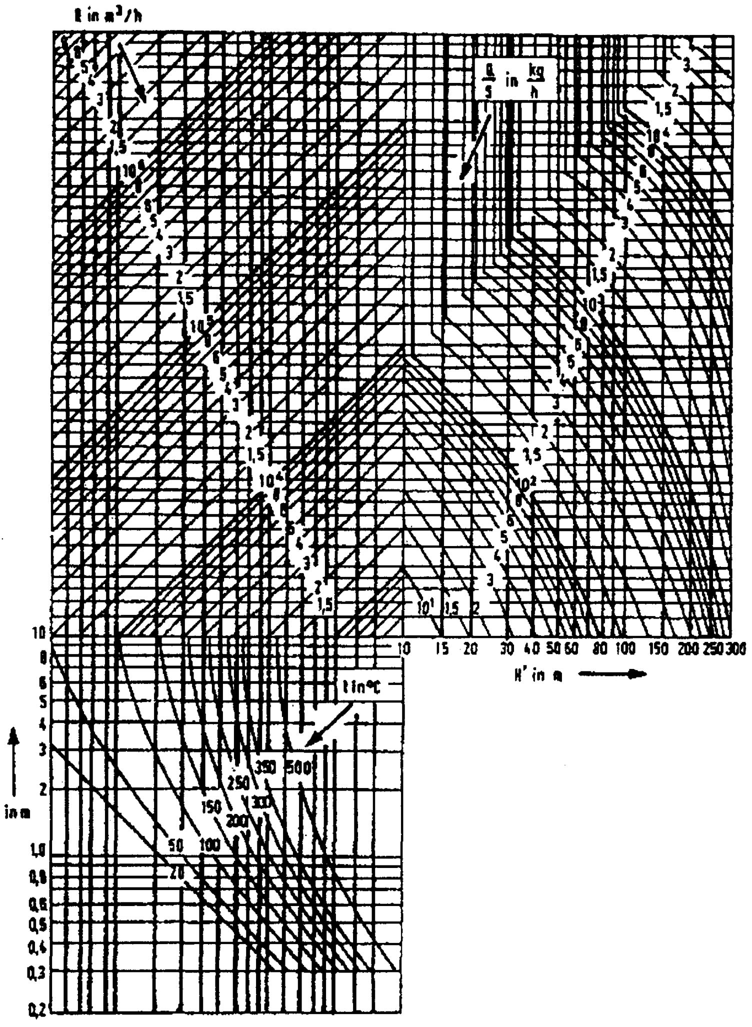
S stack height determination factor; as a rule, S shall be defined by the values specified in Annex 7.

As regards t, R and Q, they shall be defined by the values measured during due operation under conditions most unfavourable for clean air maintenance, especially as far as the use of fuels and raw materials is concerned. As regards nitrogen monoxide emissions, a transformation degree of 60 per cent for the transformation into nitrogen dioxide shall be taken as a basis; this implies that the emission mass flow of nitrogen monoxide shall be multiplied by factor 0.92 and used as the emission mass flow of nitrogen dioxide to be indicated as Q in the nomogram.

The competent ruling authority of the respective *Land* may prescribe lower values in areas subject to investigation pursuant to § 44 para. (3) of the Federal Immissions Control Act and in cases pursuant to 4.8. Such values shall not be lower than 75 per cent of the S values specified in Annex 7.

Figure 2: Stack Height Determination Nomogram



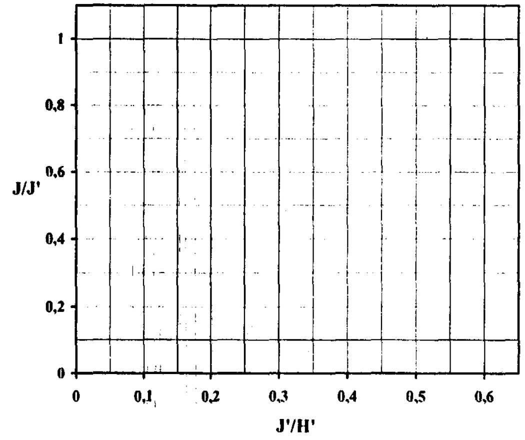
5.5.4 Stack Height Determination while Taking into Account Developed Areas and the Vegetation and in Uneven Terrain

In those cases in which a compact or existing development area or a development permissible in compliance with a development plan or the compact vegetative cover makes up for more than 5 per cent of the surface of the evaluation area, the H' stack height determined pursuant to 5.5.3 shall be increased by the additional amount designated as J. The J value in m shall be determined on the grounds of Figure 3.

Explanation:

H in m	building height of stack (H = H' + J);
J' in m	average height of the compact existing built-up area or of the built-up area cover permissible in compliance with a development plan or of the vegetative cover above ground level

Figure 3: **Chart for the Determination of J Values**



When determining the height of the stacks, unevenness of terrains shall be taken into account if the facility is located in a valley or if emission dispersion is blocked by elevations prevailing in the respective terrain. In cases in which the prerequisites to apply VDI Guideline 3781 Part 2 (August 1981 version) are met, the height of the stacks determined pursuant to 5.5.3 and 5.5.4 para. 1 shall be adapted accordingly.

5.5.5 Existing Facilities

The requirements under 5.5.2 to 5.5.4 shall not apply to existing facilities which meet the requirements of the Technical Instructions on Air Quality Control (*TA Luft*) of 27 February 1986 (GMBl. p. 95).

6 Subsequent Orders

Insofar as existing facilities do not meet the requirements under 4 and 5, the competent authorities shall issue the necessary orders through which to fulfil the obligations arising from § 5 para. (1) nos. 1 and 2 of the Federal Immissions Control Act while taking into consideration the following provisions. The periods within which to meet the requirements under 5.4 and 6 shall commence as of the effective date of this Administrative Regulation.

6.1 Subsequent Orders for the Protection against Harmful Environmental Effects

6.1.1 Discretion Restriction

Pursuant to the second sentence of § 17 para. (1) of the Federal Immissions Control Act, subsequent orders shall be issued if the protection of the general public or the neighbourhood against harmful effects on the environment or any other hazards, significant disadvantages or significant nuisances turns out to be inadequate. In such cases, subsequent orders may only be waived if special circumstances prevail which justify to evaluate otherwise. In the event of concrete health hazards, the authority shall always intervene.

6.1.2 Intervention Prerequisite

The protection against harmful effects of air pollutants on the environment is not ensured to a sufficient extent if

a) the immission values in order to ensure the protection of human health pursuant to 4.2.1 are exceeded at a place within the sphere of influence of the facility which is permanently accessible for humans,

b) the immission values in order to ensure the protection against significant nuisances pursuant to 4.3.1 are exceeded within the sphere of influence of the facility and if it cannot be excluded that intolerable nuisances actually occur in the area affected,

c) the immission values in order to ensure the protection against significant nuisances, especially the protection of the vegetation and of ecosystems, pursuant to 4.4.1 or 4.4.2 are exceeded within the sphere of influence of the facility and if ecosystems requiring protection prevail in the area affected,

d) a special-case examination pursuant to 4.8 is to be carried out and shows that air pollutant immissions lead to hazards, significant disadvantages or significant nuisances for the general public or the neighbourhood

and if the operation of the facility contributes to the harmful effects on the environment to a relevant extent.

6.1.3 Measures

If adequate protection against harmful effects on the environment cannot be ensured by applying measures to implement best available techniques, further measures to reduce emissions shall be ordered. If such measures do not suffice either, the conditions of disposal shall be demanded to be improved. In cases pursuant to the second sentence of § 17 para. (1) of the Federal Immissions Control Act, it shall be checked whether the licence is to be completely or partially revoked.

6.1.4 Time Limits

Subsequent orders for the protection against harmful effects on the environment shall be issued immediately after clarification of the prerequisites for intervention. If several polluters contribute to harmful effects on the environment to a relevant extent, the prerequisites for intervention shall be clarified with regard to all polluters concerned and, if necessary, several orders issued. Taking into account the principle of proportionality, a time limit may be allowed for within which measures can be implemented. The third sentence shall only apply if no concrete health hazards may occur during the transitional period and if nuisances or disadvantages of limited duration may be tolerated by those affected.

6.1.5 EC Air Quality Values

If immission values pursuant to 4 are exceeded the observation of which shall only become mandatory as of a certain date in the future in compliance with Daughter Directives of the Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management ("Air Quality Framework Directive"), the facility may be approved to contribute to excess immission values until expiry of the transitional period. The measures required for future observation of immission values shall be ordered no later than when drawing up a clean air plan.

6.2 Subsequent Orders to Provide Precautions against Harmful Environmental Effects

6.2.1 Principle

If a facility does not meet the requirements to provide precautions against harmful effects on the environment specified in this Administrative Regulation, the competent authority shall issue the necessary orders by which to adapt the facility to the best available techniques pursuant to 5 and to the other requirements to provide precautions specified there under. If the emission standards pursuant to 5 are only exceeded to a low extent, ordering extensive corrective measures may lack proportionality. In all other respects, the principle of proportionality (§ 17 para. (2) of the Federal Immissions Control Act) shall, as a rule, be observed by granting a period of compliance pursuant to 5.4 to 6.

6.2.2 Immediate Rehabilitation

If a facility does not meet the requirements to take precautions against harmful effects on the environment specified in the Technical Instructions on Air Quality Control (*TA Luft*) of 27 February 1986 (GMBl. p. 95), a period of compliance shall only be granted in a subsequent order insofar as this is indispensable to carry out the measures. If such requirements have been specified on a case-to-case basis by imposed condition or by subsequent order, they shall be implemented immediately.

6.2.3 Granting Rehabilitation Periods

Insofar as new requirements are established in this Administrative Regulation, periods of compliance shall be granted with a view to

- the technical efforts required,

- the extent of deviation from such requirements and
- the significance for the general public and the neighbourhood.

6.2.3.1 Rehabilitation Periods for Measures the Implementation of which requires only Administrative Changes or Few Technical Efforts

It shall be determined in subsequent orders the implementation of which requires only administrative changes or few technical efforts, especially when shifting to lower-emission fuels or charge substances and when carrying out simple changes of process management or improvements in the efficiency of existing waste gas purification plants that the implementation of such measures shall be completed within three years after such new requirements have become effective.

6.2.3.2 Rehabilitation Periods for Measures by which to Meet the Existing and New Requirements Simultaneously

As to facilities which meet neither the requirements of the Technical Instructions on Air Quality Control of 1986 nor the new requirements, it shall be attempted to implement measures to meet both the existing and the new requirements simultaneously. The period within which to meet all requirements shall not exceed three years.

All requirements shall be met no later than by 30 October 2007 by facilities pursuant to no. 7.1 letter b) of the Annex of the 4th Ordinance on the Implementation of the Federal Immissions Control Act which require notification as of 3 August 2001 pursuant to § 67 para. (2) of the Federal Immissions Control Act.

6.2.3.3 General Rehabilitation Period

As to facilities which have up to now represented best available techniques all requirements shall be demanded notwithstanding any other provisions of 6.2.3.1, 6.2.3.4 and 6.2.3.5 - to be met no later than by 30 October 2007.

6.2.3.4 Special Rehabilitation Periods pursuant to 5.4 of this Administrative Regulation

Insofar as special rehabilitation periods are specified for certain facility types in 5.4, these shall take precedence over any other provisions.

6.2.3.5 Rehabilitation Periods in Clean Air Plans pursuant to § 47 of the Federal Immissions Control Act

Insofar as clean air plans pursuant to § 47 of the Federal Immissions Control Act contain rehabilitation periods, these shall take precedence over the periods specified in 5.4 and 6.2.3.1 to 6.2.3.3.

6.2.4 Licence Waiver

Subsequent orders shall not be issued if the operator has expressed a waiver in writing to the licensing authority renouncing to operate the facility over a period exceeding the periods specified in 6.2.3.2 to 6.2.3.4. The first sentence shall not apply to subsequent orders pursuant to 6.2.3.1 and 6.2.3.5.

6.2.5 Compensation

In cases pursuant to § 17 para. (3a) of the Federal Immissions Control Act, the competent authority shall refrain from issuing subsequent orders.

7 Cancellation of Regulations

The Technical Instructions on Air Quality Control (*TA Luft*) of 27 February 1986 (GMBl. p. 95) shall be cancelled as of entry into force of this General Administrative Regulation.

8 Entry into Force

This General Administrative Regulation shall enter into force on the first day of the third calendar month after publication.

Approved by the *Bundesrat*.

Annex 1 Determining the Minimum Distance from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems with Regard to the Requirements under 4.8

Examination pursuant to 4.8 as to whether the protection against significant disadvantages due to damage or harm caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems is ensured

The provisions under 4.8 stipulate that it is considered evidence for the occurrence of significant disadvantages due to damage or harm caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems if the minimum distances given in Figure 4: Minimum Distance of Facilities from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages due to Damage or Harm Caused by the Effects of Ammonia on these Protected Resources will Occur if the Minimum Distances are not Observed

are not observed.

As to facilities for farming or breeding of livestock the emission factors in Fehler! Verweisquelle konnte nicht gefunden werden. **shall be used to determine the yearly ammonia emissions expected for the respective facility under conditions most unfavourable according to species, production specialization, livestock housing and commercial fertilizer storage and according to the respective stocking density. In the event of different species and different types of farming and breeding the respective yearly ammonia emissions shall be added up. The yearly ammonia emission can be used to identify the minimum distance in Figure 4: Minimum Distance of Facilities from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages due to Damage or Harm Caused by the Effects of Ammonia on these Protected Resources will Occur if the Minimum Distances are not Observed**

. It is considered evidence for the occurrence of significant disadvantages if such a minimum distance is not observed.

Table 11: Ammonia Emission Factors for Facilities for Farming or Breeding of Livestock*

Species, Production Specialization, Livestock Housing, Commercial Fertilizer Storing	**Ammonia Emission Factor (kg/(Stocking Rate· a))**
Fattening pigs	
Compulsory ventilation, liquid manure system (partially or fully slated floors)	3.64
Compulsory ventilation, solid manure system	4.86
Naturally ventilated housing, kennel housing (liquid or solid manure system)	2.43

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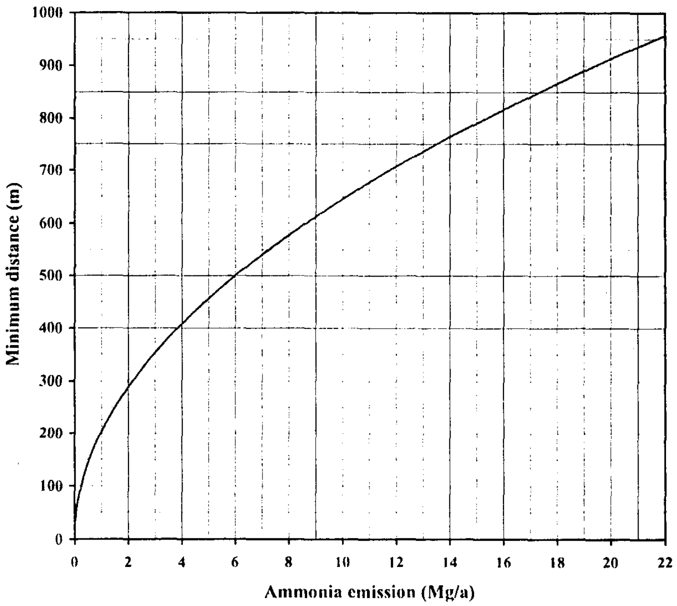
* If facilities for farming or breeding of livestock significantly diverge from the procedures listed in **Fehler! Verweisquelle konnte nicht gefunden werden.** in relation to species, production specialization, livestock housing, feeding or commercial fertilizer storage, diverging emission factors for calculation may be drawn upon on the basis of plausible reasoning (e.g. measuring reports, practical examinations).

Species, Production Specialization, Livestock Housing, Commercial Fertilizer Storing	Ammonia Emission Factor (kg/(Stocking Rate· a))
Naturally ventilated housing, deep litter or composting system	4.86
Swine nursery (breeding sow management)	
All areas and types of livestock housing (breeding sows incl. piglets up to 25 kg)	7.29
Laying hens	
Cage rearing using ventilated dropping belts	0.0389
Aviary housing using ventilated dropping belts	0.0911
Floor management/free-range (manure removal 1 time per turn)	0.3157
Feeding poultry	
Fryers, floor management	0.0486
Ducks	0.1457
Turkeys	0.7286
Dairy cattle	
Tied housing, liquid or solid manure system	4.86
Cubicle housing, liquid or solid manure system	14.57
Free stall, deep litter system	14.57
Free stall, sloping floor straw yard system	15.79
Fattening bullock, young cattle incl. breeding (6 months up to 2 years)	
Tied housing, liquid or solid manure system	2.43
Free stall, liquid manure system	3.04
Free stall, sloping floor straw yard system	3.64

Figure 4: Minimum Distance of Facilities from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages due to Damage or Harm Caused by the Effects of Ammonia on these Protected Resources will Occur if the Minimum Distances are not Observed



For calculating the minimum distance according to Figure 4: Minimum Distance of Facilities from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages due to Damage or Harm Caused by the Effects of Ammonia on these Protected Resources will Occur if the Minimum Distances are not Observed

the following equation shall apply:

$$X_{\min} = \sqrt{F \cdot Q}$$

F shall be 41668 $m^2 \cdot a/Mg$ and Q the yearly ammonia emission in Mg/a. This equation may also be used in the event of yearly ammonia emissions being higher than the value of 22 Mg/a depicted Figure 4: Minimum Distance of Facilities from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages due to Damage or Harm Caused by the Effects of Ammonia on these Protected Resources will Occur if the Minimum Distances are not Observed

If it is proved by applying a dispersion calculation pursuant to Annex 3 and taking into consideration the conditions in which the animals are kept that in cases where the distance to be determined falls below the value given in Figure 4: Minimum Distance of Facilities from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages due to Damage or Harm Caused by the Effects of Ammonia on these Protected Resources will Occur if the Minimum Distances are not Observed

, the additional load for ammonia of 3 $\mu g/m^3$ is not exceeded in any significant evaluation parcel, it is considered evidence for the occurrence of significant disadvantages due to damage or harm caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems if such newly determined distances fall below the given values.

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It is not considered evidence for the occurrence of significant disadvantages if the total load of ammonia does not exceed 10 $\mu g/m^3$ in any evaluation parcel.

The minimum distance curve has been derived for sources close to the ground and does not take into consideration that the immission concentration may be reduced due to the discharge of waste gases through stacks pursuant to 5.5. A dispersion calculation pursuant to Annex 3 may be carried out to take into consideration such discharge conditions.

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Annex 2 Curves for Deriving Mass Flows on the Basis of Immission Projections

Figure 5: Arsenic and Inorganic Arsenic Compounds

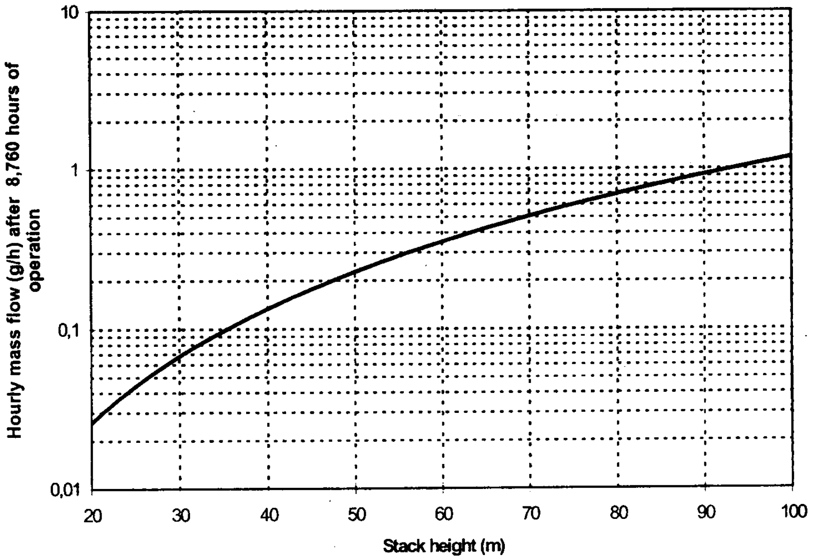

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Figure 6: Lead and Inorganic Lead Compounds

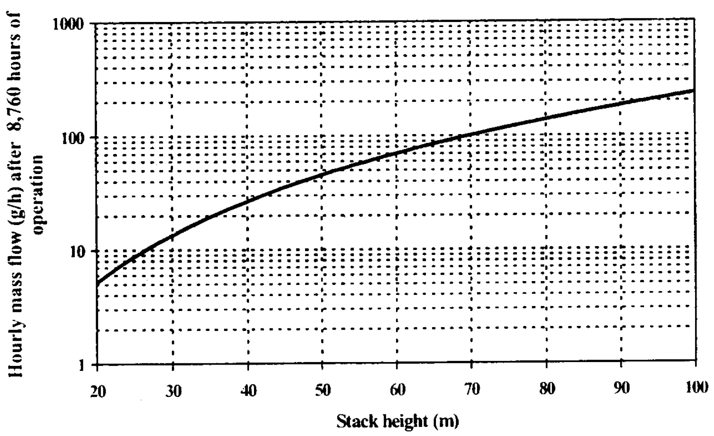

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Figure 7: **Cadmium and Inorganic Cadmium Compounds and Thallium and Inorganic Thallium Compounds**

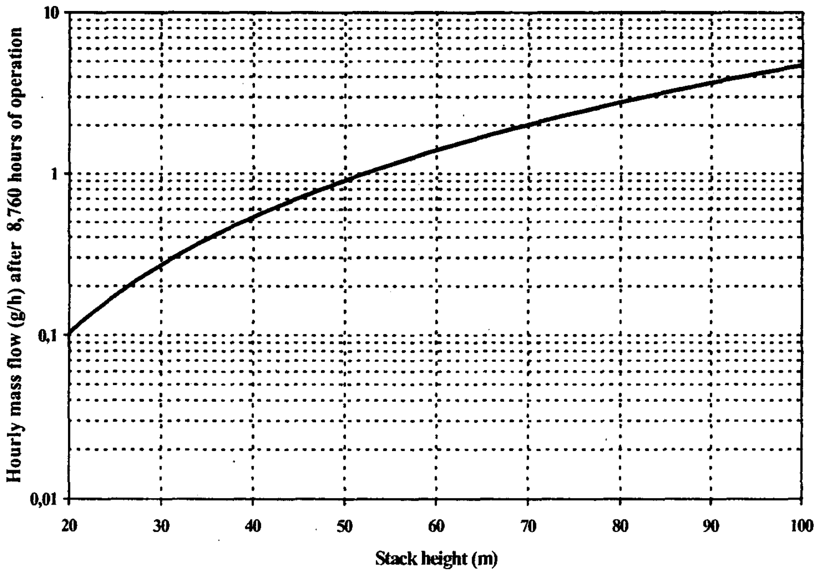


Figure 8: Nickel and Inorganic Nickel Compounds

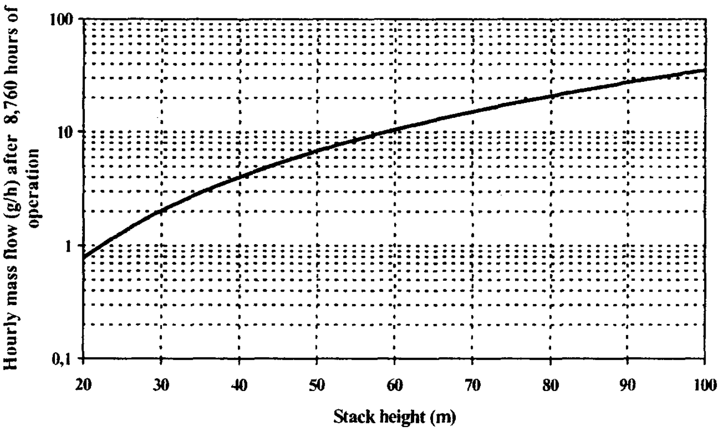
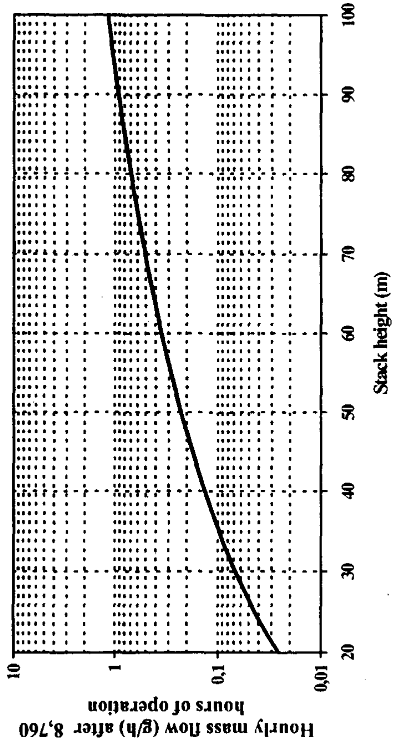


Figure 9: **Mercury and Inorganic Mercury Compounds**



Annex 3 Dispersion Calculations

1 General

The dispersion calculation for gases and dusts shall be carried out as a time series calculation over a period of one year respectively or on the basis of a frequency distribution of dispersion situations over a period of several years according to the procedure described herein using the particle models of the VDI Guideline 3945 Part 3 (September 2000 version) and under consideration of other Guidelines quoted further below.

When using a time series calculation the dispersion model will furnish the concentration of a substance (as mass/volume) and the deposition (as mass/(surface · time)) for each hour of the year for the given model parcels. When using a frequency distribution according to chapter 12 in this Annex the dispersion model will furnish the relevant annual mean values.

The results of a calculation for a raster of model parcels shall serve to select the evaluation parcels pursuant to 4.6.2.5.

The results at the evaluation parcels represent the *additional load* and shall serve, together with the time series of the existing load values measured, to determine the *total load*.

2 *Determination* of Emissions

Emission sources shall be determined as such points where air pollutants are let out of the facility into the atmosphere. The release conditions prevailing in the event of emissions being disposed of shall be taken account of.

The emission parameters of the emission source (emission mass flow, waste gas temperature, waste gas volume flow) shall be indicated as hourly mean values. If the emission parameters vary in time, e.g. batch operation, they are to be indicated as time series. If such a time series is not available or cannot be used, the most unfavourable conditions for clean air maintenance during due operation shall be assumed. If the emission rate is dependent on the wind velocity (wind-induced sources), this shall be taken account of correspondingly.

3 Dispersion Calculation for Gases

As to gases for which no immission values have been established for deposition, the dispersion calculation shall be carried out without taking account of the deposition. For ammonia and gaseous mercury the deposition velocity values v_d as stipulated in Table 12 shall be used:

Table 12: Deposition Velocity for Gases

Substance	v_d in m/s
Ammonia	0.010
Mercury	0.005

The conversion times indicated in VDI Guideline 3782 Part 1 (December 2001 version) shall be used to calculate the conversion of NO to NO_2 .

4 Dispersion Calculation for Dusts

The dispersion calculation for dusts shall take account of dry deposition and sedimentation. The calculation shall be carried out for the following classes of particle size distribution, indicated as aerodynamic diameter d_a, of the emission mass flow, at the same time using the respective given deposition velocity values v_d and sedimentation velocity v_s :

Table 13: Deposition and Sedimentation Velocity for Dusts

Class	d_a in μm	v_d in m/s	v_s in m/s
1	less than 2.5	0.001	0.00
2	2.5 to 10	0.01	0.00
3	10 to 50	0.05	0.04
4	more than 50	0.20	0.15

The dispersion calculation for one particle size class shall be carried out using the emission mass flow of the relevant particle size class. To calculate the deposition of the dust in total the deposition values of the particle size classes shall be added up. The individual measurements of the concentration for PM-10 (aerodynamic diameter less than 10 µm) are made up of the sum of the individual measurements of the concentration of the particle size classes 1 and 2.

In cases where the particle size distribution is not known, PM-10 shall be considered as Class 2 dust. For dusts having an aerodynamic diameter larger than 10 µm the value 0.07 m/s shall be used for v_d and 0.06 m/s for v_s.

5 Soil Roughness

The soil roughness of the area shall be described by a mean roughness length z_0. Such soil roughness shall be determined according to Table 14 on the basis of the land cover classes of the CORINE Land Cover Inventory * (the indicated numbers correspond to the CORINE land cover nomenclature):

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* Data on ground cover in the Federal Republic of Germany ("*Daten zur Bodenbedeckung der Bundesrepublik Deutschland*") provided by the Federal Statistical Office, Wiesbaden

Table 14: **Mean Roughness Length Subject to the Land Cover Classes Indicated in the CORINE Land Cover Inventory**

z_0 in m	CORINE Classes
0.01	Beaches, dunes and sand plains (331); Water bodies (512)
0.02	Dumpsites (132); Pastures (231); Natural Grassland (321); Sparsely vegetated areas (333); Salt marshes (421); Intertidal flats (423); Water courses (511); Estuaries (522)
0.05	Mineral extraction sites (131); Sport and leisure facilities (142); Non irrigated arable land (211); Glaciers and perpetual snow (335); Coastal lagoons (521)
0.10	Airports (124); Inland marshes (411); Peat pogs (412); Sea and ocean (523)
0.20	Road and rail networks and associated land (122); Green urban areas (141); Vineyards (221); Complex cultivation patterns (242); Land principally occupied by agriculture with significant areas of natural vegetation (243); Moors and heathland (322); Bare rock (332)
0.50	Port areas (123); Fruit tree and berry plantations (222); Transitional woodland scrub; (324)
1.00	Discontinuous urban fabric (112); Industrial or commercial units (121); construction sites (133); coniferous forest (312)
1.50	Broad-leaved forest (311); Mixed forest (313)
2.00	Continuous urban fabric (111)

The roughness length shall be determined for an area that is located within a circle around the stack, drawn by a radius equal to 10 times the actual stack height. If such area is composed of units having different soil roughness, a mean roughness length shall be determined by calculating the arithmetic mean by weighting the respective proportion of the overall area and subsequently be rounded to the next higher value in the table. It shall be examined whether the use of land has changed considerably, since the inventory was drawn up, or whether it can be expected that the immission projection will be significantly different.

If the soil roughness varies strongly within the area under consideration, it shall be examined how the roughness length value effects the immission values calculated.

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6 Effective Emission Height

The effective emission height shall be determined pursuant to VDI Guideline 3782 Part 3 (June 1985 version). The emitted heat flow M in MW shall be calculated using the following formula:

$$M = 1.36 \cdot 10^{-3} \cdot R' (T - 283.15\ K) \qquad (1)$$

M being the heat flow in MW, R' the volume flow of the waste gas (f) in normal condition in m^3/s and T the waste gas temperature in K.

If waste gases are disposed of via cooling towers, VDI Guideline 3784 Part 2 (March 1990 version) shall be applied accordingly.

7 Calculation Area and Model Parcels

The calculation area applied to a single emission source shall be the area which is perfectly located within a circle around the centre of emission drawn by a radius equal to 50 times the actual stack height. If several sources contribute to the additional load, the calculation area shall be composed of the total calculation areas of the individual sources. In cases where the terrain shows a special nature it may be necessary to select a larger calculation area.

The raster for calculating concentration and deposition shall be selected in such a way, that it will be possible to determine location and amount of the maximum immission values in a sufficiently reliable way. As a rule this is the case when the horizontal mesh does not exceed the stack height. If sources are located in a distance that exceeds a radius of 10 times the stack height, it is possible to select a proportionally larger horizontal mesh.

The concentration at the model parcels shall be calculated as a mean value using a vertical interval from the ground up to 3 m height above ground and shall thus be representative for a model parcel height of 1.5 m above ground. The mean values

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thus calculated for a volume or a surface of the calculation grid shall be considered as point values for the model parcels contained therein.

8 Meteorological Data

8.1 General

Meteorological data shall be indicated as hourly mean values, with the mean wind velocity to be determined by a vector. The values used should be characteristic for the location of the facility. If no measurements are available at the location of the facility, data shall be used which come from a suitable station of the German Meteorological Services (*Deutscher Wetterdienst*) or from another accordingly equipped station. It shall be examined whether these data can be transferred to the location of the facility; such examination can be carried out e.g. by comparing the data to data determined in a location study. Measurement gaps that do not exceed more than 2 hourly values may be bridged by interpolation. Data availability shall be at least 90 per cent of the hours per year.

The meteorological boundary-layer profiles required for the particle model shall be determined pursuant to VDI Guideline 3783 Part 8.* In this context, the following values will be required:

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* The profiles indicated in the following publications shall be used until VDI Guideline 3783 Part 8 will have been introduced: L. Janicke, U. Janicke: "*Vorschlag eines meteorologischen Grenzschichtmodells für Lagrangesche Ausbreitungsmodelle". Berichte zur Umweltphysik 2*, Ingenieurbüro Janicke, ISSN 1439-8222, September 2000 ("Proposal for a meteorological boundary-layer model for Lagrangian dispersion models").

Table 15: Values for Meteorological Boundary-layer Profiles

r_a	Wind direction in anemometer height h_a
u_a	Wind velocity in anemometer height h_a
L_M	Monin-Obukhov Length
h_m	Boundary layer height
Z_0	Roughness length
D_0	Displacement height

8.2 Wind Direction

The wind direction shall be the direction from which wind blows and shall be indicated in anemometer height as an angle exactly in degree clockwise against northerly direction. If the meteorological time series used for calculating the dispersion only contains rounded values for wind direction (sector data), an equally distributed random wind direction of the respective sector shall be used for calculating the dispersion.

For circulating winds an equally distributed random wind direction shall be selected from the sector 1° to 360°. For intervals with low winds up to duration of 2 hours the wind direction shall be determined by linear interpolation between the last value prior to the start of the low wind and the first value after the end of the low wind. For intervals longer than two hours the wind direction shall be selected randomly according to the wind direction distribution for wind velocities up to 1.2 m/s.

The rotation D of the wind direction r in the boundary layer shall be taken into consideration as a function of the height z above ground according to the formulas 2 and 3:

$$r(z) = r_a + D(z) - D(h_a) \qquad (2)$$

$$D(z) = 1.23\, D_h[1-\exp(-1.75\, z/h_m)] \qquad (3)$$

The value for D_h shall be derived as function of the Monin-Obukhov Length L_M (chapter 8.4 of this Annex) and the boundary layer height h_m (chapter 8.5 of this Annex) of Table 16:

Table 16: **Determination of D_h**

D_h in degree	Stability
0	$h_m/L_M < -10$
$45 + 4.5\, h_m/L_M$	$-10 \leq h_m/L_M < 0$
45	$L_M > 0$

For heights above the boundary layer height the wind direction in the boundary layer height shall be used.

8.3 Wind Velocity

The wind velocity in anemometer height shall be indicated in m/s, including the first digit to the right of the decimal point. If the wind velocity is indicated in steps larger than 0.1 m/s in the meteorological time series, an equally distributed random velocity shall be selected from the steps selection for calculating the dispersion, if necessary.

In the event of low wind and of wind velocities below 0.8 m/s in anemometer height an arithmetic value of 0.7 m/s shall be used for the wind velocity in anemometer height.

8.4 Monin–Obukhov Length

The stability of atmospheric layers shall be determined by indicating the Monin-Obukhov Length L_M. If the value of the Monin-Obukhov Length is not known, a dispersion class shall be determined according to Klug/Manier pursuant to VDI Guideline 3782 Part 1 (December 2001 version) and the Monin-Obukhov Length shall be determined in metre pursuant to Table 17:

Table 17: **Determining the Monin–Obukhov Length L_M**

Dispersion Class *according to* Klug/Manier	Roughness Length z_0 in m								
	0.01	**0.02**	**0.05**	**0.10**	**0.20**	**0.50**	**1.00**	**1.50**	**2.00**
I (very stable)	7	9	13	17	24	40	65	90	118
II (stable)	25	31	44	60	83	139	223	310	406
III/1 (indifferent)	99999	99999	99999	99999	99999	99999	99999	99999	99999
III/2 (indifferent)	-25	-32	-45	-60	-81	-130	-196	-260	-326
IV (unstable)	-10	-13	-19	-25	-34	-55	-83	-110	-137
V (very unstable)	-4	-5	-7	-10	-14	-22	-34	-45	-56

The value of the Monin-Obukhov Length between two dispersion classes is the harmonic mean value of the values in the neighbouring dispersion classes, e.g. the reciprocal value shall be determined by calculating the arithmetic mean of the reciprocal values. Such limits between classes shall be used if reference is explicitly made to dispersion classes according to Klug/Manier.

8.5 Boundary Layer Height

If the boundary layer height is unknown, such boundary layer height shall be determined using the following method. As to values of the Monin-Obukhov Length from the area of the dispersion classes IV and V, a boundary layer height h_m of 1,100 m shall be used for calculation. Otherwise a value of 800 m shall be used for calculation, unless Formula 4 results in a lower value:

$$h_m = \begin{cases} \alpha \dfrac{u_*}{f_c} & \text{for } L_M \geq \dfrac{u_*}{f_c} \\ \alpha \dfrac{u_*}{f_c}\left(\dfrac{f_c L_M}{u_*}\right)^{1/2} & \text{for } 0 < L_M < \dfrac{u_*}{f_c} \end{cases} \qquad (4)$$

α equals 0.3 and the Coriolis parameter f_c equals 10^{-4} s^{-1}. The friction velocity u_* shall be determined on the basis of the wind profile of the meteorological boundary layer model.

8.6 Displacement Height

The displacement height d_0 indicates, how far the theoretical meteorological profiles shall be shifted in the vertical due to vegetation or developed areas. The displacement height shall be assumed 6 times the roughness length z_0 (chapter 5 of this Annex), for densely developed areas as 0.8 times the mean height of developed areas. Below the height of 6 z_0 + d_0 the wind velocity shall be interpolated in a linear way up to a value of zero if z equals zero; all other meteorological parameters shall be kept constant.

9 Taking into Consideration Statistical Uncertainties

The immission values calculated by using the method described herein show statistical uncertainties due to the statistical nature of the method indicated in VDI Guideline 3945 Part 3 (September 2000 version). It shall be observed that the model-related statistical uncertainty, which is calculated as a statistical dispersion of the calculated values, may not exceed 3 per cent of the yearly immission value as to the yearly immission value and 30 per cent of the daily immission value as to the daily immission value. The statistical uncertainty may be reduced by increasing the particle number.

If the evaluation parcels are located at points of maximum additional load, it shall not be necessary to take the statistical uncertainty separately into consideration. Otherwise the yearly, daily and hourly immission values calculated shall be increased by the respective statistical uncertainty. In this context the relative statistical uncertainty of the hourly immission value shall equal the relative statistical uncertainty of the daily immission value.

10 Taking into Consideration the Development of Areas

Impacts of area development on the immission in the calculation area shall be taken into consideration. If the stack height is 1.2 times higher than the height of the buildings or if buildings, for which this requirement is not met, are located in a distance of more than 6 times of their respective height from the emission source, as a rule the following can be applied:

a) If the building height of stack is higher than 1.7 time of the height of the building, it suffices to take into consideration the development by roughness length (chapter 5 of this Annex) and displacement height (chapter 8.6 of this Annex).

b) If the building height of stack is lower than 1.7 time of the height of the building and if a free flow can be ensured, the impact can be taken into consideration by using a diagnostic wind field model for airflow around buildings. Until a suitable VDI Guideline has been introduced, such wind field models shall be used whose suitability has been proved to the competent upper *Land* authority.

All buildings that are located in a distance from the emission source of less than 6 times of the stack height shall be significant for evaluating the building heights pursuant to paras. a) or b).

11 Taking into Consideration the Unevenness of Terrain

As a rule uneven terrain shall only be taken into consideration, if within the calculation areas differences in level occur in relation to the emission location of more than 0.7 times of the building height of stack and gradients of more than 1:20. In this context the gradient shall be determined on the basis of the difference in level over a certain distance that corresponds to twice the building height of stack.

As a rule uneven terrain can be taken into consideration using a meso-scale diagnostic wind field model if the gradient of the terrain does not exceed the value of

1:5 and if considerable impact of local wind systems or other meteorological particularities can be ruled out.

Until a suitable VDI Guideline has been introduced, such wind field model be used whose suitability has been proved to the competent upper *Land* authority.

12 Using a Frequency Distribution for the Hourly Dispersion Situation

It is possible to use a frequency distribution for the hourly dispersion situations, if the hourly mean value of mean wind velocities is lower than 1 m/s at the facility's location occur for less than 20 per cent of the yearly hours. A dispersion situation shall be determined by wind velocity class, wind direction sector and dispersion class.

The wind velocities u_a in anemometer height h_a shall be classified as follows:

Table 18: Classification of Wind Velocities

Wind Velocity Class	Wind Velocity u_a in ms^{-1}	Operand u_R in ms^{-1}
1	< 1.4	1
2	1.4 to 1.8	1.5
3	1.9 to 2.3	2
4	2.4 to 3.8	3
5	3.9 to 5.4	4.5
6	5.5 to 6.9	6
7	7.0 to 8.4	7.5
8	8.5 to 10.0	9
9	> 10.0	12

The wind direction shall be classified in 36 sectors of 10° respectively. The first sector shall comprise the wind directions 6° to 15°, the other sectors follow clockwise. As to the wind velocity class 1 the same distribution to the wind direction sectors shall prevail as for velocity class 2.

Cases of circulating winds shall be allocated to the corresponding dispersion and wind velocity classes; the distribution to the wind direction sectors shall be carried out according to the wind direction distribution in the respective wind velocity class.

The dispersion class shall be determined according to VDI Guideline 3782 Part 1 Annex A (December 2001 version).

For each dispersion situation quoted in the frequency distribution as having a probability of larger than zero a dispersion calculation not related to time shall be carried out according to the method indicated for the time series. In this context the arithmetic value u_R shall used as wind velocity u_a. The dispersion calculation for a wind direction sector of 10° shall be carried out in the form of calculations for 5 wind directions, with a distance of 2° respectively by calculating the arithmetic mean of the results. For the first sector these are the wind directions 6°, 8°, 10°, 12°, 14° and for the following sectors correspondingly.

The yearly mean value calculated for concentration or deposition shall be the mean value averaged by the probabilities of the concentration and/or deposition values to be calculated for the individual dispersion situations.

Annex 4 Organic Substances of Class I pursuant to 5.2.5

Table 19: Organic Substances of Class I pursuant to 5.2.5

Substance	CAS–Number
1,1,2,2-Tetrabromoethane	79–27–6
1,2,3-Propanetriol, trinitrate	55–63–0
1,2,4-Benzenetricarboxylic acid	528–44–9
1,2-Benzenediol (Pyrocatechin)	120–80–9
1,2-Ethanediamine, N-(2-aminoethyl)-	111–40–0
1,2-Ethanediol, dinitrate	628–96–6
1,2-Propanediol, dinitrate	6423–43–4
1,3-Butadiene, 1,1,2,3,4,4-hexachloro–	87–68–3
1,3-Propanediamine	105–83–9
1,4-Dioxane	123–91–1
1,5-Naphthalenediamine	2243–62–1
1,6-Hexamethylene diisocyanate	822–06–0
1,6-Hexanediamine	124–09–4
1-Butanamine,	109–73–9
1-Butanethiol	109–79–5
1-Naphthalenamine	134–32–7
1-Propene, 3-chloro-2-methyl-	563–47–3
2,4,7-Trinitrofluorenone	129–79–3
2,5-Furandione	108–31–6
2-Butenal (Crotonaldehyde)	123–73–9
2-Butyne-1,4-diol	110–65–6
2-Chloro-1,3-butadiene (Chloroprene)	126–99–8
2-Cyclohexen-1-one, 3,5,5-trimethyl–	78–59–1
2-Ethoxyethyl acetate	111–15–9
2-Furancarboxaldehyde (Furfural)	98–01–1
2-Furanmethanamine	617–89–0
2-Hexanone	591–78–6
2-Imidazolidinethione	96–45–7

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Substance	CAS–Number
2-Methyl-m-phenylenediamine	823–40–5
2-Naphthyl phenyl amine	135–88–6
2-Nitro-p-phenylenediamine,2	5307–14–2
2-Propanamine, 2-methyl-	75–64–9
2-Propenal (Acrolein, Acrylaldehyde)	107–02–8
2-Propenoic acid, butyl ester	141–32–2
2-Propenoic acid, ethyl ester (Ethyl acrylate)	140–88–5
2-Propenoic acid, methyl ester	96–33–3
2-Propyn-1-ol	107–19–7
3,3'-Diamino-benzidine	91–95–2
4,4'-Methylenebis(2-methylcyclohexylamine)	6864–37–5
4-Amino-2-nitrophenol	119–34–6
4-Methyl-3-oxa-1-pentanol	109–59–1
4-Tert-butyltoluene	98–51–1
Acetaldehyde	75–07–0
Acetamide	60–35–5
Acetamide, N-phenyl–	103–84–4
Acetic acid anhydride	108–24–7
Acetic acid ethenyl ester	108–05–4
Acetic acid, chloro-	79–11–8
Acetic acid, chloro-, methyl ester	96–34–4
Acetic acid, methoxy-	625–45–6
Acetic acid, trichloro–	76–03–9
Acrylic acid	79–10–7
Alkyl-lead compounds	
Aniline	62–53–3
Aniline, N-methyl-	100–61–8
Benzenamine, 2,4-dimethyl–	95–68–1
Benzenamine, 2-methyl-5-nitro-	99–55–8
Benzenamine, 4-methoxy-	104–94–9
Benzenamine, 5-chloro-2-methyl-	95–79–4
Benzenamine, N,N-dimethyl-	121–69–7

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Substance	CAS-Number
Benzene, (dichloromethyl)-	98-87-3
Benzene, 1,1'-methylenebis[4-isocyanato-	101-68-8
Benzene, 1,2,4,5-tetrachloro-	95-94-3
Benzene, 1-chloro-2-nitro	88-73-3
Benzene, 1-chloro-4-nitro-	100-00-5
Benzene, 1-methyl-3-nitro-	99-08-1
Benzene, 1-methyl-4-nitro-	99-99-0
Benzene, 2,4-dichloro-1-methyl-	95-73-8
Benzene, nitro-	98-95-3
Benzenesulfonyl chloride	98-09-9
Benzoyl chloride	98-88-4
Benzoyl peroxide	94-36-0
Biphenyl (Diphenyl)	92-52-4
Bis(2-ethylhexyl)phthalate	117-81-7
Butylamine, iso-	78-81-9
Camphor	76-22-2
Caprolactam	105-60-2
Carbamic chloride, diethyl-	88-10-8
Carbon tetrachloride	56-23-5
Carbonyl sulfide	463-58-1
Chloroacetic acid isopropyl ester	105-48-6
Chloroform (Trichloromethane)	67-66-3
Chloromethane	74-87-3
Chloropicrin (Trichloronitromethane)	76-06-2
Diaminoethane (Ethylenediamine)	107-15-3
Dichlorophenols	
Diglycidyl ether	2238-07-5
Diisocyanattoluol,2,6-	91-08-7
Di-n-butyltindichloride	683-18-1
Dinitronaphthalene (all isomers)	27478-34-8
Diphenyl ether	101-84-8
Diphenylamine	122-39-4

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Substance	CAS-Number
Diphenylmethane-2,4'-Diisocyanate	5873-54-1
Ethanamine, N-ethyl-	109-89-7
Ethane, 1,1,2,2-tetrachloro-	79-34-5
Ethane, 1,1,2-trichloro-	79-00-5
Ethane, 1,1-dichloro-1-nitro-	594-72-9
Ethane, hexachloro-	67-72-1
Ethane, pentachloro-	76-01-7
Ethanedial (Glyoxal)	107-22-2
Ethanethiol (Ethyl mercaptan)	75-08-1
Ethanol, 2-chloro-	107-07-3
Ethanolamine	141-43-5
Ethene, 1,1-dichloro-	75-35-4
Ethene, 1,1-difluoro- (Genetron 1132a)	75-38-7
Ethyl chloride	75-00-3
Ethyl chloroacetate	105-39-5
Ethylamine	75-04-7
Ethylene	74-85-1
Formaldehyde	50-00-0
Formamide	75-12-7
Formic acid	64-18-6
Glutaral	111-30-8
Hexahydrophthalic Anhydride	85-42-7
Hexanoic acid, 2-ethyl-	149-57-5
Hydrazine, phenyl-	100-63-0
Hydroquinone (1,4-Benzenediol)	123-31-9
Isophorone diisocyanate	4098-71-9
Ketene	463-51-4
Kresole	1319-77-3
Lead acetate (monobasic)	1335-32-6
Mecrylate	137-05-3
Methanamine, N-methyl-	124-40-3
Methane, isocyanato-	624-83-9

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Substance	CAS–Number
Methane, tribromo–	75–25–2
Methanethiol (Methyl mercaptan)	74–93–1
Methyl bromide	74–83–9
Methyl chloride	107–05–1
Methyl iodide	74–88–4
Methylamine	74–89–5
Methylene chloride	75–09–2
m-Nitroaniline	99–09–2
Montanic acid waxes, Zn-salts	73138–49–5
Morpholine	110–91–8
N,N,N',N",N"- Pentamethyldiethylenetriamine	3030–47–5
Naphthalene, 1,5-diisocyanato-	3173–72–6
Nitrocresols	
Nitrophenols	
Nitropyrenes	5522–43–0
Nitrotoluene (all isomers)	1321–12–6
N-Methyl-N,2,4,6-tetranitroaniline (tetryl)	479–45–8
N-Vinylpyrrolidone	88–12–0
o-Nitroaniline	88–74–4
Oxalic acid	144–62–7
p-Benzoquinone	106–51–4
Pentachloronaphthalene	1321–64–8
Phenol	108–95–2
Phenol, 2,4,5-trichloro–	95–95–4
Phenol, p-tert-butyl	98–54–4
Phenyl-1-(p-tolyl)-3-dimethylaminopropane,1–	5632–44–0
Phthalic anhydride	85–44–9
Phthalonitrile	91–15–6
Piperazine	110–85–0
p-Nitroaniline	100–01–6
Propane, 1,2-dichloro-	78–87–5
Propane, 1-bromo-	106–94–5

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Substance	CAS–Number
Propanoic acid, 2,2-dichloro-	75–99–0
p-Toluidine	106–49–0
Pyridine	110–86–1
Sodium chloroacetate, Sodium salts	3926–62–3
Sodium Trichloroacetate	650–51–1
Tetrachloroethylene	127–18–4
Thioalcohols	
Thioethers	
Thiourea	62–56–6
Toluene-2,6-diisocyanate-	584–84–9
Trichloroaphtalene	1321–65–9
Trichlorobenzenes (all isomers)	12002–48–1
Trichloroethylene	79–01–6
Trichlorophenols	
Tricresyl phosphate (ooo,oom,oop,omm,omp,opp)	78–30–8
Triethylamine	121–44–8
Trimellitic anhydride	552–30–7
Tri-n-butylphosphate	126–73–8
Trinitrotoluene (TNT)	118–96–7
Xylenols (except for 2,4–Xylenol)	1300–71–6

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Annex 5 Equivalence Factors for Dioxins and Furans

The concentrations of the following dioxins and furans determined in the waste gas shall be multiplied and totalled by the given equivalence factors in order to receive the totals required under 5.2.7.2 or the relevant requirements pursuant to 5.3 or 5.4.

Table 20: Equivalence Factors for Dioxins and Furans

Substance	Equivalence Factors
2,3,7,8 – Tetrachlorodibenzodioxin (TCDD)	1
1,2,3,7,8 – Pentachlorodibenzodioxin (PeCDD)	0.5
1,2,3,4,7,8 – Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,7,8,9 – Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,6,7,8 – Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,4,6,7,8 – Heptachlorodibenzodioxin (HpCDD)	0.01
Octachlorodibenzodioxin (OCDD)	0.001
2,3,7,8 – Tetrachlorodibenzofuran (TCDF)	0.1
2,3,4,7,8 – Pentachlorodibenzofuran (PeCDF)	0.5
1,2,3,7,8 – Pentachlorodibenzofuran (PeCDF)	0.05
1,2,3,4,7,8 – Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,7,8,9 – Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,6,7,8 – Hexachlorodibenzofuran (HxCDF)	0.1
2,3,4,6,7,8 – Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,4,6,7,8 – Heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,7,8,9 – Heptachlorodibenzofuran (HpCDF)	0.01
Octachlorodibenzofuran (OCDF)	0.001

Annex 6 VDI Guidelines and Standards in Relation to Emission Measuring

Table 21: VDI Guidelines and Standards in Relation to Emission Measuring

Test Object	Method		VDI Guideline		DIN/EN Standards	
	Continuous	Inter-mittent	Guideline/Standard	Version	Guideline/Standard	Version
General Guidelines						
Calibration			3950 P. 1	Jul. 94		
Measuring plans			2448 P. 1	Apr. 92		
Emission measuring			4200	Dec. 00		
Requirements for testing bodies			4220	Sep. 99		
Dust						
Dust (general)		X	2066 P. 1	Oct. 75		
Dust	X		2066 P. 4	Jan. 89		
	X		2066 P. 6	Jan. 89		
Dust (lower concentrations)		X	2066 P. 7	Aug. 93	EN 13284-1	Nov. 01
Dust (higher concentrations)		X	2066 P. 2	Aug. 93		
Fractionating dust measuring		X	2066 P. 5	Nov. 94		
Soot level		X	2066 P. 8	Sep. 95		
Dust Components						
Heavy metals (sampling)		X	3868 P. 1	Dec. 94		
Heavy metals (analysis)		X	2268 P. 1	Apr. 87		
		X	2268 P. 2	Feb. 90		
		X	2268 P. 3	Dec. 88		
		X	2268 P. 4	May 90		
Mercury		X			13211	Jun. 01
Asbestos		X	3861 P. 2	Sep. 96		

Test Object	Method		VDI Guideline		DIN/EN Standards	
	Continuous	Inter-mittent	Guideline/Standard	Version	Guideline/Standard	Version
Sulphur Compounds						
Sulphur dioxide		X	2462 P. 8	Mar. 85		
Sulphur trioxide		X	2462 P. 7	Mar. 85		
Hydrogen sulphide		X	3486 P. 1	Apr. 79		
		X	3486 P. 2	Apr. 79		
Carbon disulphide		X	3487 P. 1	Nov. 78		
Nitrogen Compounds						
Nitrogen monoxide/-dioxide		X	2456 P. 8	Jan. 86		
Basic nitrogen compounds		X	3496 P. 1	Apr. 82		
Carbon Monoxide						
		X	2459 P. 1	Dec. 00		
		X	2459 P. 7	Feb. 94		
Chlorine Compounds						
Hydrogen chloride		X			1911-1 1911-2 1911-3	Jul. 98
Chlorine		X	3488 P. 1	Dec. 79		
		X	3488 P. 2	Nov. 80		
Fluoride Compounds						
Hydrogen fluoride		X	2470 P. 1	Oct. 75		
Organic Substances						
Hydrocarbons (general)			3481 P. 6	Dec. 94		
Hydrocarbons		X	3481 P. 2	Sep. 98		
Hydrocarbons (FID)	X		3481 P. 1	Aug. 75	12619	Sept. 99
	X		3481 P. 3	Oct. 95		
Hydrocarbons (IR)			2460 P. 1	Jul. 96		
		X	2460 P. 2	Jul. 74		
		X	2460 P. 3	Jun. 81		

Test Object	Method		VDI Guideline		DIN/EN Standards	
	Continuous	Inter-mittent	Guideline/Standard	Version	Guideline/Standard	Version
Determination of organic compounds by gas chromatography		X	2457 P. 1	Nov. 97	13649 (prEN)	
		X	2457 P. 2	Dec. 96		
		X	2457 P. 3	Dec. 96		
		X	2457 P. 4	Dec. 00		
		X	2457 P. 6	Jun. 81		
		X	2457 P. 7	Jun. 81		
Aliphatic aldehydes (C_1 to C_3)		X	3862 P. 1	Dec. 90		
		X	3862 P. 2	Dec. 00		
		X	3862 P. 3	Dec. 00		
		X	3862 P. 4	May 01		
Acrylonytrile		X	3863 P. 1	Apr. 87		
		X	3863 P. 2	Febr. 91		
PAH (general)		X	3873 P. 1	Nov. 92		
PAH in relation to facilities in carbon industry		X	3467	Mar. 98		
Vinyl chloride		X	3493 P. 1	Nov. 82		
Dioxins and furans		X			1948-1 1948-2 1948-3	May 97
Odorous substances						
		X	3881 P. 1	May 86		
		X	3881 P. 2	Jun. 87		
		X	3881 P. 3	Nov. 86		

Annex 7 S–Values

Table 22: S–Values

Substance	S–Value
Suspended particulate matter	0.08
Lead and its inorganic compounds, indicated as Pb	0.0025
Cadmium and its inorganic compounds, indicated as Cd	0.00013
Mercury and its inorganic compounds, indicated as Hg	0.00013
Chlorine	0.09
Inorganic gaseous chlorine compounds, indicated as hydrogen chlorine	0.1
Fluoride and its inorganic gaseous compounds, indicated as hydrogen fluoride	0.0018
Carbon monoxide	7.5
Sulphur oxides (sulphur dioxide and sulphur trioxide), indicated as sulphur dioxide	0.14
Hydrogen sulphide	0.003
Nitrogen oxides, indicated as nitrogen dioxides	0.1
For substances pursuant to 5.2.2	
• Class I	0.005
• Class II	0.05
• Class III	0.1
For substances pursuant to 5.2.5	
• Carbon	0.1
• Class I	0.05
• Class II	0.1
For substances pursuant to 5.2.7	
• 5.2.7.1.1 Class I	0.00005
• 5.2.7.1.1 Class II	0.0005
• 5.2.7.1.1 Class III	0.005

附件六：瑞士揮發性有機物收費制度
簡報資料

附件六：瑞士揮發性有機物收費制度簡報資料

Swiss Agency for the Environment, Forests and Landscape September 2003

Clarification of the Ordinance on incentive taxes on volatile organic compounds (OVOC)

Contents

1. Introduction

修正案

[illegible] On 21 December 1995 the Swiss Federal Assembly adopted the Amendment of the Federal Law relating to Protection of the Environment, LPE (BBl. 1996 I 233). In the absence of a referendum, the deadline for expressing opposition to this expired on 9 April 1996. By decision of the Federal Council on 21 May 1997 the Law was brought into force on 1 July 1997. The Ordinance of implementation for the levy of incentive tax upon VOC is based on Articles 35a and 35c of the LPE. The tax has been levied since 1 January 2000.

2. The necessity of reducing VOC emissions

There is great need for environmental policy to reduce VOC emissions. To supplement the measures already taken, the introduction of an incentive tax was necessary. Together with the nitrogen oxides, VOC contribute to excessive formation of ozone near ground level (summer smog). The immission limits for ground-level ozone established by the Ordinance on Air Pollution Control (OAPC) have often been exceeded, sometimes considerably, and for a period of years. In 2001 excess immission levels were measured at the measuring stations of the Swiss National Observation Network for Atmospheric Pollution (NABEL) for up to 750 hours. These excessive immissions damage public health and the environment, and must be reduced, according to Articles 1 and 11 of the LPE, through a corresponding reduction of emissions.

1998年
850 hr

For the stagewise implementation of the LPE, the Federal Council's Strategy against Air Pollution set a minimum target of reducing emissions to the level of 1960. The first stage should see a significant reduction in ozone levels. This corresponds to a reduction of 55 per cent from the maximum VOC emissions in 1984. Nevertheless, this first step is not suffcient. The primary factor determining the measures to be taken is the objective measurement of how far the ozone limits have been exceeded. To keep within the immission limits, VOC emissions must be reduced not merely by 55%, but by 70-80% (i.e. to a level of approximately 80 000 tonnes annually). This target was confirmed by the Federal Council in his report on the air pollution control measures taken by the Confederation and the cantons. (Bericht des Bundesrates über die lufthygienischen Massnahmen des Bundes und der Kantone vom 23. Juni 1999, 99.077). The tax provides an incentive to continue reducing emissions.

VOC, principally solvents, come from numerous different sources. They are used in many different branches of business and are contained in many products such as paints and varnishes, glues, and cleaning materials.

Target reducing VOC emissions to
the level of 1960

First stage reduction 55% VOC in 1984

3. System of collection

The VOC as chemicals will be taxed if they are imported into or manufactured within Switzerland. This system of collection means that VOC-containing products which are manufactured in Switzerland have already been taxed on the VOC they contain. Conversely, imported products which contain VOC must be taxed on import according to the quantity of VOC they contain (see Number 1.4 list of substances and products).

In principle, only quantities of VOC which are emitted should be taxed. Levying the tax on import and on production in Switzerland means that VOC which are not emitted into the environment, or those which are exported, are exempt (see 1.6, Exemption, refund and procedure for formal commitment).

4. List of substances and products

List of substances

All VOC which are subject to the tax are described individually in Appendix 1 of the Ordinance (list of substances). This list clarifies which VOC are subject to tax for any potential taxpayer, and for the enforcement authorities.

Essentially, there are many organic substances which correspond to the definition of a VOC. However, the list of substance contains only those used and emitted in quantities which might affect the environment, or where this risk exists.

List of products

According to the list of substances, VOC are also taxable when they are imported in VOC-containing products, which are given in the list of products (Appendix 2 of this Ordinance). On the import of these products, tax is levied on the VOC they contain.

Many of the products listed, such as cosmetics, contain only traces of VOC. Such quantities of VOC do not significantly pollute the environment in the sense of Article 35a Paragraph 2 of the LPE. Therefore, products which contain a maximum of 3 per cent VOC are exempt from the tax.

5. Rate of tax

The Ordinance sets a rate of Swiss francs 3/kg and outlines its stepwise introduction (Swiss francs 2/kg from 1 January 2000 to 31 December 2002, then Swiss francs 3/kg). The development of VOC emissions and the effect of the tax will be analysed periodically.

In parliamentary debates, a motion to withdraw the tax as soon as the target is reached was rejected. Without profound and lasting changes in the technology, a renewed increase in VOC emissions after withdrawal of the tax would be certain.

減免 退稅

6. Exemption, refund and procedure for formal commitment

預期

The Law and the Ordinance anticipate several conditions for exemption. As a rule, exemption is realised through a refund of the tax. Someone who exports, uses or treats large quantities of VOC in such a way that they are not emitted, or who, as a wholesaler, can prove a specified average minimum stock of VOC, may obtain VOC which is provisionally not subject to tax. These persons must however pay tax on the VOC which are not eliminated. 剔除

① 出口
② 使用或處理大量VOC，避免排放
③ 批發商

暫時

7. Exemption for emissions which have been reduced well below legal requirements

Under Article 35a Paragraph 4, the Federal Council may exempt from tax, VOC emissions which have been reduced well below legal requirements, to the extent of the additional costs incurred.

[illegible]

The present Ordinance anticipates that emissions from installations may qualify for tax exemption until the end of 2003 or 2008. To qualify for this, the VOC emissions from an installation must be reduced by at least 30% respectively 50% below the quantity permitted by the OAPC.

20-50

以[illegible]許可量

8. Enforcement

Except for the distribution of revenue from the tax and the regular review of the effect of the tax (which are the responsibility of SAEFL), the Federal Customs Administration is responsible for the implementation of the incentive tax. It collects the tax and is responsible for decisions on exemption and refund.

The cantons (cantonal air pollution services) support the Customs Administration in this implementation. In particular, they inspect the VOC balance sheets of firms which request a tax refund, or who are bound by the procedure for formal commitment. They also examine applications for refund under Article 35a Paragraph 4 of the Law. Through their enforcement of the OAPC, the cantonal air pollution services are usually familiar with the firms' operating conditions.

The Customs Administration alone makes decisions regarding exemption and refund of tax. Thus complaints against these decisions can be processed in a uniform legal way.

In addition, a commission of experts was set up, which will represent the various parties of interest (Confederation, cantons, business). This commission has a consultative function.

9. Distribution of revenue

The Law requires that the revenue be distributed equally between all members of the population. This also holds for the revenue from the incentive tax on the sulphur content of "extra light" heating oil. This tax has been collected since 1 July 1998 at a rate of Swiss francs 12 per 1000 kg of heating oil containing more than 0.1 percent of sulphur. Revenue from both taxes amounted to Swiss francs 150 M until the end of 2001 (the share of the revenue of the incentive tax on the heating oil is very small, around Swiss francs 800'000). From 2002, the total revenue is expected to be around Swiss francs 100 M to 140 M annually.

From 2003 there should therefore be a total of about Swiss francs 15-20 per capita to be distributed annually. Because of the modest size of the revenue, the Federal Assembly has decided against distributing part of it to industry.

For greatest cost effectiveness, distribution to the population will be carried out through the mandatory health insurance. The population is registered more completely by health insurance than by any other system. This method has been chosen because the cost of implementation is significantly lower than with other methods of distribution. Because this falls outside the usual remit of the insurers, they will be reimbursed for their administrative expenses.

This model is not equivalent to a subsidy of health insurance premiums. Health insurance is simply being used as an administrative channel. Premiums for basic insurance will not be affected by the distribution of tax revenue. To maintain transparency, the deduction must be shown clearly on insurance policies or accounts for premiums.

Research has shown that the cost of implementation by any other model would be disproportionately high compared with the modest payments to each person. Transferring these amounts by postal giro would cost about Swiss francs 10 million in administration per payment to the whole population. The addresses of those entitled to payments would still have to obtained from the health insurers. Payment through the cantonal tax authorities would also be costly and complicated, since it would be necessary to issue special regulations for tax-payers not subject to cantonal income tax (more than 10 per cent of taxpayers), and for those (around 5 per cent) who pay income tax at source (payment by postal giro, local or cantonal regulations for people who pay income tax at source).

VOC Emissions 2001

- around 130‘000 tons

- Target, to keep within the ozone immission levels: 80‘000 tons

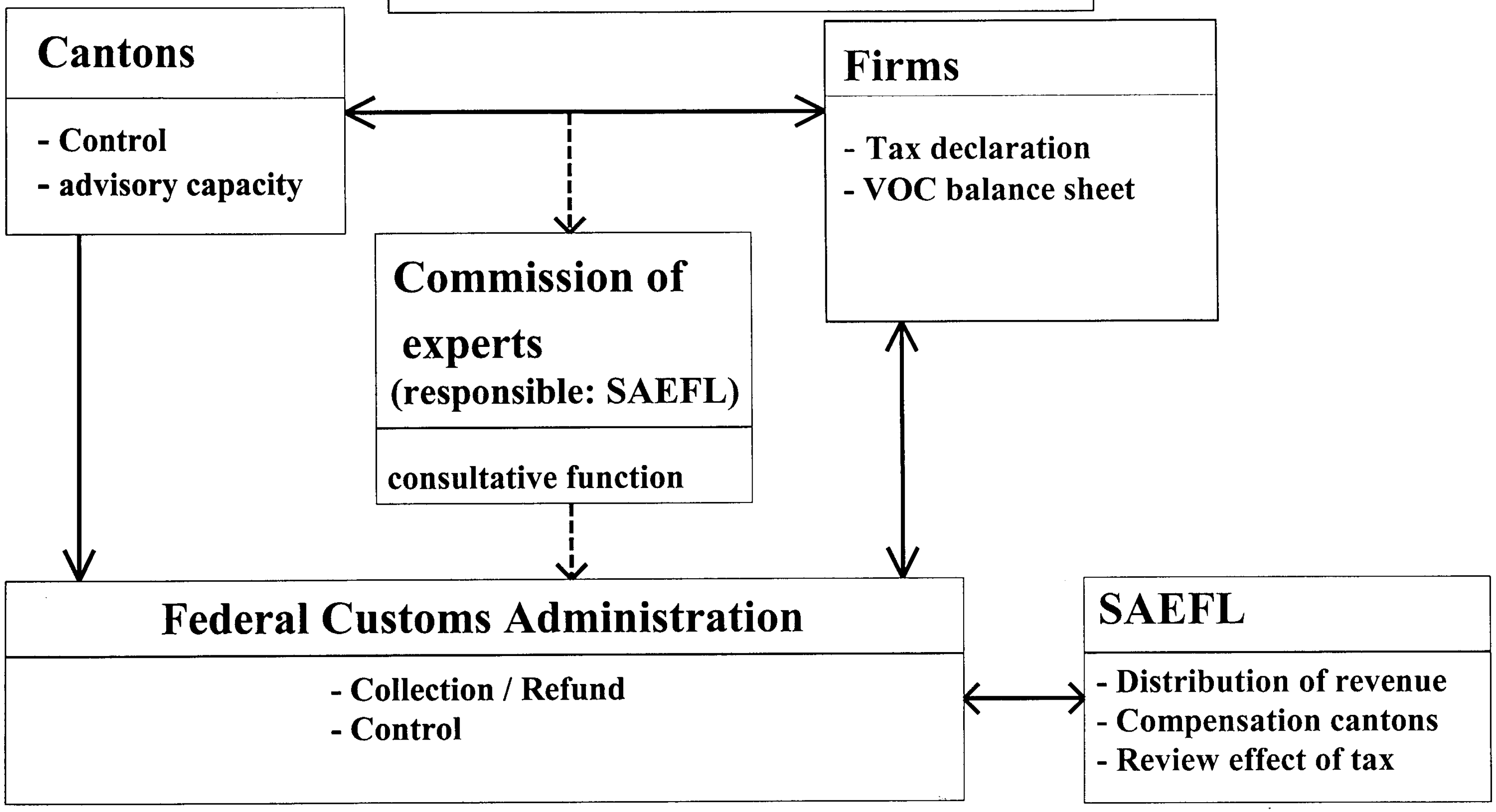
Regulatory framework

- Environmental Protection Law of 7 October 1983
- Ordinance on Air Pollution Control of 16 December 1985
- Ordinance on Incentive taxes on Volatile Organic Compounds of 12 November 1997

System of collection

- Tax is collected when VOC is imported or manufactured in Switzerland
- List of substances / List of products
- Rate of tax: Swiss francs 3/kg VOC

Enforcement of the incentive tax on VOC



Distribution of revenue

- Revenue: distributed equally between all members of population
- distribution through mandatory health insurance (cost effectiveness)
- 2003: Swiss francs 21.-/person

Exemption, refund

- Exemption realized through refund of tax
- VOC which are not emitted into the environment
- VOC that are exported
- VOC balance sheet

附件七：英國 2003 年 8 月臭氧污染事件分析報告

附件七：英國 2003 年 8 月臭氧污染事件分析報告

Air Pollution Forecasting: Ozone Pollution Episode Report (August 2003)

Andrew Kent, **netcen**
19/8/2003

INTRODUCTION

During the first half of August, the UK rural and urban air quality monitoring networks recorded ozone levels in the Defra HIGH band (90-180 ppb, 180-360 μgm^{-3}). Between 1st and 15th August, HIGH ozone levels were reported on 10 days and MODERATE concentrations (50-90 ppb, 100-180 μgm^{-3}) were reported on all 15 days. The highest concentration of the episode was 125 ppb (250 μgm^{-3}, index 8) which occurred on 11th August at Lullington Heath. In total, 38 sites reported HIGH concentrations during the episode and 78 sites in the network reported MODERATE concentrations. Concentrations remained in the LOW band at only 3 sites in the network during the period - London Marylebone Road, Bury Roadside and Edinburgh Centre. These are sites where high NO_x emissions are likely to 'scavenge' ozone, preventing the development of an episode.

Summer ozone episodes can be hard to neatly delimit because ozone levels are often in the MODERATE band during the summer season. This report covers the period 1st to 15th August because before and after this period the number of sites reporting MODERATE concentrations could be considered to be normal for the time of year. The purpose of this report is to detail the extent and duration of these elevated levels and to describe the weather situation and other causal factors that may have contributed to the event. The final data for the period of the event has yet to be ratified and all statistics and charts are based on provisional data as used in the actual forecasting process.

Table 1 shows the number of sites in MODERATE, HIGH and VERY HIGH bands for ozone on each day and lists the maximum exceedence concentration (hourly/ 8 hourly running mean, on which the ozone bandings are based). Table 2 provides details of each network site involved in the episode (those which reported MODERATE concentrations or above). The number of days on which MODERATE, HIGH and VERY HIGH concentrations were reported are presented for each site, along with the maximum exceedence concentration measured at each site. Figure 1 is a time series chart showing the changing hourly concentrations for a selection of sites that reported HIGH concentrations or above. There were too many sites reporting HIGH concentrations to meaningfully present all in a single graph. Therefore, the number of sites charted in figure 1 has been limited to those reporting the highest concentrations and which best represent each zone/ agglomeration. Figures 3 through 12 are four day back trajectory charts showing the forecast origin of air masses affecting the UK over the period.

A list of appropriate internet links has been compiled and is presented towards the back of this report. These provide web based access to news articles and press releases in the national press concerning the record temperatures and this highly publicised summer smog episode.

DEVELOPMENT OVER TIME

- The weather during the period was dominated by a persistent high pressure system which brought stable conditions to the whole of the UK. There were successive days of long hours of sunshine and high temperatures, highest in the south and east of the UK. This heatwave was forecast in advance by the Met Office and was highly publicised and temperature records were threatened. There was little change in the weather during the period of the episode. Cloudless skies over the whole of the UK were typical. Winds remained light throughout although the direction changed several times as the forecast air mass back trajectories (figures 3 through 12) show.
- Figure 3 illustrates that Saturday 2nd August saw clean Atlantic air masses affecting the UK from the west. However, despite the lack of abundant ozone precursors, the long hours of intense sunlight and associated rising temperatures did result in ozone levels rising into the MODERATE band at 17 sites, mostly in London and the south east.

- Sunday 3rd August saw continuing light westerly winds, as shown in figure 4. Ozone levels continued to rise, particularly in the south east and ozone entered the HIGH band at 3 sites, all in London, (Hillingdon reported an hourly concentration of 95 ppb, Brent reported 97 ppb and North Kensington reported 102 ppb). MODERATE levels of ozone were reported by 53 network sites on this day.

- The following day (Monday 4th August), clean air masses affecting Scotland and Northern Ireland were originating over the Atlantic without passing over any major sources of the ozone precursors. However, air affecting the whole of England and Wales were recirculating over the UK (figure 5), resulting in elevated concentrations in Wales, south west England and northern England. A total of 60 sites reported MODERATE concentrations. There were 5 sites reporting HIGH concentrations - Bottesford recorded an hourly concentration of up to 97 ppb, London Hillingdon recorded 93 ppb, and in the north of England Ladybower reported 92 ppb and Wigan Leigh reported 98 ppb. The highest concentration of 102 ppb was reported by Harwell. The instrument at Harwell was recently discovered to be over reading by as much as 15%. However, the instrument was replaced on 17th July as a result of this discovery. The data presented for Harwell in this report therefore is from a new analyser which is not over reading although the data remains provisional until final ratification is complete.

- The back trajectory for Tuesday 5th August (figure 6) shows that almost all of the UK is affected by air that has passed over significant land masses and associated pollution sources in the hours before measurement. Air originated over the UK and circulated over northern Germany and France before passing over the UK again from the south. Given the conditions and the modelled levels shown in the back trajectory, it might have been expected that this day would have seen the highest ozone levels of the episode to date. However, generally levels dipped on this Tuesday and only 3 sites (Bournemouth, Harwell and Yarner Wood) reported HIGH concentrations with 54 reporting MODERATE concentrations, a reduction from the previous day. Early week days have historically produced the fewest occurrences of HIGH ozone[1] because generated ozone levels are dependent on VOCs accumulated in the previous days, which tend to be lower over the weekends. Therefore it is not surprising that levels dipped on this Tuesday. The previous day (Monday) may also have seen more ozone than this Tuesday due to VOC contributions to the chemistry from the end of the previous week, before the weekend.

- A slight shift in the winds on Wednesday 6th August resulted in air masses passing over industrial heartland areas of Germany and France before arriving at the UK. These air masses, likely to have been abundant in hydrocarbons, were influencing southern and eastern England and Scotland. The rest of the UK was fed by cleaner air masses originating over south western France and the Bay of Biscay, as shown in figure 7. Incoming hydrocarbons from industrial Germany and France, coupled with the stable weather conditions, bright sunshine and high temperatures are likely to have combined to result in the dramatically increased ozone levels on 6th August compared with the previous day. There were 17 sites reporting concentrations in the HIGH band and 60 reporting MODERATE concentrations. All of the sites reporting HIGH concentrations were in London, the south east or midlands of England and the highest concentrations was 121 ppb, measured at London Brent.

- Over Thursday 7th and Friday 8th August, concentrations dropped again slightly. HIGH levels were measured at 4 sites (maximum hourly concentration of 105 ppb at Harwell) on 7th and 9 sites (maximum hourly concentration of 101 ppb at London Hillingdon) on Friday 8th August. Back trajectories for these days are provided in figures 8 and 9.

- The height of the episode occurred on Saturday 9th August with HIGH levels of ozone being reported across 26 sites and MODERATE levels at 69 sites. Most of the sites reporting HIGH concentrations were located in southern regions of the UK, particularly the south east, London and midlands. However, there was also a large number of sites reporting HIGH ozone in the north west of England including Glazebury, Liverpool Speke, Wigan Leigh, Blackpool and Preston. The highest concentration measured on this day was 120 ppb at Portsmouth. As shown by figure 10, air masses affecting the UK had passed over significant potential sources of VOCs from the continent prior to being measured in the UK. Saturdays typically report more HIGH ozone than early on in the week[1]. This is because the five previous days are likely to have resulted in an abundance of VOCs being accumulated throughout the working week which fuel the chemical reaction that results in ozone. Furthermore, it is likely that the characteristic reduction in NO_x emissions from road traffic over the weekends compared with the working week might have further exacerbated rising ozone levels on this day, particularly noticeable in urban areas.

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[1] Jenkin, M E, Davies, T J and Stedman, J R (2002) The origin and day-of-the week dependence of photochemical ozone episodes in the UK. Atmospheric Environment, 36, 999-1012

- From Sunday 10th August, the episode was beginning to decline and table 1 illustrates how the number of sites reporting HIGH concentrations fell to just 4 on 12th August. Trajectories shown in figures 11 and 12 show how the wind changed direction over this time to bring in clean Atlantic air into the UK from the north (figure 12). Despite this general decline in ozone concentrations, several notable points occurred during this period. Firstly, the highest ozone concentration of the episode was actually measured at this time - an hourly average of 125 ppb was recorded at Lullington Heath on 11th August (see tables 1 and 2 and figure 1). Secondly, as shown in the time series chart (figure 1) and in the more detailed chart (figure 2), there was a peak in ozone concentrations around midnight at sites in the south east. Being a photochemically derived pollutant, night time ozone peaks are normally a sign of a mechanical fault with the monitoring equipment. However, this trend was observed at several different stations which supports the argument that these levels were genuinely representative of the ambient conditions rather than the result of equipment failure. Thurrock recorded the highest concentration of 106 ppb at midnight on Sunday 10th August. Southend-on-sea and Rochester both reached their peaks at 23.00 on 10th, measuring 99 ppb and 97 ppb respectively. St. Osyth, London Brent and London Bexley each exhibited similarly unusually timed peaks although these were of a lower magnitude and occurred several hours earlier in the evening. This unusual trend is difficult to explain. The timing of these high levels in the late hours of August 10th dictates that ozone generation cannot be responsible in the absence of a photochemical mechanism. The most reasonable explanation therefore is that ozone levels recorded by these sites was generated elsewhere hours earlier and has subsequently drifted over south east England. The back trajectories (figures 11 and 12) show complex winds at this time. Wind direction changed from north easterly to due easterly for a few hours around midnight. This may have brought ozone rich air to some south easterly sites from the sea, where the night time loss mechanisms are much reduced relative to night time deposition to the land surface. Therefore, this strange night time ozone elevation is most likely the result of drifting ozone generated elsewhere during the daytime of Sunday 10th August.
- By Wednesday 13th August no sites in the network were reporting ozone HIGH ozone levels and MODERATE levels were only being recorded at 18 sites. Figure 13 shows the back trajectories for 14th August which was characteristic of the winds from this point onwards, bringing cleaner air with fewer ozone precursors to the UK.

DISCUSSION

The August 2003 episode was notable for a number of reasons, Duration, high temperatures and the highest ozone concentrations recorded in London for over a decade.

Duration

High (greater than 90 ppb, 100 µg m^{-3}) concentration of ozone were measured on 10 consecutive days, ozone episodes more typically last for 3-6 days. This was due to the sustained period of very hot weather. The Met Office website reports the following:

"During the summer of 1976, Heathrow had 16 consecutive days over 30 °C from 23 June to 8 July (their highest number of consecutive days above 30 °C). This year, Heathrow managed three consecutive days above 30 °C between 4 and 6 August 2003, and five consecutive days between 8 and 12 August 2003 (digital data records go back to 1949).

During the summer of 1976, Enfield had six consecutive days over 30 °C from 23 June to 28 June, and seven consecutive days between 2 July and 8 July. This year, Enfield has had ten consecutive maximum temperatures over 30 °C from 3 to 12 August 2003 (their highest number of consecutive days above 30 °C, using patchy digital records back to 1960's)."

High temperature

The highest temperature ever recorded in the UK was 38.1 C at Gravesend in Kent on 10 August 2003. Thus temperatures similar to or hotter than the summer of 1976 were recorded during 2003 but maximum hourly ozone concentrations in 2003 were approximately 50-60 % of those measured in 1976. This shows the significant reductions in ozone precursors between 1976 and 2003.

High ozone concentrations in London

The highest hourly mean ozone concentration recorded at sites in the national network in London during this episode was 121 ppb at Brent on Wednesday 6 August 2003. The highest concentration at sites in the LAQN was 131 ppb at Enfield Ponders End on the same day. This was the highest concentration measured in London since 1990. Table 3 lists the annual maximum of hourly average ozone concentrations in London for exceedences of 130 ppb since measurements commenced in the early 1970s. The highest concentration was 212 ppb at County Hall in 1976.

Ozone concentration in excess of 130 ppb were relatively frequent in the 1970s but rather less frequent in the 1980s ceasing after 1990. 1990 corresponds roughly with the peak in traffic NO_x emissions. Since 1990 emissions of both NO_x and VOC have declined. The high ozone concentration recorded in London during August 2003 were due to a combination of the very hot weather and the reductions in UK traffic NO_x emissions, which are now at similar levels to the early 1970s.

SUMMARY

- A persistent high pressure system was responsible for long hours of intense sunshine in all areas of the UK each day during the episode, resulting in record temperatures.
- Recirculating air over the UK and south easterly/ easterly winds during the episode supplied the UK with abundant ozone precursors, providing ideal conditions for ozone generation.
- The episode built over a couple of days (3rd to 6th August) before dipping slightly (7th and 8th August) and then subsequently peaking rapidly on 9th August. From 10th to 12th August the episode declined gradually until typical summer time levels were achieved on 13th.
- An interesting and unusual minor peak in levels occurred at several sites in SE England over night on 10th August. The reasons for this are complex but have been due to drifting ozone generated earlier in the day elsewhere in the UK or perhaps even on the continent.

LINKS

Below is a list of internet links to press articles, press releases and other sources of information concerning the high pollution levels associated with the August heatwave.

- An article from London's Evening Standard:

  'Heat brings smog danger'
  Victoria Fletcher, Consumer Correspondent
  Dated 7th August 2003
  http://www.thisislondon.co.uk/news/articles/6123729?source=Evening%20Standard

- An article from The Daily Telegraph:

  'Heat brings worst smog for 10 years'
  Graham Tibbetts
  Dated 8th August 2003
  http://www.telegraph.co.uk/news/main.jhtml?xml=%2Fnews%2F2003%2F08%2F08%2Fnsmog08.xml

- An article from The Times:

  'Smog clouds the picture as heatwave turns toxic'
  Patrick Barkham
  Dated 8th August 2003
  http://www.scientific-alliance.org/news_archives/climate/smogcloudsthe.htm

- A press release from Friends of the Earth:

  'Smog Smashes Health Limits in Summer Scorcher'
  Dated 12th August 2003
  http://www.foe.co.uk/resource/press_releases/smog_smashes_health_limits.html

Table 1 – Ozone concentrations by date and band

Date	Number of MOD sites	Number of HIGH sites	Number of V HIGH sites	Maximum exceedence (ppb)
01/08/03	1		-----	50
02/08/03	17		-----	66
03/08/03	53	3	-----	102
04/08/03	60	5	-----	101
05/08/03	54	3	-----	99
06/08/03	60	17	-----	121
07/08/03	51	4	-----	105
08/08/03	63	9	-----	101
09/08/03	69	26	-----	120
10/08/03	59	10	-----	115
11/08/03	31	13	-----	125
12/08/03	37	4	-----	114
13/08/03	18		-----	72
14/08/03	6		-----	61
15/08/03	15		-----	77

Table 2 – Ozone concentrations by band and duration

Site	Number days MODERATE	Number days HIGH	Number days VERY HIGH	Maximum hourly/ 8 hourly mean mean (ppb)
London Brent	13	7	-----	121
London Hillingdon	12	7	-----	105
Harwell	12	7	-----	119
Rochester	11	6	-----	113
Thurrock	12	5	-----	111
Southend-on-Sea	11	5	-----	108
Wigan Leigh	8	4	-----	110
Bottesford	12	3	-----	102
London Bexley	12	3	-----	103
London Teddington	12	3	-----	111
Bournemouth	12	3	-----	115
Portsmouth	12	3	-----	120
St Osyth	11	3	-----	109
London Westminster	11	3	-----	112
Lullington Heath	10	3	-----	125
Northampton	12	2	-----	113
Yarner Wood	11	2	-----	99
Southampton Centre	11	2	-----	113
Birmingham East	10	2	-----	91
Coventry Memorial Park	10	2	-----	93
London Bloomsbury	8	2	-----	90
Cwmbran	12	1	-----	95
Leicester Centre	12	1	-----	102
Wicken Fen	12	1	-----	113
Leamington Spa	11	1	-----	90
Ladybower	11	1	-----	92
Sibton	11	1	-----	93
Bolton	10	1	-----	95
Weybourne	9	1	-----	91
Liverpool Speke	8	1	-----	91
Sandwell West Bromwich	8	1	-----	93
Glazebury	8	1	-----	94
Plymouth Centre	8	1	-----	95
Blackpool	8	1	-----	106

Site	Number days MODERATE	Number days HIGH	Number days VERY HIGH	Maximum hourly/ 8 hourly mean mean (ppb)
Swansea	7	1	-----	91
Salford Eccles	5	1	-----	96
Preston	4	1	-----	94
London N. Kensington	4	1	-----	97
Somerton	11	-----	-----	77
Norwich Centre	10	-----	-----	77
Port Talbot	10	-----	-----	86
Manchester Piccadilly	9	-----	-----	77
Hull Freetown	8	-----	-----	63
High Muffles	8	-----	-----	65
Aston Hill	8	-----	-----	74
Cardiff Centre	8	-----	-----	82
Redcar	7	-----	-----	59
Middlesbrough	7	-----	-----	63
Strath Vaich	7	-----	-----	73
Exeter Roadside	7	-----	-----	75
Great Dun Fell	7	-----	-----	78
Narberth	7	-----	-----	79
Wolverhampton Centre	7	-----	-----	84
Bristol Centre	6	-----	-----	70
Manchester South	6	-----	-----	75
Leeds Centre	5	-----	-----	59
Bradford Centre	5	-----	-----	63
Nottingham Centre	5	-----	-----	63
Sheffield Centre	5	-----	-----	63
Eskdalemuir	5	-----	-----	64
Stoke-on-Trent Centre	5	-----	-----	66
Newcastle Centre	4	-----	-----	52
London Southwark	4	-----	-----	55
Barnsley Gawber	4	-----	-----	61
Bush Estate	4	-----	-----	61
Rotherham Centre	4	-----	-----	63
London Haringey	4	-----	-----	67
Belfast Centre	4	-----	-----	69
London Eltham	3	-----	-----	48
London Lewisham	3	-----	-----	53
London Hackney	3	-----	-----	54
Glasgow Centre	3	-----	-----	62
London Wandsworth	2	-----	-----	53
Wirral Tranmere	2	-----	-----	53
Lough Navar	2	-----	-----	63
Derry	2	-----	-----	71
Aberdeen	1	-----	-----	46
Birmingham Centre	1	-----	-----	64

N.B - In tables 1 and 2, in cases where levels progress through the MODERATE band and into the HIGH band over the course of a day, the occasion is counted in both the MODERATE and HIGH categories.

Table 3 Annual maximum of hourly mean ozone concentrations for exceedences of 130 ppb in London.

Year	Site	Ozone concentration (ppb)
1973	Central London	136
1974	Central London	164
1975	County Hall	171
1975	Teddington	140
1976	Central London	144
1976	County Hall	212
1976	Hainalt	175
1976	Teddington	211
1976	St Bartholomews	203
1977	London Canvey	179
1978	Central London	149
1978	Teddington	157
1978	London Canvey	147
1979	County Hall	153
1979	Kew	156
1979	London Harrow	180
1984	Chigwell	160
1985	Central London	149
1986	County Hall	130
1990	Teddington	141
2003	Enfield	131

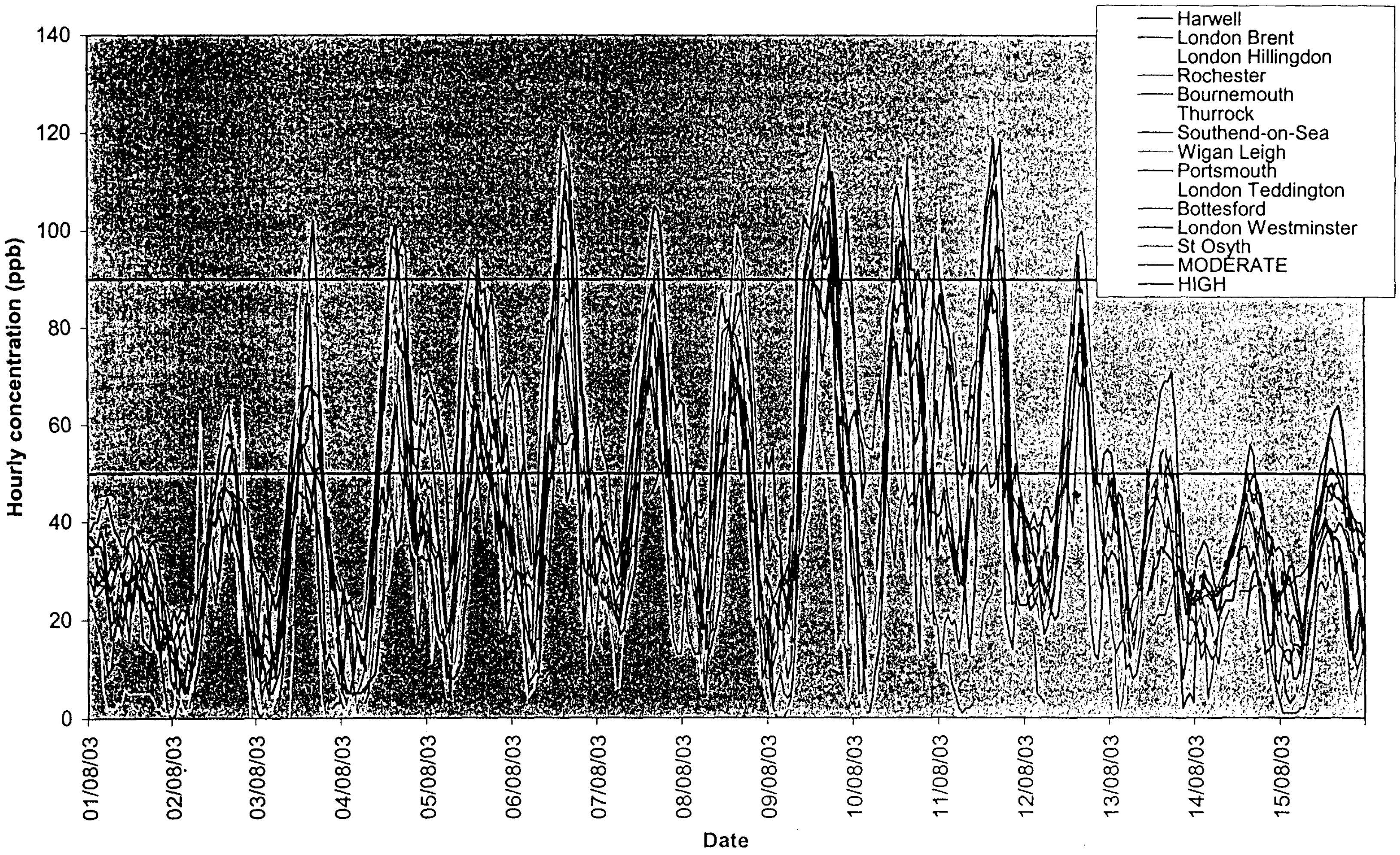

Figure 1 – Hourly ozone concentrations at a selection of sites which reported the highest concentrations over the episode

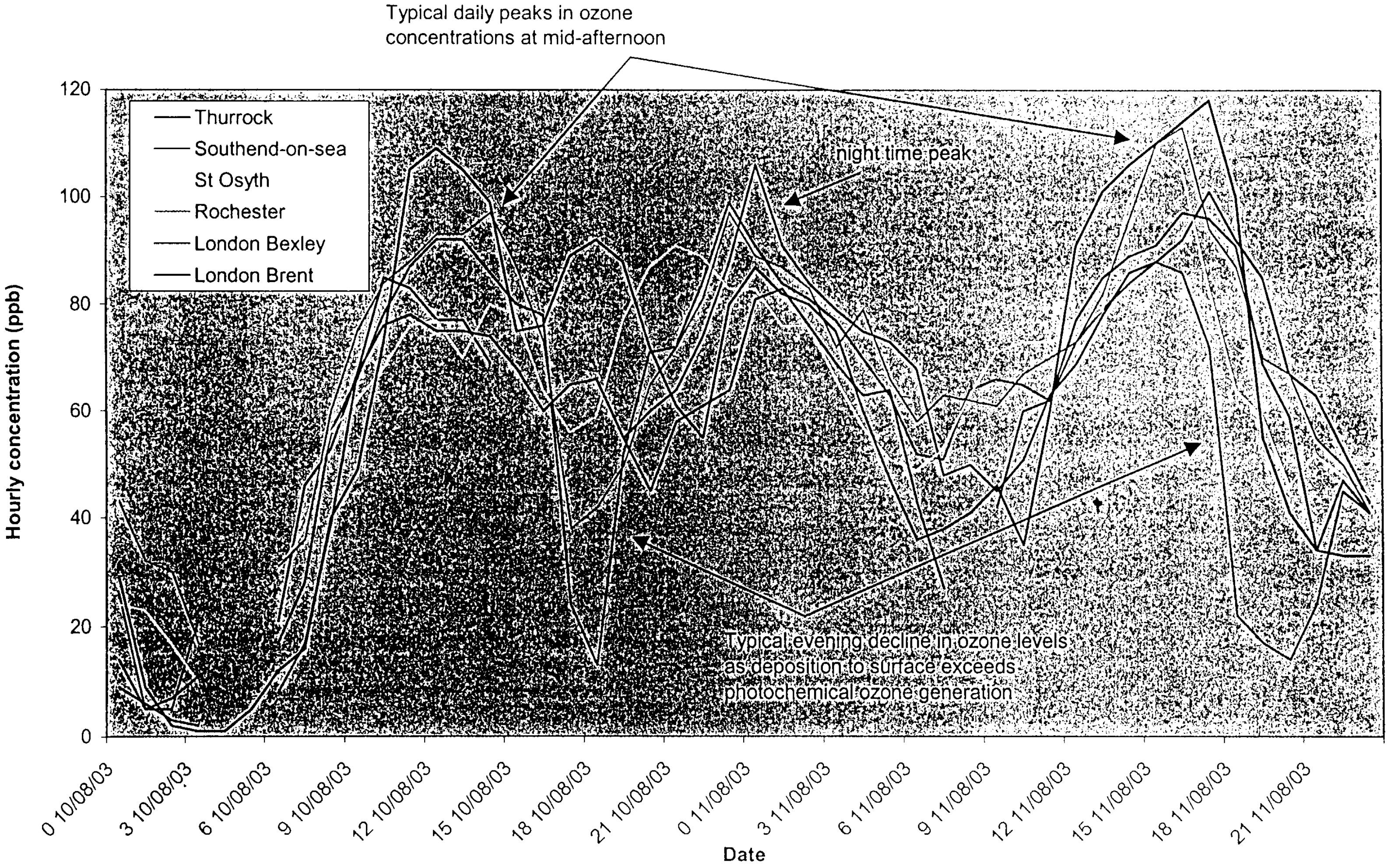

Figure 2 – Hourly concentrations at sites in SE England which recorded a night time peak between 10th and 11th August

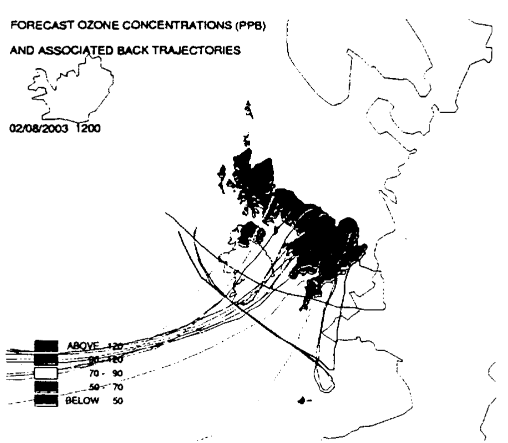

Figure 3 – Four day forecast back trajectories UK, 2nd August 2003

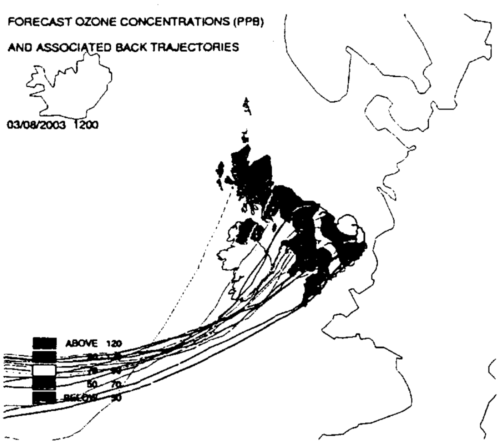

Figure 4 – Four day forecast back trajectories UK, 3rd August 2003

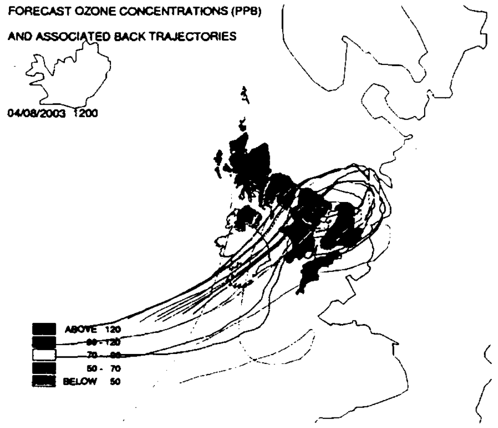

Figure 5 – Four day forecast back trajectories UK, 4th August 2003

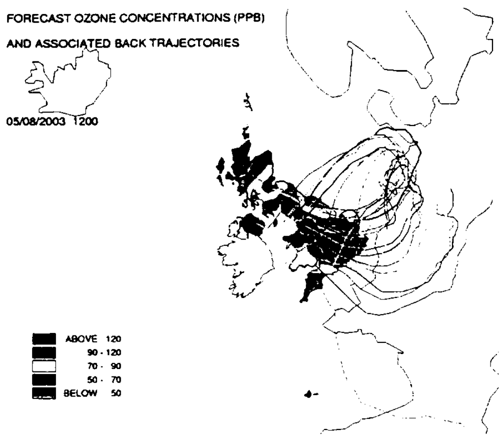

Figure 6 – Four day forecast back trajectories UK, 5th August 2003

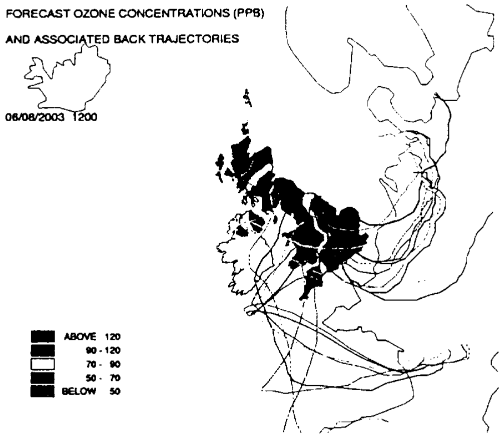

Figure 7 – Four day forecast back trajectories UK, 6th August 2003

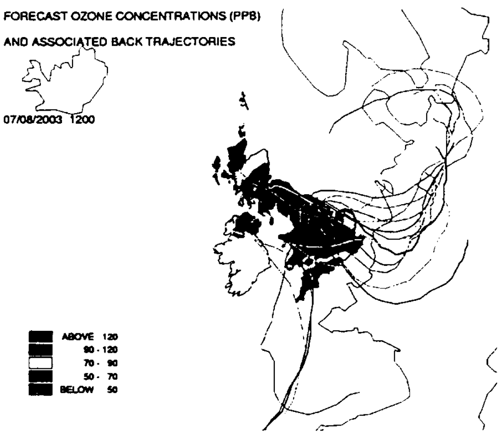

Figure 8 – Four day forecast back trajectories UK, 7th August 2003

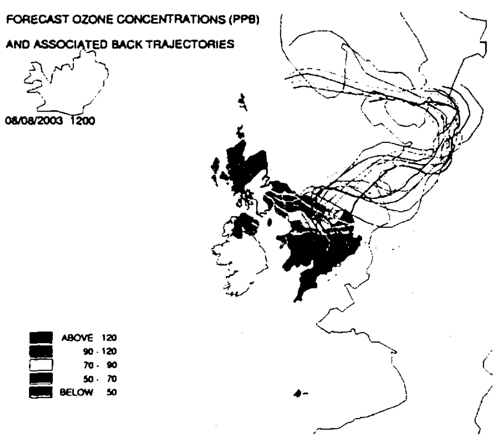

Figure 9 – Four day forecast back trajectories UK, 8th August 2003

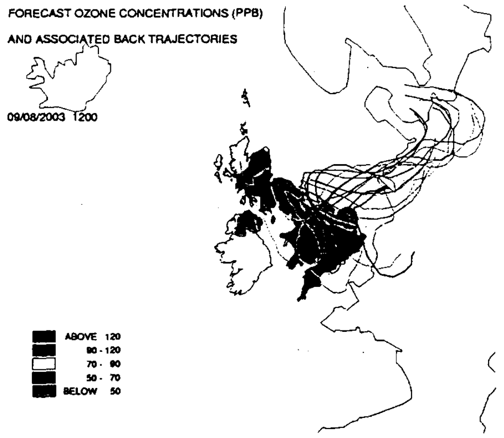

Figure 10 – Four day forecast back trajectories UK, 9th August 2003

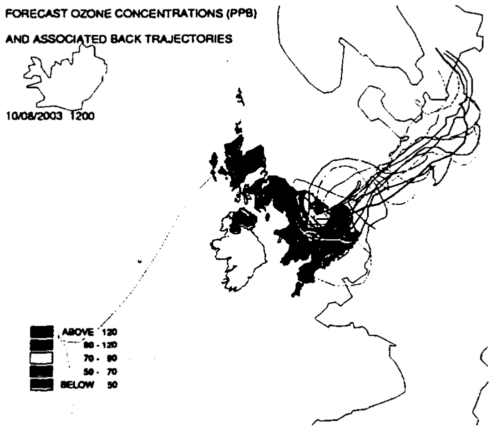

Figure 11 – Four day forecast back trajectories UK, 10th August 2003

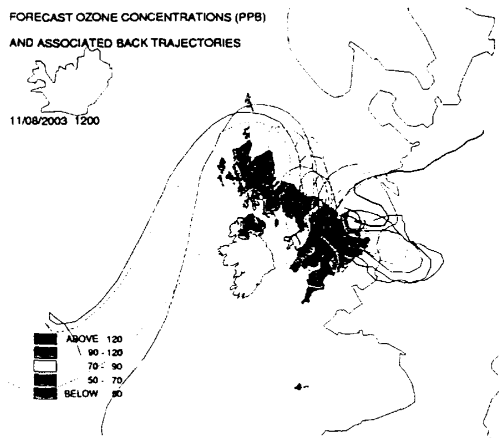

Figure 12- Four day forecast back trajectories UK, 11th August 2003

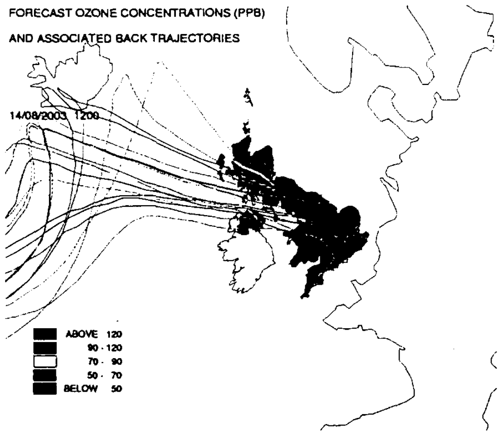

Figure 13 - Four day forecast back trajectories UK, 14th August 2003

附件八：英國對於歐盟溶劑排放公約之執行指南

附件八：英國對於歐盟溶劑排放公約之執行指南

GUIDANCE NOTE FROM THE DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS AND THE NATIONAL ASSEMBLY FOR WALES ON THE IMPLEMENTATION OF THE SOLVENT EMISSIONS DIRECTIVE

This note gives guidance on the Directions issued on 22 March 2002 under Pt I Environmental Protection Act 1990 and the Pollution Prevention and Control Regulations 2000 in order to implement EU Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations. This is referred to as the Solvent Emissions Directive (SED)[1].

Background

1. The SED has been transposed for certain activities within its scope through Directions under Pt I of the Environmental Protection Act 1990 and the Pollution Prevention and Control Regulations 2000.

2. The aim of the SED is to prevent or reduce the direct and indirect effects of emissions of volatile organic compounds (VOCs) into the environment, mainly into air, and the potential risks to human health, by providing measures and procedures to be implemented for the activities defined in Annex I of the SED (set out in Part II to Schedule 1 of both Directions), in-so-far as they are operated above the solvent consumption thresholds listed in Annex IIA of the SED(set out in Parts III and IV to Schedule 1 of both Directions). The list of sectors covered, thresholds and emission limit values specified in the SED is attached in Appendix 1 to this note.

3. Activities within the scope of the Directions, are those listed in the SED and either regulated under Pt I of the Environmental Protection Act (EPA) 1990 or the Pollution Prevention and Control (PPC) Regulation 2000. The Directions require regulators to include conditions in EPA authorisations or PPC permits to meet the additional SED requirements. The technical requirements will be outlined in the relevant Technical or Process Guidance Notes which are currently being revised to take account of the new requirements of the SED.

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[1] Council Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations.
The full text of the Directive can be found at http://europa.eu.int/eur-lex/en/lif/dat/1999/en_399L0013.html

This guidance is for:

- regulators: who must have regard to the guidance in Technical or Process Guidance Notes when determining applications and reviewing existing authorisations and permits,
- operators: who are advised also to have regard to it when making applications, and in the subsequent operation of their process,
- members of the public: who may be interested to know how the Government has transposed the Directive.

4. This guidance describes the main provisions of the SED and sets out the views of the Secretary of State for the Department for Environment, Food and Rural Affairs (DEFRA) on how it should be applied and certain terms interpreted. This guidance explains the main legal provisions of the SED, but the precise requirements can only be determined by referring to the Directions themselves.

Timeframe for complying with the SED Directions

5. New installations are required to meet the SED requirements before they are put into operation.

6. However, where a new installation has received an authorisation or permit before 22 March 2002, it is required to meet the SED requirements no later than 22 July 2002.

7. Existing installations have until the 31 October 2007 to fully meet SED requirements.

8. If an existing installation undergoes a substantial change on or after 1 April 2001 then that part which has undergone the substantial change must be treated as a new installation and meet the SED requirements from the date that the authorisation or permit is varied (unless the operator satisfies the exception and the whole installation can be treated as an existing installation – see paragraph 9 below). It is only the SED part of the installation undergoing the substantial change, which is to be treated as a new installation.

9. Where that substantial change was made on or after 1 April 2001 but before 22 March 2002, the substantially changed part is required to meet the SED requirements no later than 22 July 2002.

10. If the total emissions of the **whole** installation do not exceed those that would have resulted had the substantially changed part been treated as a new installation, the whole installation may be treated as an existing installation (see paragraph 6 for the timeframe for compliance).

11. Operators who opt for the reduction scheme must notify the regulator in writing by 31 October 2005.

12. For installations not using the reduction scheme, any VOC abatement equipment installed after 1 April 2001 must comply with the emission limit values in the SED. Where such equipment has been installed before 22 March 2002, the SED requirements must be met no later than 22 July 2002.

13. Operators can opt to comply with the SED earlier if, for instance, they wish to have the SED requirements included in their new permits as they are phased into the new PPC regime. Regulators should not require compliance earlier than is specified in the Directions unless earlier compliance is envisaged in the Technical or Process Guidance Notes or the regulator judges earlier compliance to represent BATNEEC or BAT in the particular case.

14. Regulators must include specific conditions in the authorisations or permits so as to ensure the activity is operated in accordance with the requirements of the SED.

Definitions

15. The meaning of "installation", "existing installation", "small installation" and "substantial change" are as defined in the SED as follows:

- "**Installation**" means a stationary technical unit where one or more activities within the scope of the SED are carried out and any other directly associated activities, which have a technical connection with the activities carried out on that site and which could have an effect on emissions.
  - Whilst this is effectively the same definition as in the Integrated Pollution Prevention and Control regime,[2] the definition of an associated activity is limited only to those that have an effect on VOC emissions from the installation. This is because under the SED an emission is defined as any discharge of volatile organic compounds from an installation into the environment.

- "**Existing installation**" means an installation in operation or, in accordance with legislation existing before 1 April 2001, an installation which is authorised or registered or, in the view of the competent authority, the subject of a full request for authorisation, provided that the installation is put into operation no later than 1 April 2002.
  For the purposes of the directions, this includes an installation:
    that is authorised or permitted under EPA or PPC and in operation before 1 April 2002; or for which the regulator is in receipt of a full valid application before 1 April 2001for either an authorisation or a permit in accordance with the EPA or PPC regimes, so long as it is put into operation before 1 April 2002.

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[2] "Integrated Pollution Prevention and Control, A Practical Guide", (copies are available free of charge from DEFRA Publications Unit, Admail 6000, London SW1A 2XX 08459 556000 or the DEFRA website at http://www.defra.gov.uk/environment/ppc/ippcguide/index.htm)

- **“Small Installation”** means an installation which falls within the lower threshold band of items 1,3,4,5,8,10,13,16 or 17 of Annex IIA of the SED or for the other activities of Annex IIA which have a solvent consumption of less than 10 tonnes/year.

- “**New installation**“ is not defined in the SED. However, any installation that does not come within the definition of an existing installation is a new installation.

- “**Substantial change**” is defined specifically in the SED and this definition overrides the EPA and PPC definitions for SED purposes:

  Substantial change shall mean:
  a) – for installations falling within the scope of the IPPC Directive, the definition specified in that Directive – which is:
  - a change in operation which, in the opinion of the competent authority, may have significant negative effects on human beings or the environment;

  b) – for small installations:
  - a change of the nominal capacity leading to an increase of emissions of volatile organic compounds of more than 25%; or
  - any change that may have, in the opinion of the competent authority, significant negative effects on human health or the environment is also a substantial change.

  c) for all other installations:
  – a change of the nominal capacity leading to an increase of emissions of volatile organic compounds of more than 10%; or
  – any change that may have, in the opinion of the regulator, significant negative effects on human health or the environment is also a significant change.

  Nominal capacity is defined in the SED as the maximum mass input of organic solvents by an installation averaged over one day, if the installation is operated under conditions of normal operation at its design output.

Compliance for new installations

16. Where a regulator deals with an application for a new installation specific conditions must be included in the authorisation or permit when granted to ensure compliance with the SED requirements.

17. Where an authorisation or permit has been granted after 1 April 2001, but before the 22 March 2002, that authorisation or permit will need to be varied by 22 July 2002 to incorporate the requirements of the SED. Regulators should advise operators of any proposed changes required to meet the SED before the variation is issued.

18. Where part of an installation is to be treated as a new installation following a substantial change, the specific conditions must be included in the authorisation or permit when varied. Where the change was made on or

after 1 April 2001 but before 22 March 2002, regulators will need to vary the authorisation or permit no later than 22 July 2002.

19. Permitting of all new installations and substantial changes must be in line with the standards and requirements of the SED. Where there are any differences or conflicts between what is required under the Directions and what is BAT or BATNEEC as specified in the Technical or Process Guidance notes, the former should be taken to apply, except regard should be had to the guidance notes to the extent that they envisage standards additional to or more stringent than the SED.

20. If an activity is identified as operating without an authorisation when it should have had one under EPA or PPC, then that activity **MUST** be treated as a new installation.

Compliance for Existing processes/installations

21. The deadline for complying with the SED requirements for existing processes or installations is no later than 31 October 2007.

22. However if an operator of an installation wants to opt to use a "reduction scheme", they must notify the regulator of this in writing by 31 October 2005. Annex IIB of the SED (Schedule 3 to both Directions) gives details of time periods for achieving emission limits where a reduction scheme is used for the relevant industry sectors.

23. Article 5.11 of the Directive provides for exemption from emission limit values until 1 April 2013 for existing installations using existing abatement equipment provided the following conditions are met:

    - Existing installations which operate existing abatement equipment and comply with the following emission limit values:

    - 50 mg CN/m³ in the case of incineration,
    - 150 mg CN/m³ in the case of any other abatement equipment,

    shall be exempt from the waste gases emission limit values in the table in Part III of Schedule 1 to both Directions for a period of 12 years from 1 April 2001, provided the total emissions of the whole installation do not exceed those that would have resulted had all the requirements of the table been met.

24. However, if an existing installation, not using the reduction scheme, wants to install any new abatement equipment after the 1 April 2001, it must ensure that the emissions from that new abatement equipment meet the emissions limits outlined in Annex IIA of the Directive (Part III to Schedule 1 in both Directions). Where new abatement equipment has been already been installed (ie after 1 April 2001 but before 22 March 2002), it must meet the SED emissions limits by 22 July 2002. Abatement equipment includes end of pipe technology such as the installation of an incinerator, condenser or bio-scrubber.

25. Existing installations which use substances or preparations containing volatile organic compounds that are classified as **carcinogenic**, **mutagenic** or **toxic to reproduction**, and which carry specified risk phrases, have to take steps to replace them, as far as possible, with less harmful substances and preparations within the shortest possible time (see paragraph 33 below).

26. It should be noted that the SED introduces a specific definition of a volatile organic compound (VOC). Under the SED, VOCs include substances that are volatile at room temperature and under their conditions of use – such as when heat is applied during a process.

27. A summary of the implementation timetable is given in Appendix 2.

General Requirements:

28. The specific requirements for compliance with the SED are found in the Directions. Specialist guidance will be made available in the revised Process or Technical Guidance Notes for each of the industry sectors affected.

29. New installations, new abatement equipment (where the reduction route for compliance is not used) and substantial changes to existing activities which do not fulfil the exemption outlined in paragraph 9 will have to meet the SED's requirements from the 22 March 2002.

30. Unchanged existing authorised activities (or activities where there has been a change that is NOT a substantial change) will have until 31 October 2007 to fully comply if using the Emission Limit Values compliance route.

31. In general, activities operated above the solvent consumption threshold will need to either:
    - meet an emission limit value in waste gases (mg/CN m^3) and a fugitive emission limit value (percentage of solvent use); or
    - meet the total emission limit value; or
    - implement a solvent reduction scheme to reduce emissions from the installation equal to those that would be achieved by meeting the total emission limit value.

NB: The reduction scheme cannot be used for certain R phase compounds.

32. There are stricter requirements for those activities using potentially more harmful substances such as halogenated VOCs which are assigned the risk phrase R40 or VOCs carrying the risk phrases R45, R46, R49, R60, R61. (The text of the R phrases is given in Appendix 3 to this document). See paragraph 33 for more information.

33. The SED (Schedule 2 paragraph 2 to both Directions) gives discretion to the competent authority to adopt different emission limits or exempt an installation from complying with a specific emission limit value if, for example, the Directive requirements are demonstrated not to be technically and economically feasible provided that the significant risks to human health

or the environment are not expected. The Department expects the Directive's emission limits to be applied in all but a few exceptional cases, specifically where the activities cannot be carried out in contained conditions such as the coating of constructional steel, railway carriages, aircraft and boats. Any such alternative measures would need to be clearly justified and approved by the competent authority. The operator must demonstrate to the satisfaction of the regulator that the best available technique is being used and that there are no significant risks to human health or the environment. The Regulator must notify the Department for Environment, Food and Rural Affairs of any cases where the emission limits are not applied before the permit is issued giving full justification for granting the application for the derogation.

Halogenated VOCs and substances classified as carcinogenic, mutagenic or toxic to reproduction

34. Where an activity uses certain harmful substances such as halogenated VOCs which are assigned the risk phrase R40 or substances or preparations containing VOCs that are classified as carcinogenic, mutagenic or toxic to reproduction and which carry the risk phrase R45, R46, R49, R60 or R61, the SED sets out further controls that need to be met. Conditions must be included in authorisations and permits to:

- ensure compliance with emission limit values in the shortest possible time;
- control emissions under contained conditions as far as technically and economically feasible to safeguard public health and the environment;

and additionally, for substances classified as carcinogenic, mutagenic or toxic to reproduction and which carry the risk phrase R45, R46, R49, R60 or R61:

- work towards substituting the substance within the shortest possible time.

35. Where the mass flow of the sum of the compounds causing the labelling R40 is 100g/h or more, an emission limit value of 20 mg/m^3 of the mass sum of the individual compounds shall be complied with.

36. Where the mass flow of the sum of the compounds causing the labelling R45, R46, R49, R60 or R61 is 10g/h or more, an emission limit of 2mg/m^3 of the mass sum of the individual compounds shall be complied with.

Substitution within the shortest possible time

37. The SED requires existing installations using the compounds or substances classified as carcinogenic, mutagenic or toxic to reproduction and which carry the risk phrases R45, R46, R49, R60 or R61 to substitute these substances and preparations in the shortest possible time. Regulators should request operators of these installations to submit a timetable for the substitution. The timetable should be submitted no later than 22 March 2003.

38. Where a substance or preparation is reclassified, regulators should request operators to submit a timetable for the substitution of that substance or preparation in the shortest possible time. Such request should be made within one year of the reclassification.

39. Where regulators are satisfied that the timetables will achieve substitution within the shortest possible time, they should vary the authorisations or permits to incorporate them.

40. Regulators need to consider the time needed for substitution and whether to require compliance with emission limit values within the shortest possible time as an interim measure. Where substitution is not currently technically or economically feasible, compliance with emission limit values must be within the shortest possible time.

41. Operators need to demonstrate to the satisfaction of the regulator that they have taken steps to substitute these harmful substances in the shortest possible time. In determining the shortest possible time, the operator will need to justify their timetables taking account of the technical or economic feasibility of the substitution. In identifying the use of substitutes, operators and regulators must consider :

- Fitness for use;
- Potential effects on human health;
- Potential effects on the environment; and
- The economic consequences, in particular the costs and benefits of the options available.

42. Regulators and operators should also take into account any guidance issued in the relevant PG notes or technical guidance notes and by the European Commission.

Regulating two or more activities on a site

43. Some sites may operate two or more activities in the one installation. Where different activities take place the SED only applies to those that fall within its scope (see paragraph 3). Unless the activities are technically connected, only the solvent consumption of the activity within the scope of the SED counts towards the threshold in determining whether the installation falls within the scope of the SED or not.

44. Directly associated activities i.e. those which have a technical connection which could have an effect on the discharge of VOCs from the installation must be taken into account when determining whether the installation is within the scope of the SED. This could include, for instance, storage tanks used for storing solvents on site. Further guidance on defining technically connected activities is given in Integrated Pollution Prevention and Control - a Practical Guide (see footnote 2).

45. Technically connected solvent activities carried out within the same installation will form part of the main activity and have to meet the requirements and waste gas emission limits of that activity unless it falls within a separate activity (Annex I of the SED as set out Part II to Schedule 1 of both Directions) and meets the solvent consumption threshold (in Annex IIA of the SED as set out in Parts III and IV to Schedule 1 of both Directions). In that case it should be regarded as an additional activity within a single installation.

46. Where two or more of the activities in Annex I of the SED are carried out, each of which exceeds the thresholds in Annex IIA of the SED, it may be advantageous to treat them together as if they were one activity. This is permitted, as long as the solvent emissions of the whole installation do not exceed those that would have resulted if each activity had individually been treated according to the SED.

Example:
A printworks carries out continuous coating operations using 5 tonnes or more of solvent. The coating and any associated printing on the same article should be regarded as part of the coating installation. If additional printing that does not involve continuous coating is carried out and is technically connected to the coating activity then that forms part of the installation, if it uses less than 15 tonnes of solvent. If it uses 15 tonnes or more, it should be regarded as a separate printing activity as defined within the SED. If additional printing is carried out within the same installation, which is not technically connected to the coating activity, that additional printing should be regarded as a separate activity and assessed separately to see if it meets the SED threshold. If so, it is treated as a separate SED activity.

47. An installation carrying out both food and non-food contact coating, for instance, could comply with two different reduction schemes. In such a case the operator will need to assess the emissions from each activity separately. If it is not possible to split the emissions from each activity, then the more stringent limit applies. However, if the emissions cannot be split because the contribution from the non-food contact coating was sufficiently small that it could not be identified separately, a *de minimis* rule may be applied and the contribution to the total emissions from the non-food contact coating process be ignored.

48. It is not possible to use the approach set out in paragraph 45 in relation to certain volatile organic compounds with risk phrases R45, R46, R49, R60, R61 and halogenated volatile organic compounds with a risk phrase R40. They must meet the requirements specified for each activity individually (see paragraph 33).

The solvent management plan (Schedule 4 to both Directions)

49. Each operator must compile an annual Solvent Management Plan. This can usefully coincide with the annual stocktaking requirements. The purpose of

the plan is to demonstrate compliance with the requirements of the SED as specified in paragraph 16 to Schedule 2 to the Directions.

50. It should be noted that solvent consumption for the purposes of determining whether an activity meets the threshold is **not** the same as solvent consumption for the purposes of demonstrating compliance with the SED. For clarity therefore, solvent consumption to demonstrate compliance is referred to as **'actual solvent consumption'**. For the purposes of demonstrating compliance with the SED, such plan needs to be compiled on an annual basis.

51. The details of the Solvent Management Plan will depend on the route chosen by the operator to comply with the requirements of the SED. Schedule 3 to both Directions gives guidance on carrying out of the plan.

52. In the case of an installation using the reduction option, actual solvent consumption may be calculated as follows: quantity of organic solvents input into the process less organic solvent contained in preparations recovered for reuse other than in the activity, save for solvent contained in preparations intended for commercial sale. A parallel exercise should also be carried out to determine solids used in coating in order to derive the annual reference emission and target emission each year.

53. For installations where two or more activities are carried out, each of which exceeds the threshold in Annex IIA of the SED, the Solvent Management Plan should be compiled to determine total emissions from all activities concerned. That figure should then be compared with the total emissions that would have resulted had the requirements of Annex II of the SED been met for each activity separately.

54. The total emissions are defined as the sum of the fugitive emissions and emissions in waste gases. The waste gases are the contained emissions from a stack or abatement equipment into the air. Fugitive emissions include uncaptured emissions released into the outside environment via doors, windows, vents and similar openings. Venting from a storage tank for instance would be considered a fugitive emission.

Monitoring and reporting

55. In addition to submitting an annual Solvent Management Plan, operators using the emission limit values option must demonstrate to the regulator once a year or on request that the emissions comply with the requirements of the Directive. Where the emission is abated and is more than 10kg/h (as carbon), emissions must be monitored continuously for compliance. This can include surrogate measurements such as monitoring the operating temperature or CO emissions from incinerators.

56. If compliance with emission limit values is achieved without the use of abatement equipment, continuous monitoring is not required. However

operators must still supply the regulator once a year or on request with data that enables the regulator to verify compliance with the Directive.

Non compliance

57. Enforcement action for non-compliance may be taken under the relevant powers under Pt I EPA '90 or the PPC Regulations 2000.

58. The Directive specifically states that where the requirements of the SED have been breached:
    a) the operator must inform the regulator and take measures to ensure that compliance is restored within the shortest possible time;
    b) in cases of non compliance causing immediate danger to human health the operator must suspend the activity.

Public access to information

59. Construction of inventories of materials consumed and disposed of for the Solvent Management Plan may involve the identification of individual solvents or solids. This may give rise to an issue of commercial confidentiality. Information supplied as part of the Solvent Management Plan must be placed on the public register, unless exclusion has been granted on the grounds of commercial confidentiality or national security. The rules applying to commercial confidentiality are the same as those that apply under the existing regimes. These are explained in Integrated Pollution Prevention and Control – a Practical Guide see footnote 2).

60. In determining whether the information should be withheld from public registers for reasons of commercial confidentiality, operators and regulators should consider whether inclusion of the information would prejudice to an unreasonable degree the commercial interests. It should take account of both the extent of any damage that might be caused and the likelihood of such damage in fact being caused. Consideration should also be given to any benefits to the public interest that would arise from inclusion of the information in question and whether the information might enable the public to be better informed of the likely environmental impact of the process.

Reporting to the Commission

61. At intervals of every three years, the SED requires Member States to send to the Commission, information on the implementation of the Directive in the form of a report. The report will be drawn up on the basis of a questionnaire drafted by the Commission. Regulators will be required to submit data relating to SED installations they regulate. The Department will make arrangements to request this data six months before the start of the period covered by the report.

Appendix 1

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
1	Heatset web offset printing (> 15)	15 – 25 > 25	100 20	30 (1) 30 (1)				(1) Solvent residue in finished product is not to be considered as part of fugitive emissions
2	Publication rotogravure (> 25)	> 25	75	10	15			
3	Other rotogravure, flexography, rotary screen printing, laminating or varnishing units (> 15) rotary screen printing on textile/cardboard (> 30)	15 – 25 > 25 > 30 (1)	100 100 100	25 20 20				(1) Threshold for rotary screen printing on textile and on cardboard.
4	Surface cleaning (1) (> 1)	1 – 5 > 5	20 (2) 20 (2)	15 10				(1) Using compounds specified in Article 5(6) & (8). (2) Limit refers to mass of compounds in mg/Nm^3, and not to total carbon.
5	Other surface cleaning (> 2)	2 – 10 > 10	75 (1) 75 (1)	20 (1) 15 (1)				(1) Installations which demonstrate to the competent that the average organic solvent content of all cleaning material used does not exceed 30% by weight are exempt from application of these values.

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit *values in waste* gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
6	Vehicle coating (< 15) and vehicle refinishing	> 0.5	50 (1)	25				(1) *Compliance in accordance with* Article 9(3) should be demonstrated based on 15 minute average *measurements.*
7	Coil coating (> 25)	>25	50 (1)	5	10			(1) For installations which use techniques which allow reuse of recovered solvents, the emission limit shall be 150.
8	Other coating, including metal, plastic, textile (5), fabric, film and paper coating (> 5)	5 – 15 > 15	100 (1) (4) 50/75 (2) (3) (4)	25 (4) 20 (4)				(1) Emission limit value applies to coating application and drying processes operated under contained conditions. (2) The first emission limit value applies to drying processes, the second to coating application processes. (3) For textile coating installations which use techniques which allow reuse of recovered solvents, the emission limit applied to coating application and drying processes taken together shall be 150. (4) Coating activities which cannot be applied under contained conditions (such as shipbuilding, aircraft painting) may be exempted from these values, in accordance with Article 5(3)(b). (5) Rotary screen printing on textile is covered by activity No 3.
9	Winding wire coating (> 5)	> 5				10 g/kg (1) 5 g/kg (2)		(1) *Applies for installations where* average diameter of wire ≤ 0.1 mm. (2) *Applies for all other installations.*
10	Coating of wooden surfaces (> 15)	15 – 25 > 25	100 (1) 50/75 (2)	25 20				(1) Emission limit applies to coating application and drying processes operated under contained conditions. (2) The first value applies to drying processes, the second to coating application processes.

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
11	Dry cleaning					20 g/kg (1) (2)		[1] Expressed in mass of solvent emitted per kilogram of product cleaned and dried. [2] The emission limit in Article 5(8) does not apply for this sector.
12	Wood impregnation (> 25)	> 25	100 (1)	45		11 kg/m^3		[1] Does not apply for impregnation with creosote.
13	Coating of leather (> 10)	10 – 25 > 25 > 10 (1)				85 g/m^2 75 g/m^2 150 g/m^2		Emission limits are expressed in grams of solvent emitted per m^2 of product produced. [1] For leather coating activities in furnishing and particular leather goods used as small consumer goods like bags, belts, wallets etc.
14	Footwear manufacture (> 5)	> 5				25 g per pair		Total emission limit values are expressed in grams of solvent emitted per pair of complete footwear produced.
15	Wood and plastic lamination (>5)	>5				30 g/m^2		
16	Adhesive coating (> 5)	5 – 15 > 15	50 (1) 50 (1)	25 20				[1] If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150.

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
17	Manufacture of coating preparations, varnishes, inks and adhesives (> 100)	100 – 1 000	150	5		5% of solvent input		The fugitive emission value does not include solvent sold as part of a coatings preparation in a sealed container.
		> 1 000	150	3		3% of solvent input		
18	Rubber conversion (> 15)	> 15	20 (1)	25 (2)		25% of solvent input		(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150 (2) The fugitive emission value does not include solvent sold as part of products or preparations in a sealed container.
19	Vegetable oil and animal fat extraction and vegetable oil refining activities (> 10)	> 10				Animal fat: 1.5 kg/tonne Castor: 3 kg/tonne Rape seed: 1 kg/tonne Sunflower seed: 1 kg/tonne Soya beans (normal crush): 0.8 kg/tonne Soya beans (white flakes): 1.2 kg/tonne Other seeds and other vegetable matter: 3 kg/tonne(1) 1.5 kg/tonne (2) 4 kg/tonne (3)		(1) Total emission limit values for installations processing individual batches of seeds and other vegetable matter should be set by the competent authority on a case-by-case basis, applying the best available techniques. (2) Applies to all fractionation processes excluding de-gumming (the removal of gums from oil). (3) Applies to de-gumming.
20	Manufacturing of pharmaceutical products (> 50)	> 50	20(1)	5 (2)	15 (2)	5% of solvent input	15 % of solvent input	(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150. (2) The fugitive emission limit value does not include solvent sold as part of

								products or preparations in a sealed container.

Appendix 2

Timetable for Implementation:

Status	Treat as new or existing	Transitional Arrangements	Date for compliance
Authorised or permitted or submitted valid application pre 1 April 2001 and operating prior to April 2002. (not using substances labelled with certain risk phrases – see below)	Existing	No	No later than 31 October 2005 for notification of compliance using the Reduction Scheme. No later than 31 October 2007 for any other method of compliance.
Operating without the required authorisation or permit when it should have one	New	No	SED conditions to be included in permit from 22 March 2002.
Existing installation installs new abatement equipment after 1 April 2001 but before 22 March 2002	Existing	Yes	Emissions from the abatement equipment must comply with the ELVs in the Directive by 22 July 2002
Existing installation installs new abatement equipment after 22 March 2002	Existing	No	Emissions from the abatement equipment must meet the ELVs in the Directive from the date of the change.
Substantial change made pre 1 April 2001 or application for substantial change made pre 1 April 2001 and operating prior to April 2002	Existing	No	No later than 31 October 2005 for notification of compliance using the Reduction Scheme. No later than 31 October 2007 for any other method of compliance.
Valid application for a substantial change submitted; or Comes within the scope of the Directive for the first time following a substantial change after 1 April 2001 and authorised or permitted before 22 March 2002	Can treat substantial change as new or existing subject the following conditions: Where the total emission from the whole installation do not exceed those that would have resulted had the substantially changed part been treated as a new installation it is treated as existing.	Yes	Where the substantial change is treated as a new installation, compliance must be achieved by 22 July 2002. If the substantial change meets the conditions and it is regarded as existing installation, compliance must be no later than 31 October 2007. The unchanged part of the installation continues to be treated as an existing installation

Substantial change to existing installation after 22 March 2002	Can treat substantial change as new or existing subject the following conditions: Where the total emission from the whole installation do not exceed those that would have resulted had the substantially changed part been treated as a new installation it is treated as existing.	No	Where the substantial change is treated as a new installation compliance is from the date of the change. If the substantial change meets the conditions and it is regarded as existing installation compliance is no later than October 2007. The unchanged part of the installation continues to be treated as an existing installation
Installations using certain volatile organic compounds with risk phrases R45,R46,R49,R60,R61 and halogenated volatile organic compounds with a risk phrase R40	Existing	Yes	From the date of the Direction, ensure compliance with SED emission limit values in the shortest possible time; Additionally, for substances classified as carcinogenic, mutagenic or toxic to reproduction and which carry the risk phrase R45, R46, R49, R60 or R61: work towards substituting the substance within the shortest possible time.
Valid application for a new installation, submitted after 1 April 2001 and permitted before 22 March 2002	New	Yes	Compliance with the SED must be achieved by 22 July 2002
Application under PPC post 22 March 2002 for a process that has not been operational prior to 1 April 2002.	New	No	SED conditions to be included in permit when issued.

Appendix 3
Text of Risk Phrases

R Phrase	**Definition**
R40	Possible risk of irreversible effects
R45	May cause cancer
R46	May cause heritable genetic damage
R49	May cause cancer by inhalation
R60	May impair fertility
R61	May cause harm to the unborn child

Taken from The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 ("CHIP 3")

INTERIM GUIDANCE ON:

THE IDENTIFICATION OF PPC INSTALLATIONS FALLING WITHIN THE REMIT OF

DIRECTIVE 1999/13/EC

ON

THE LIMITATION OF EMISSIONS OF VOLATILE ORGANIC COMPOUNDS

("SOLVENTS DIRECTIVE")

Guidance for Environment Agency Staff

Issued: 05 April 2002

For Internal Consultation

IMPORTANT NOTES - PLEASE READ

This explanatory note is intended for specific internal Environment Agency use to help officers interpret and implement the Council Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations ("Solvents Directive"). This policy and guidance may be subject to change in the light of regulatory changes, future Government guidance, Regulations or experience in its use. In the interests of transparency this policy/guidance is available to other persons to assist in interpretation and compliance with the Directive. However, it has no status other than internal Agency guidance to staff.

1 Council Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations (abbreviated in this document to SED, standing for Solvents Emissions Directive) was implemented for England and Wales by two Secretary of State Directions on the 22nd March 2002 (one for IPC, the other for PPC), together with Government guidance upon the directions.

2 SED applies to certain specified activities which are operated above a solvent consumption threshold. The broad types of activities are set out in the box below. It should be noted that surface cleaning includes maintenance activities such as degreasing baths. Many of the activities that fall within the remit of SED fall outside the remit of the EA and can be ignored, e.g. dry cleaning, vehicle coating, printing etc.

Coating Use	Printing and Adhesive Use	Other
Vehicle refinish, Coil coating ,Other coating, Wood coating, Leather Coating , Coating of winding wire , Vehicle coating	Heatset printing, Publication gravure printing , Other printing, Wood/plastic lamination, Adhesive coating	Surface cleaning, Dry cleaning, Wood impregnation, Coating manufacture , Rubber conversion , Vegetable oil extraction, Pharmaceutical manufacture The manufacture of coating preparations, inks and adhesives

It is anticipated that the EA will primarily be involved with activities such as pharmaceutical manufacture, surface cleaning, coil coating, vegetable oil extraction and the manufacture of coating preparations, inks, varnishes and adhesives.

3 The EA is responsible for implementing SED for those PPC installations and IPC processes for which it is the regulator, and which contain SED activities where solvent consumption is above the thresholds listed in SED.

4 SED implementation and transitional arrangements are complex and detailed guidance is still being drafted to support the Government guidance. It is expected that this guidance will be finalised within a month.

5 As part of the PPC determination process a check must be made to see if a SED activity, operated above the solvent consumption threshold, is part of the PPC installation. SED activities and applicable thresholds are set out at Appendix 1, below. There are three possible results of this check:-

6 First, if there is no SED activity on site this should be noted on the decision document and no further action is required.

7 Second, if there is a SED activity but this is currently operating below the solvent consumption threshold then this should be noted on file and no further action is required at present. It should be noted that if solvent consumption were to increase above the threshold then the full requirements of the SED must be met before solvent consumption increases above the threshold.

8 Third, if a SED activity is identified and this activity is operating above the solvent consumption threshold then further advice must be sought from Mark Snoddy, HO Policy Advisor, 0113 231 2432. PPC permitting decisions involving SED activities must not now be taken unless the requirements of SED are fully taken into account.

9 Relevant definitions of "organic solvent", "consumption" and "reuse" are set out at Appendix 2.

Mark Snoddy
5 April 2002

Appendix 1
(Extract from the Directive)

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
1	**Heatset web offset printing (> 15)**	15 – 25 > 25	100 20	30 (1) 30 (1)				(1) Solvent residue in finished product is not to be considered as part of fugitive emissions
2	**Publication rotogravure (> 25)**	> 25	75	10	15			
3	**Other rotogravure, flexography, rotary screen printing, laminating or varnishing units (> 15) rotary screen printing on textile/cardboard (> 30)**	15 – 25 > 25 > 30 (1)	100 100 100	25 20 20				(1) Threshold for rotary screen printing on textile and on cardboard.
4	**Surface cleaning (1) (> 1)**	1 – 5 > 5	20 (2) 20 (2)	15 10				(1) Using compounds specified in Article 5(6) & (8). (2) Limit refers to mass of compounds in mg/Nm^3, and not to total carbon.
5	**Other surface cleaning (> 2)**	2 – 10 > 10	75 (1) 75 (1)	20 (1) 15 (1)				(1) Installations which demonstrate to the competent that the average organic solvent content of all cleaning material used does not exceed 30% by weight are exempt from application of these values.

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (*percentage of solvent input*)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
6	**Vehicle coating (< 15) and vehicle refinishing**	> 0.5	50 (1)	25				(1) Compliance in accordance with Article 9(3) should be demonstrated based on 15 minute average measurements.
7	Coil coating (> 25)	>25	50 (1)	5	10			(1) For installations which use techniques which allow reuse of recovered solvents, the emission limit shall be 150.
8	**Other coating, including metal, plastic, textile (5), fabric, film and paper coating (> 5)**	5 – 15 > 15	100 (1) (4) 50/75 (2) (3) (4)	25 (4) 20 (4)				(1) Emission limit value applies to coating application and drying processes operated under contained conditions. (2) The first emission limit value applies to drying processes, the second to coating application processes. (3) For textile coating installations which use techniques which allow reuse of recovered solvents, the emission limit applied to coating application and drying processes taken together *shall* be 150. (4) Coating activities which cannot be applied under contained conditions (such as shipbuilding, aircraft painting) may be exempted from these values, in accordance with Article 5(3)(b). (5) Rotary screen printing on textile is covered by activity No 3.
9	**Winding wire coating** (> 5)	> 5				10 g/kg (1) 5 g/kg (2)		(1) Applies for installations where average diameter of wire ≤ 0.1 mm. (2) Applies for all other installations.
10	Coating of wooden surfaces (> 15)	15 – 25 > 25	100 (1) 50/75 (2)	25 20				(1) Emission limit applies to coating application and drying processes operated under contained conditions. (2) The first value applies to drying processes, the second to coating application processes.

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
11	Dry cleaning					20 g/kg (1) (2)		(1) Expressed in mass of solvent emitted per kilogram of product cleaned and dried. (2) The emission limit in *Article 5(8)* does not apply for this sector.
12	Wood impregnation (> 25)	> 25	100 (1)	45		11 kg/m^3		(1) Does not apply for impregnation with creosote.
13	Coating of leather (> 10)	10 – 25				85 g/m^2		Emission limits are expressed in grams of solvent emitted per m^2 of product produced.
		> 25				75 g/m^2		
		> 10 (1)				150 g/m^2		(1) For leather coating activities in furnishing and particular leather goods used as small consumer goods like bags, belts, wallets etc.
14	Footwear manufacture (> 5)	> 5				25 g per pair		Total emission limit values are expressed in grams of solvent emitted per pair of complete footwear produced.
15	Wood and plastic lamination (>5)	>5				30 g/m^2		
16	Adhesive coating (> 5)	5 – 15	50 (1)	25				(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150.
		> 15	50 (1)	20				

	Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special provisions
				New	Existing	New	Existing	
17	**Manufacture of coating preparations, varnishes, inks and adhesives** (> 100)	100 – 1 000	150	5		5% of solvent input		The fugitive emission value does not include solvent sold as part of a coatings preparation in a sealed container.
		> 1 000	150	3		3% of solvent input		
18	**Rubber conversion** (> 15)	> 15	20 (1)	25 (2)		25% of solvent input		(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150 (2) The fugitive emission value does not include solvent sold as part of products or preparations in a sealed container.
19	**Vegetable oil and animal fat extraction and vegetable oil refining activities** (> 10)	> 10				Animal fat: 1.5 kg/tonne Castor: 3 kg/tonne Rape seed: 1 kg/tonne Sunflower seed: 1 kg/tonne Soya beans (normal crush): 0.8 kg/tonne Soya beans (white flakes): 1.2 kg/tonne Other seeds and other vegetable matter: 3 kg/tonne (1) 1.5 kg/tonne (2) 4 kg/tonne (3)		(1) Total emission limit values for installations processing individual batches of seeds and other vegetable matter should be set by the competent authority on a case-by-case basis, applying the best available techniques. (2) Applies to all fractionation processes excluding de-gumming (the removal of gums from oil). (3) Applies to de-gumming.
20	**Manufacturing of pharmaceutical products** (> 50)	> 50	20 (1)	5 (2)	15 (2)	5% of solvent input	15 % of solvent input	(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150. (2) The fugitive emission limit value does not include solvent sold as part of products or preparations in a sealed container.

Appendix 2

Definitions

*"**Organic solvent** shall mean any VOC which is used alone or in combination with other agents, and without undergoing a chemical change, to dissolve raw materials, products or waste materials, or is used as a cleaning agent to dissolve contaminants, or as a dissolver, or as a dispersion medium, or as a viscosity adjuster, or as a surface tension adjuster, or a plasticiser, or as a preservative;"*

*"**consumption** shall mean the total input of organic solvents into an installation per calendar year, or any other 12-month period, less any VOCs that are recovered for reuse"*

*"**reuse** of organic solvents shall mean the use of organic solvents recovered from an installation for any technical or commercial purpose and including use as a fuel but excluding the final disposal of such recovered organic solvent as waste;"*

General guidance for applicants
SEPA guidance for installations in Scotland
Charging scheme
Cross-sector guidance
Speciality organic chemicals sector guidance
BAT reference notes
Monitoring notes
Legal and regulatory guidance
IPPC: a practical guide (DETR)

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Appendix 3: Volatile Organic Compounds

Introduction

Volatile organic compounds (VOCs) are of serious environmental concern because of the harmful or offensive properties that they exhibit in varying degrees. These include:

- direct toxicity to human health and other eco-systems
- contribution to photochemical ozone creation at ground level with consequent harmful effects
- destruction of stratospheric ozone
- contribution to global climate change; and
- sensory effects such as malodour

The harmfulness of VOCs varies greatly, not only because the individual and combined significance of these properties exhibits wide variation between substances, but also because it is dependent on the presence of the substance in the environment. This is related to mass release rate and subsequent dispersion and to the environmental persistence and fate of the substance under prevailing conditions.

Categorisation

In order to assess BAT for processes that release VOCs, it is necessary to categorise VOCs according to their harmfulness.

Substances such as benzene, vinyl chloride and 1,2- dichloroethane pose serious health risks to humans and are regarded as highly harmful. These are given individual, very low achievable levels of emission in guidance.

Some other VOCs carry a lesser but still significant health risk or may contribute substantially to photochemical ozone creation or stratospheric ozone destruction or global warming. These are regarded as of medium harmfulness and are allocated to Class A. They will include the substances listed in the Montreal Protocol, the phase-out of which is covered by EC Regulations 594/91, 3952/92, 2047/93 and 3093/94.

The remaining majority of VOCs are of low harmfulness but are also substances whose release should be prevented or minimised. These are allocated to Class B.

Odorous VOCs may be offensive at extremely low concentrations and this property may indicate the need for very tight control of a substance that would otherwise be categorised as of low harmfulness.

The research report "The Categorisation of Volatile Organic Compounds" (DOE/HMIP/RR/95/009) provides a method of categorisation, information on the properties of some 500 VOCs and a summary table of resulting categorisations.

In seeking to categorise a VOC, first search the summary table of categorisations. If the VOC is not included, the method and decision tree given in the research report should be used to arrive at a conclusion supported as well as possible by information from established sources. These include the Registry of Toxic Effects of Chemicals, the "CHIP" list, the Montreal Protocol and Sax' Dangerous Properties of Industrial Materials.

Knowledge of the harmful effects of VOCs is developing and there may be occasional differences of experts' opinions on the precise interpretation of information. In these few instances, it will be prudent to adopt the more cautious view.

Achievable Benchmark Levels

The levels of emission that can be achieved are dependent on factors that include the process itself, the VOC concerned and the abatement method used.

Where possible, process- and substance-specific achievable levels of release are given in Table 3.1 of this Note. However, in the absence of sufficient information or where it is agreed that an assessment is not possible, the following guidelines may be used to provide a practical approach to setting limits.

- The benchmark release concentrations given below should be aimed for where the following mass release limits are exceeded:

  Total Class A - 100 g/h
  Total Class B (expressed as carbon) - 2 kg/h

  - but emissions below these mass emission levels may not be trivial, and so may still require controls and the setting of appropriate release limits.
- Highly harmful VOCs pose major human health risks and have individual guidance levels given in Table 3.1 of this Note.
- For Class A compounds, BATabatement techniques should achieve a benchmark release level of 20 mg/m3 for continuous emissions.
- Some VOCs cause significant malodour problems even at very low concentrations after dispersion, and limits lower than Class A compounds may be required.
- Class B compounds are those of low environmental harmfulness such as acetone and toluene and the Class B benchmark level has been set at 75 mg/m3 (expressed as carbon) based on abatement techniques involving adsorption with activated carbon.
- For mixed streams the release level may be calculated by summing the class levels multiplied by their respective mass fractions.
- The use of a release concentration limit is not normally appropriate in the case of a release from an air-deficient saturated vapour space such as storage tanks for solvents or process vessels. An approach based on limiting total mass released or mass per unit of production is likely to be more effective.
- In some processes, the VOCs released to air may well consist of partial oxidation products rather than defined compounds that can be classified as above. In such cases an approach based on a TOC release concentration is likely to be more

appropriate.

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ENVIRONMENT AGENCY

Integrated Pollution Prevention and Control
Guidance for the Speciality Organic Chemicals Sector

welcome | the process | common questions | documents and guidance

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2.2 Emissions control

2.2.1 Point source emissions to air

The nature and source of the emissions expected from each activity is given in previous sections and will be confirmed in detail in the Operator's response to the emissions inventory. In general they comprise:

A wide variety of techniques are available for the control of releases to air. The abatement of releases of volatile organic compounds (VOCs) is the primary concern for this sector.

2.2.1.1 Control of emissions of volatile organic compounds (VOCs)

Releases of VOCs may be broadly characterised as those from:

- fugitive sources (leaking valves, pumps, etc)
- point sources (reactor, separator release points, etc, as well as situations where fugitive emissions are collected and sent for end-of-pipe abatement)

Techniques for the abatement of the former are process- related and are discussed in Section 2.2.4 of this Note. The main issues that influence the selection and cost of VOC abatement techniques for this sector are:

- the intermittent nature of releases from batch processes
- and the complex nature of the gas streams involved, with many different VOCs often being present as well as moisture, particulates and acid gases

Both of these issues have a profound influence on the selection of abatement techniques. The Environment Agency (or its predecessor) has issued guidance on abatement techniques to deal with:

- particulates - Technical Guidance Note (Abatement) A3
- acid gases - Technical Guidance Note (Abatement) A3
- combustion by-products - IPC Guidance Notes on Combustion Processes (S2 1.01) and Incineration (S2 5.01) respectively

These documents should be referred to where these pollutants are of relevance. (See References 9 and 20)

Before selecting the appropriate technique(s) it is important to quantify systematically flows, chemical compounds and concentrations over all potential operating conditions.

Quantification allows opportunities for in-process minimisation to be considered as well as aiding in the selection of the appropriate abatement techniques. Particular attention may have to be given to vent header systems that receive gas streams from a number of different sources.

Techniques for the abatement of VOCs may be broadly characterised as those that:

- recover the VOC and offer the potential for recycle/re-use (adsorption, absorption and condensation)
- destroy the VOC (thermal, catalytic, flameless and biological oxidation, respectively)

Unless a viable recycle/re-use route is available for the former techniques, then there will still be a need for disposal. All of these techniques have been and will continue to be widely applied in the sector.

Recovery versus destruction for VOCs

Recovery followed by re-use/recycling is generally preferable compared to destruction. A number of issues need to be considered when deciding if this is a viable option. These include:

- Composition of the gas stream. Generally the more complex the mixture of VOCs, the harder it will be to justify recovery technically or economically unless recovery is to be followed by energy recovery rather than re-use/recycle.
- Quality requirements. It may not be possible to recover the target VOC(s) with a quality sufficient to satisfy the requirements of re-use/recycle.
- Economics. The economics of recovery will reflect the complexities associated with the gas stream's composition and the quality requirements of the process as well as such considerations as the cost of the VOC and the volume that can be recovered.
- Release levels. In certain situations recovery techniques may not provide sufficiently good release levels.

Adsorption of VOCs

Adsorption requires a consideration of the following factors:

Arrangement of adsorption system

There are five ways of supporting the adsorbent in adsorption systems:

- *Canister capture systems* can be fitted readily to sources of low flow and concentration. The operator should have a procedure that anticipates or detects breakthrough in the system. Spent canisters need to be disposed of.
- *Skid-mounted capture systems* are larger than canister systems (typically containing 1000 kg of adsorbent compared to 75 kg in a canister) but they are still mobile and can be retrofitted with relative ease. Skid-mounted systems are usually returned to the supplier for regeneration.
- *Fixed-bed systems* consist of two or more fixed adsorption beds. At any given time, one bed will be operating on-line, whilst the other bed is regenerated. Three beds may be used, where one bed is kept on stand-by in case of primary bed failure.
- *Fluidised beds* use a fluidised rather than solid bed of adsorbent. They tend to be more complex than fixed-bed systems but their smaller size may be an advantage. Attrition may require new adsorbent to be added periodically and may also cause entrainment of particulates in the exhaust gas stream.
- *Continuous adsorption-desorption* is not widely used in this sector, being more complex and expensive to operate and usually more appropriately applied to continuous processes.

Adsorbent

A number of adsorbents are available. The main ones are summarised in Table 2.1 together with some of their strengths and weaknesses.

Table 2.1: Main Adsorbants

Adsorbent	Strengths	Weaknesses
Granular activated carbon (GAC)	- Good for non-polar compounds. - Extensive experience of their application in a wide range of situations. - Wide range of grades available at different costs to deal with a diversity of operating conditions, VOCs and desired release levels.	- Poor for polar compounds; - Poor for high VOC concentrations (above 10000 ppm). - Poor for very high or low molecular masses (only effective in the range 45-130) - Poor for mixtures of high- and low-boiling point VOCs. - Poor for relative humidities above 50%. - Poor for reactive compounds (organic acids, aldehydes, ketones and monomers). - Poor for high-boiling-point compounds (plasticisers, resins, long- chain hydrocarbons (C14 and above), phenols, glycols and amines).
Activated carbon mat	- Good for non-polar compounds and can be used for the removal of VOCs. - Compared to GAC, they have a relatively large number of adsorption points per unit volume, which reduces the number of regenerations required.	- As for GAC. - Significantly more expensive than GAC.
Macroporous polymer particles	- Good for non-polar compounds and can be used for the removal of VOCs. - Good for continuous adsorption/desorption processes. - Durable. - Unaffected by high humidity, does not catalyse degradation of unstable VOCs. - High-purity VOCs recovered. -	- Significantly more expensive than GAC. - Cannot be used for very polar compounds - Cannot be used for low boiling compounds.
Molecular sieve zeolites;	- Can be used for the removal of VOCs, although not widely applied for this purpose. - Good for dehydrating gas streams. - Hydrophobic zeolites are available that have a higher capacity than GAC at low VOC inlet concentrations and a higher capacity at high relative humidities (above 50%). - Non-flammable, therefore good with VOCs that may present a fire risk. - Uniform size of pores means they can be used to separate compounds on the basis of molecular mass and shape.	- Expensive. - If dehydration is not desired, can preferentially adsorb water and allow pollutant to pass through.
Silica gel.	- Good for dehydrating gas streams.	- Generally not effective for VOCs. - Ineffective above 260oC.
Sodium aluminium silicates	- Good for the removal of carbon dioxide, hydrogen sulphide, sulphur dioxide.	- Generally not effective for VOCs. - Ineffective above 260oC.

Adsorption/desorption properties of VOCs

As it is the most widely used adsorbent in the chemical industry, this section relates to the use of GAC. Activated carbon mat and macroporous polymers will have broadly similar strengths and weaknesses, whilst zeolites, silica gel and silicates will be more appropriately used for polar compounds. Certain types of substance are particularly amenable to adsorption by GAC. These include those with the following properties:

- relatively high molecular mass and/or boiling point (mass 45-130)
- low polarity
- cyclic rather than linear molecules
- unsaturated rather than saturated compounds
- compounds with a low volatility

However, not all substances that are readily adsorbed are as easy to desorb and thus recover. This may be because:

- the energy requirements to separate the pollutant from the adsorbent are excessive, eg high boiling point VOCs
- the adsorbent may catalyse the decomposition of the pollutant, eg cyclohexanone tends to polymerise on GAC
- certain compounds, in particular ketones, may present a combustion risk because of the large amounts of heat that they liberate during the adsorption process
- the wider the variety of VOCs that are present in the gas stream, the more likely that non-uniform adsorption will take place

Physical characteristics of gas stream

Good adsorption is promoted by:

- low flow rates and low temperatures, both of which increase residence time in the bed
- increased pressure
- minimising moisture and particles in the gas stream, both of which may blind, and thus reduce the availability of, adsorption points
- uniform airflow distribution so that the full capacity of the adsorbent is utilised
- sufficient adsorbent capacity to deal with projected airflows and concentrations

Pre-treatment of the gas stream may be necessary to ensure that these requirements are achieved. This usually adds to the overall cost and complexity of the system.

Regeneration of adsorbants

Regeneration is required for all but canister systems. The main options are as follows.

- **Regeneration of fixed beds.** A number of options exist for regenerating saturated fixed beds. These include:
  - *Thermal swing.* The temperature of the bed is elevated, usually using saturated steam to desorb the VOCs. An effluent is generated that will require either treatment then disposal or the use of a separation technique to allow re-use/recycle.
  - *Inert gas.* Hot inert gas (usually nitrogen at 200-300°C) is passed through the saturated bed. Once any moisture is removed, the inert gas strips out the pollutant, which is then recovered by condensation.
  - *Vacuum.* A vacuum is applied to the bed, which allows the pollutant to be re-vaporised. The pollutant is then removed from the system by back-purging and subsequently recovered by condensation.
  - *Displacement cycle.* This is an infrequently used approach whereby the adsorbed material is preferentially displaced by another material. It will only be applied when the adsorbate is both temperature-sensitive and valuable, and vacuum desorption is ineffective.
- **Regeneration by continuous adsorption and desorption.** In rotating systems the desorption stage may be based on either steam or hot, inert gas and the comments made above are generally applicable. In tower systems the desorption system is usually based on hot, inert gas.

- **Control of adsorption techniques.** Instrumentation has been developed that allows fixed beds to be switched when the concentration of the pollutant in the exit gas reaches a pre-determined level. There is a risk that VOCs adsorbed onto the bed whilst the process is operating may be desorbed when the bed is out of use. To prevent this happening the gas flow should be diverted away from the bed during intervals when no production is occurring.

Condensation of VOCs

Condensation can in theory be applied to any pollutant in any gas stream. In practice the main constraint on its use is the condensation temperature that has to be achieved. Particularly low temperatures will be required for gas streams containing:

- low-boiling-point pollutants
- low concentrations of pollutants
- high concentrations of non-condensable material

The main condensation systems are:

- coolant/refrigeration
- cryogenic nitrogen

The main difference between the systems is the temperature that they can achieve.

VOC Condensation by air, water or refrigeration coolant

These systems have been widely applied in the sector. A diverse range of coolants/refrigerants are available to cover the temperature range of ambient to about -70°C. Either indirect cooling or direct cooling of the gas stream can be used. Direct cooling requires the coolant to be separated from the VOC and is rarely used. For low-volatility substances that condense with relative ease, air or water systems may be appropriate. For lower temperatures chilled water/air or brine may be used, whilst glycol may offer opportunities for further temperatures reductions. A series of condensers at progressively lower temperatures may be required to prevent process blockage.

VOC Condensation by Cryogenic nitrogen

Cryogenic nitrogen systems have only recently been applied on an industrial basis. They can achieve significantly lower temperatures than coolant/refrigerant systems, can be applied to a wider range of compounds and achieve better removal rates.

Cryogenic nitrogen condensation systems use the evaporation of liquid nitrogen to form nitrogen gas to provide cooling. They may be particularly appropriate for processes or sites that already utilise liquid nitrogen in amounts similar to the requirements of the cryogenic abatement system.

If liquid nitrogen is used on-site and the correct balance can be achieved, there appear to be a number of advantages in applying cryogenic nitrogen techniques. These include:

- all VOCs can theoretically be removed from a gas stream to better than 99%
- there is considerable future-proofing built into the technique, ie operating temperatures can be varied for new pollutants and/or tighter release levels
- systems can be designed to deal with the fluctuations in flow and concentration
- the condensed VOCs are not contaminated with other materials

A dual system of condensers alternately cooling and warming may be necessary to handle materials that freeze (eg traces of water vapour).

Control of condensation techniques

Condensers are generally easier to control than other techniques, with the outlet gas temperature being the main indicator of removal efficiency.

Absorption of VOCs

The main variables in selecting an absorption system are the following:

- physical characteristics of the gas stream
- chemical characteristics of the VOC and the scrubber liquid
- process unit design for contacting VOC with scrubber liquid

Physical characteristics of gas stream

The lower the temperature of the gas stream, the better will be the transfer between the gas and liquid phases. Lower temperatures also reduce the risk of losses of scrubber liquids due to evaporation.

Chemical characteristics of pollutant and scrubber liquid

In selecting scrubber liquids, operators need to be aware of the following issues:

- If a non-water-based scrubbing liquid is to be used, there is the potential for it to be volatilised and lost to atmosphere.
- The scrubber liquid needs to have an effective life in the system and therefore should not be susceptible to thermal or chemical degradation.
- Flammable, toxic and odorous scrubbing liquids should generally be avoided.
- The VOC needs to be at least partially soluble in the scrubbing liquid.
- Mass transfer may be enhanced by the use of appropriate surfactants.

Process unit design for contacting VOC with scrubber liquid

- The process unit used will depend upon the chemical and physical characteristics of the gas stream to be treated as well as the desired removal efficiency. A wide range of process units are available. These include:
    - packed towers
    - moving or fluidised beds
    - plate towers
    - impingement plates
    - spray towers
    - wet mop scrubbers and rotaclones
    - void towers

Control of absorption systems

A number of variables can be varied to optimise performance. These variables include:

- temperature of gas and scrubber liquid
- circulation rate of the scrubber liquid
- design of column

The gas stream may be cooled to its saturation temperature and cause a visible plume to be formed. Potential controls include fitting a demister, a knock out pot or reheating.

Thermal destruction of VOCs

Thermal processes rely on the thermally induced breakdown (oxidation) of pollutants. The main thermal processes are:

- (high-temperature) thermal oxidation

- (low-temperature) catalytic oxidation
- flameless thermal oxidation
- flares

Thermal oxidation

The use of thermal oxidisers is discussed in the IPC Guidance Note on Waste Incineration (S2 5.01. The main issues of relevance to this sector are as follows:

- Compared to other techniques it can achieve very good removal efficiencies under a wide variety of conditions.
- A supplementary energy source may be required to support the oxidation of VOCs with a low heat content or dilute flows (ie below autothermal conditions).
- The heat generated from oxidation can often be used beneficially.
- Highly variable flows may reduce the efficiency of oxidation. The use of pre-concentrators may allow the flow to be evened out over time.
- Safety devices will be required, for example flame arresters, to provide a screen between the process and the abatement technique.
- Oxidation may give rise to secondary pollutants such as acid gases that require subsequent treatment.
- There is potential for the formation of dioxins in the presence of halogens. Correct design and operation should prevent this problem occurring

Catalytic oxidation

Catalytic oxidation uses a catalyst bed to promote the oxidation process at a lower temperature than is required by thermal oxidation. This has the advantage of reducing:

- auxiliary fuel requirements
- the need for the oxidiser to be constructed out of expensive and heavy high-temperature-proof materials
- the chance of secondary pollutants such as NO_x being formed

However, they have certain disadvantages. In particular, they are susceptible to poisoning and/or blinding by constituents of the gas stream. Metals (arsenic, antimony, lead, mercury, etc) and chlorine- and sulphur-containing compounds have traditionally been the main catalyst poisons

Chrome/alumina, cobalt oxide, and copper oxide/manganese oxides have been developed for the control of chlorinated compounds. Platinum-based catalysts have been developed to deal with sulphur-containing compounds, although these catalysts are still susceptible to poisoning by chlorinated compounds. Compounds containing lead, arsenic and phosphorus are still fast-acting catalyst poisons under most conditions.

Fluidised-bed systems allow catalyst to be constantly replaced, thus reducing the impact of poisons. Attrition of the catalyst in the fluidised bed may result in particulates being entrained in the exhaust stream. Particulates may not only blind but also abrade the surface of the catalyst. Excessive temperatures, concentrations and concentration fluctuations may also damage the catalyst bed.

Recovery of energy in VOC destruction systems

An important consideration in utilising a thermal technique is the potential it provides for the recovery of useful heat energy. The main ways of recovering heat energy are the following:

- Recuperative systems use a shell and tube or other type of heat exchanger to recover heat from the hot exhaust gas and use it to preheat the incoming gas.

- Regenerative systems utilise two or more ceramic beds. Hot exhaust gas is used to heat one bed, whilst the other bed heats the inlet gas. The beds are periodically switched, leading to a net exchange of heat from exhaust to inlet gas. Purge systems, which have a third bed, ensure that the small volume of inlet gas left in a bed on swapping is not lost, unabated, in the exhaust gas.

The decision as to which energy recovery system should be utilised will be site-specific.

Gas stream characteristics of VOC destruction systems

The following gas stream characteristics may influence the use of oxidation techniques:

- The presence of moisture tends to increase secondary fuel requirements.
- Certain pollutants may need to be removed from the gas stream prior to incineration, in particular those that may foul/corrode the system or poison catalytic beds.
- An excess of air is required to provide sufficient oxygen to allow complete oxidation.

Control of thermal and catalytic oxidation techniques

The main issues to be considered in operating an oxidiser are:

- the residence time of the gas stream in the combustion chamber
- the oxygen content in the combustion chamber
- the operating temperature in the combustion chamber
- turbulence in the combustion chamber
- the use of a flame detector

Many problems associated with thermal oxidisers have arisen from poor burner operation and poor start up/shut-down procedures. An operator should be able to demonstrate that robust operating procedures, including good monitoring and maintenance programmes, are being utilised.

Flameless thermal oxidation

Flameless thermal oxidation uses an inert, hot ceramic matrix to support oxidation. Once oxidation has been initiated, radiation and convection transfer heat to the incoming gas stream, raising its temperature to the ignition point. Unlike other types of oxidiser no flame is present and so the potential for the formation of NO_x is reduced. They may be particularly suitable for the variations in flow and concentration characteristic of this sector. Similar benefits may be achieved in a regenerative system operating under autothermal conditions.

Flares

Flaring should be confined to emergency use. It is not widely practised in the sector and HMIP Technical Guidance Note A1 should be referred to for information on its use. Flaring of halogenated compounds should be avoided.

Biological oxidation of VOCs

This is a destructive technique that relies on the biologically induced oxidation of VOCs to form water and carbon dioxide. The main biological systems are:

- biofiltration, where the gas stream is passed through a moist substrate (peat, heather, etc), which supports the micro-organisms;
- bioscrubbing, where the gas stream is passed through a trickling filter or column; andbioreactors, where micro-organisms are supported on an artificial substrate in a reactor

All three systems operate on the same basic premiss, that certain organic compounds can be readily biodegraded by micro-organisms. The respective strengths and weaknesses of the three systems have been summarised by the DTI's BMB Initiative(34) and are reproduced in Table 2.2

Table 2.2: Summary of strengths and weaknesses of biological systems

System	Application	Strengths	Weaknesses
Biofilter	<0.5 g/m^3	High gas/liquid surface area. Works for VOCs and odours of medium solubility. Easy operation and start-p. Low operation costs.	Poor control of reaction conditions. Slow adaptation to fluctuating concentrations in gas stream. Large area required.
Biotrickling filters	<0.5 g/m^3	Comparable to bioscrubbing. Better retention of slow-growing micro-organisms. Single reactor.	Low surface area for mass transfer. Higher operational costs than biofilters. Potential clogging.
Bioscrubbers	<3.0 g/m^3	Better control of reaction conditions (pH, nutrients). Possibilities to avoid accumulation of products. Compact equipment. Low pressure drop.	Low surface area for mass transfer. Disposal of excess sludge. Extra air supply needed at high degradation rates Higher investment and operational costs

VOCs that can be destroyed by biological oxidation

In theory any VOC can be biologically oxidised, but in practice the time taken to oxidise certain compounds (the residence time) precludes their control by this method. Table 2.3 summarises the biodegradability of some VOCs.

Table 2.3: Biodegradability of VOCs

Relative speed of biodegradation	VOC
Rapid	Alcohols Aldehydes Amines Organic acids
Good	Esters Ketones Phenols Mercaptans
Slow	Aliphatic hydrocarbons
Very slow	Halogenated hydrocarbons Polyaromatic hydrocarbons

Operating conditions applicable to Biological oxidation

A number of factors need to be considered when operating biological techniques:

- The water content and temperature of biological systems are critical.
- Poor solubility of the target VOC in water slows this mass transfer and reduces the viability of biological oxidation.
- Biological systems are susceptible to inhibition, particle blinding and excess temperature, all of which

can reduce the effectiveness of the biological population in the system. Inhibition may be caused by certain toxic gases (hydrogen sulphide, carbon monoxide), acid gases, heavy metals and high concentrations of cyanide.

- Systems usually need a fairly constant throughput (in terms of both flow and concentration), although recent innovations have seen the introduction of activated carbon substrates that can buffer the system against `spikes' in concentration.
- Nutrients, oxygen and a neutral pH are required.
- Biological systems can be particularly effective with large volumes of gas containing low concentrations of VOC.
- Systems can be `switched off' between batches, but for longer downtimes, typically over 1-2 weeks, an artificial feed may have to be dosed to the system.
- Trials will be required before the installation of any system to identify the optimum microbiological community and operating conditions.
- The system will need to be acclimatised to the target VOC(s). Changes in the VOCs in the gas stream may necessitate a re-acclimatisation period or even a change in the biological community.
- Biofilter beds tend to consolidate and may need periodic reworking

Polymer membranes to separate VOCs

Polymer membranes allow certain molecules preferentially to pass through them. If the concentration of the VOC in the gas stream is low, then a high vacuum will be required to draw the VOC molecules through the membrane. Polymer membranes have not been demonstrated as abatement techniques in this sector because of their:

- low transmission fluxes, which means that very large membranes are needed to deal with the flows typical of the sector
- poor selectivity for the most commonly used solvents

Envirowise has published a solvent recovery guide which provides a useful overview of the respective merits of the techniques (Reference 7), and its summary is the basis of Table 2.4.

Figure 2.1summarises the concentration/flow ranges for which individual techniques may be particularly suitable and provides broad estimates of the removal efficiencies they can achieve.

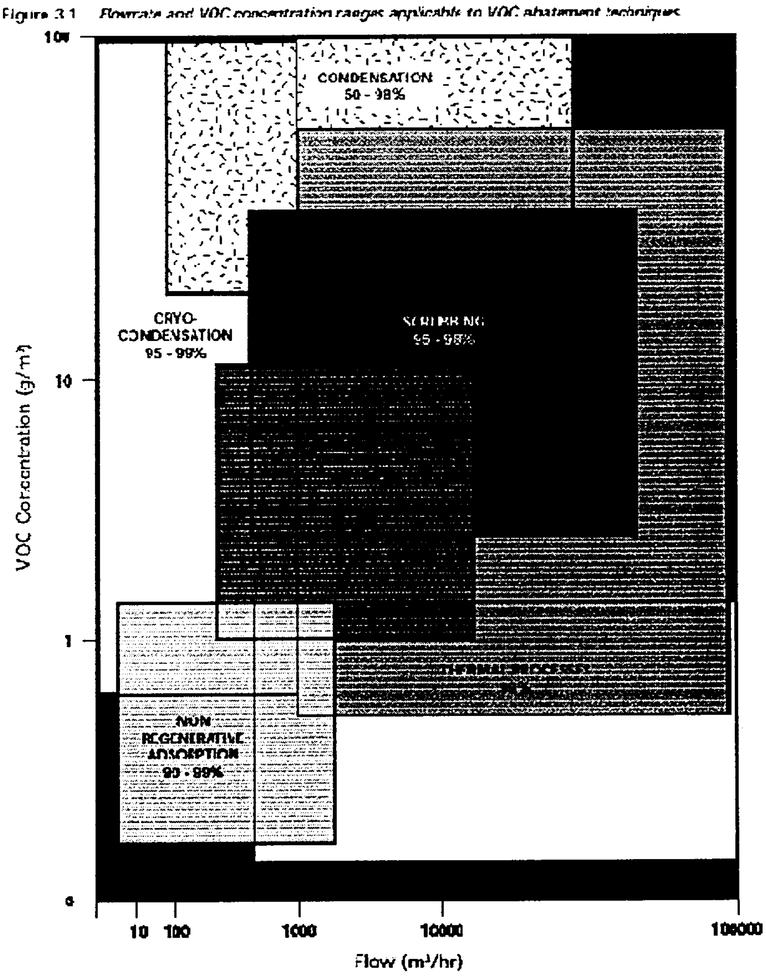
Table 2.4: Summary of the strengths and weaknesses of VOC control techniques

Issue	**Recovery and re-use techniques**			**Destructive tecnniques**		
	Adsorption	Condensation	Absorption	Thermal oxidation	Catalytic oxidation	Biologica
Low flow/low concentration	A	B	A	B	D	A
High flow/low concentration	A	C	C	B	A	A
Low flow/high concentration	D	A	A	A	D	B-D
High flow/high concentration	D	A	B	A	D	E
Hydrocarbon gases	D	E	B-D	A	A	A-C
Halogenated or sulphonated organic gases	D	E	A	B	D	C-E

Aminated organic gases	D	E	C-D	C	C	B-C
Hydrocarbon condensables	A	A	B-C	A	A	A-C
Halogenated or sulphonated organic condensables	A	A	A-B	B	D	C-E
Aminated organic condensables	A	A	B	C	C	A-C
Continuous	A	A	A	A	A	A
Batch or variable	A	A	A	D	D	A
Removal efficiency	B	C	A	B	C	A-B
Pressure drop	C	B	B	A	C	A
VOC recovery	B	A	B.	E	E	E

Key: A = Excellent B = Good C = Satisfactory D = Poor E = Unacceptable

Figure 2.1: Flowrate and VOC concentration ranges applicable to VOC abatement techniques



2.2.1.2 Control of emissions of particulates

In addition to the Waste Water and Waste Gas Treatment BREF (reference 1), HMIP Technical Guidance Note (A3) is a useful source of information on BAT in this sector (Reference 9). The main techniques that are available for the control of particulates are:
- scrubbing
- cyclones
- filters
- electrostatic precipitators

Scrubbing

Scrubbing operates on the principle that particulates can be removed from the gas stream by dissipating their momentum. This dissipation can be achieved either by impacting the particulate on to the scrubbing liquid or by impacting a solid surface, which is then washed.

The main delivery systems for contacting the scrubbing liquid with the gas stream are broadly similar to those used for VOCs. Scrubbing systems tend to be less effective than other alternatives for the control of particles <10 um. They also generate an effluent that will require treatment.

Cyclones

Cyclones are particularly effective for the removal of particles with a diameter >10 Ïm and are often used as a secondary device for the protection of more expensive abatement equipment that can achieve better release levels.

There are two basic types of cyclone:
- reverse flow
- straight through

These are differentiated by the geometry with which the gas stream enters the cyclone. The design of a cyclone will depend upon the particular gas stream that is being dealt with. Recent innovations have seen the development of cyclones containing a rotating impeller to improve removal efficiencies.

Filters

Filters are widely used for the collection of particulates > um and can usually achieve efficiencies of greater than 99%. The main variables that are available in designing filters are:
- the filter medium
- the manner in which the filter is periodically cleaned

Filter Media

A number of filter media are available to deal with a wide range of variables such as temperature, corrosiveness, composition, particle size, etc. The most commonly used filter medium is fabric. Table 2.5 summarises some of the more important fabrics that are used as filter media.

Filters can cope with a wide range of substances and operating conditions but there are limitations to their use. Very high temperatures and large, instantaneous temperature changes are often most usefully dealt with by the use of ceramic cartridges. Moisture and sticky particles can also reduce the effectiveness of fabric filters.

Table 2.5: Materials utilised in fabric filters

Common Name	Generic Name	Chemically resistant to:		Operating temp. (oC)	Max temp. (oC)	Fire resistance
		Acids	Alkalis			
Cotton	Natural fibre cellulose	Poor	Excellent	80	105	Poor
Polypropylene	Polyolefin	Excellent	Excellent	87	87	Poor
Glass	Glass	Good	Poor	260	287	Good
Nylon	Polyamide	Poor	Excellent	93	121	Poor
Nomex	Aromatic polyamide	Fair	Very good	204	218	Poor
Teflon	Fluorocarbon	Excellent	Excellent	232	260	Poor
PBI	Polybenzimidazole	Good	Fair	537	649	Poor
Goretex	Polytetrafluoro-ethylene	Excellent	Excellent	230	260	Poor
Dralon T	Homopolymer acrylic	Good	Excellent	140		Poor
Bekipor	Stainless steel	Good	Good	454	538	Good

Filter cleaning mechanisms

As particles build up on the surface of the filter they initially aid the filtration mechanism but they eventually begin to reduce gas stream throughput and reduce the removal efficiency. To address this problem fabric filters are fitted with cleaning mechanisms that allow the periodic removal of the build-up of particles. There are three main mechanisms for this particle removal, which may be summarised as:

- pulse jet - whereby a pulse of compressed air is applied to the filter in the reverse direction to the normal flow of the gas stream
- shaker - the bag is shaken to dislodge the particulates
- reverse flow - clean air is passed through the filter medium in the reverse direction to the normal flow of the gas stream

Two- and three- filter systems allow cleaning to be undertaken whilst at least one filter is left on-line, improving average performance.

Control of fabric filters

The main issues involved in the control of fabric filters are:

- ensuring that procedures are in place to clean the filter before operating efficiency is compromised by excessive build-up of captured particulates
- managing the operating temperature of the gas stream
- the risk of fire caused by particles that are extremely hot or explosion from explosive dusts

Electrostatic precipitators

Electrostatic precipitators use an electrostatic field to charge the particles in a gas stream. The charged particles are then attracted to a grounded surface from which they are periodically dislodged into a collection system. Because of the risks of fire and explosion associated with their use for flammable materials, electrostatic precipitators are not widely applied in the sector.

2.2.1.3 Control of plumes from vents and cooling towers

Cooling Tower Plumes

Several types of cooling tower are in common use. These include:

- air cooling
- natural-draught cooling towers
- low-level mechanically assisted cooling towers

Condensed plumes that come down to ground level can bring droplets containing biocides, or organisms that could be harmful, and can also cause loss of light, poor visibility and icing of roads. Such plumes should not be permitted.

Where plumes need to be abated, the temperature and the humidity need to be controlled. This may be achieved by combining conductive heat exchange and evaporative cooling in the design of the cooling tower. The degree of abatement required will depend upon local conditions and the distance from the towers to the nearest sensitive area. Plume modelling should be employed by the operator to confirm that the visible (condensed) plume will not ground beyond the boundary fence nor reach areas of habitation at a height that will cause significant loss of light. (As a guide, the width of the plume should not fill an arc that subtends an angle greater than 10 degrees when viewed vertically upwards from the ground.) Performance curves should be provided to enable the plume abatement to be demonstrated under a wide range of ambient conditions.

Vent plumes

Releases from vents generally should be hot enough to avoid visible plume formation in the vicinity of the vent. This is to prevent the condensation or absorption of environmentally harmful substances by the condensing water vapour. Exhaust gases from a wet scrubber can be heated by the use of waste process heat to raise the exit temperature of the exhaust gases and prevent immediate condensation on exit from the vent. This procedure also assists the thermal buoyancy of the plume. Where there is no available waste heat and the vent contains no significant environmentally harmful substances, the applicant may be able to demonstrate that the BAT criteria have nonetheless been met.

Indicative BAT requirements for the control of point-source emissions to air

1. The benchmark values in Section 3 should be achieved unless alternative values are justified and agreed with the Regulator in the Permit.
2. The Operator should identify the main chemical constituents of the emissions and assess of the fate of these chemicals in the environment.
3. Vent and chimney heights should be assessed (see Section 4).

Visible particulate plume control

4. Even where particulate benchmarks are already met, the operator should aim to avoid visible emissions. However, because plume visibility is a function of particle size, reflectivity angle of the light and sky background, it is accepted that, even when BAT is employed and very low emissions are being achieved, some plumes may still be visible under particular conditions.

Visible condensed water plume

5. The operator should consider the need to minimise water vapour to address local visual amenity issues which in severe cases can include loss of light, fogging, icing of roads etc. and which can also adversely affect plume dispersion. Ideally, therefore, the exhaust should be discharged at conditions of temperature and moisture content that avoid saturation under a wide range of meteorological conditions.
6. The use of **prime energy** to reduce a plume simply because it is visible is not considered BAT. However, it may be appropriate to use **waste heat**. For example heat could be removed from a gas stream prior to wet scrubbing and then used for re-heating the gas stream via a heat exchanger after scrubbing. Nevertheless, the use of energy for re-heat should be balanced against the benefits gained. Plumes must be acceptable in cold damp conditions.
7. In some processes it may be possible to reduce the plume visibility by reducing the water content of the exhaust stream.

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附件九：英國 Bristol 地方政府對 VOC 排放管制簡報資料

附件九：英國 **Bristol** 地方政府對 VOC 排放管制簡報資料

Local Authority Control of VOC Emissions.

David Muir

Senior Scientific Officer

Bristol City Council

Local Authorities and the Environment Agency

Environment Agency - Regional/National.

Local Authority - Local.

Local Authorities and the Environment Agency

Environment Agency - Small number of "large" processes.

Local Authority - Large number of "small" processes.

Local Authorities and the Environment Agency

Environment Agency - major function.

Local Authority - At best combined with noise and other nuisance work, at worst these plus (possibly) Health & Safety, food, housing, drainage ... ...

Bristol

Environment Agency - 30 processes (but only 22 sites). These include a number of non-nuclear radioactive substance sites such as hospitals.

Local Authority - About 200 processes with few, if any, multiple sites.

Impacts

Environment Agency processes - potentially large scale.

Local Authority processes - localised, potential for nuisance.

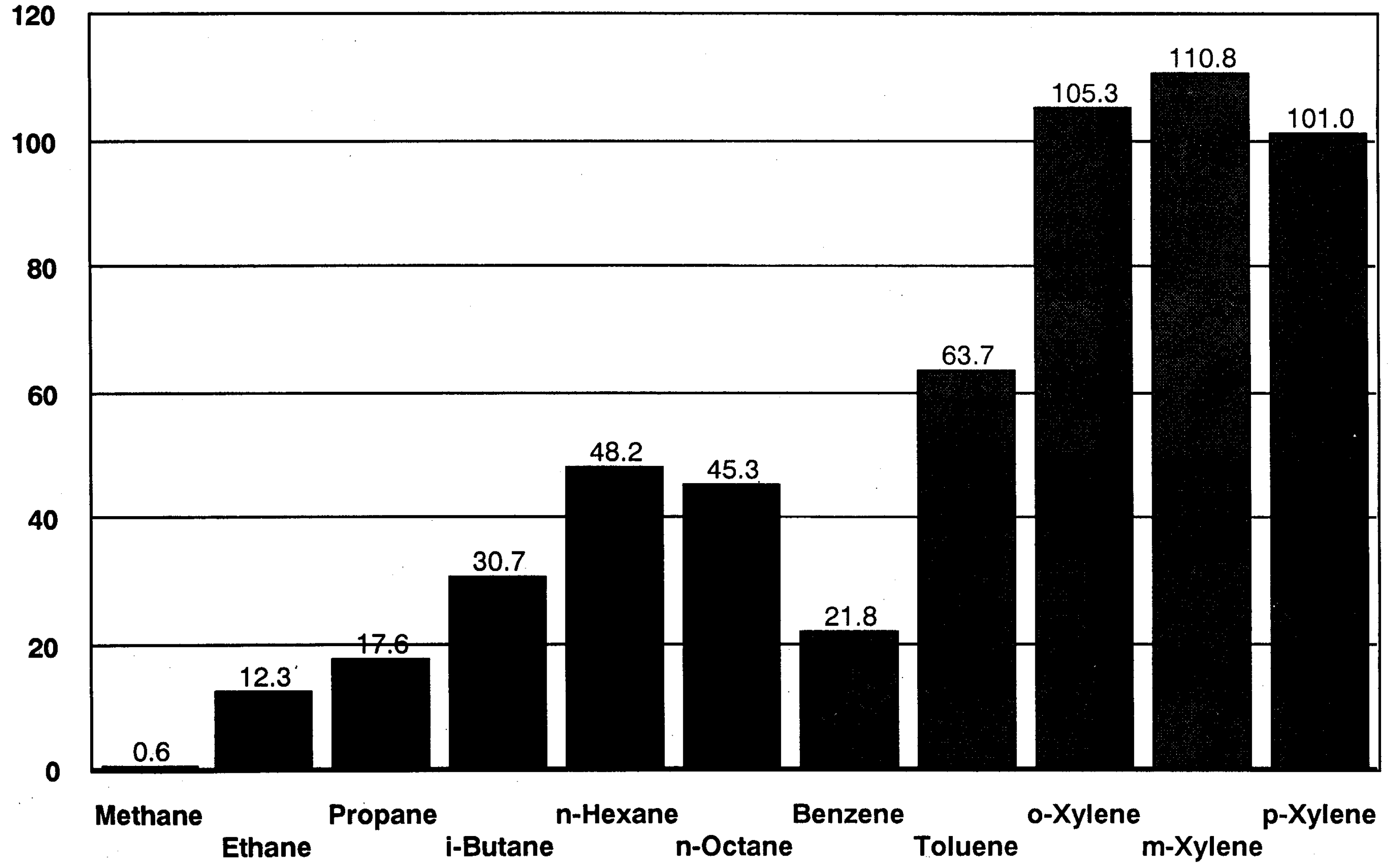
<u>Why VOC’s</u>

1. **Ozone creation potential (All NMHC’s).**

2. **Genotoxic carcinogens (benzene and 1,3 butadiene).**

3. **Climate change.**

Ozone creation potential.



From: Derwent *et al*, Atmospheric Environment, Vol. 32, 24292441, 1998

Processes in Bristol involving VOC's

EA:

3 - "manufacture and use of organic compounds";

1 - "gasification and associated processes".

Processes in Bristol involving VOC's

Bristol City Council:

2 - "gasification";

2 - "storage terminals";

4 - "coatings manufacture";

47 - "coating";

93 - "gas recovery" = petrol filling station.

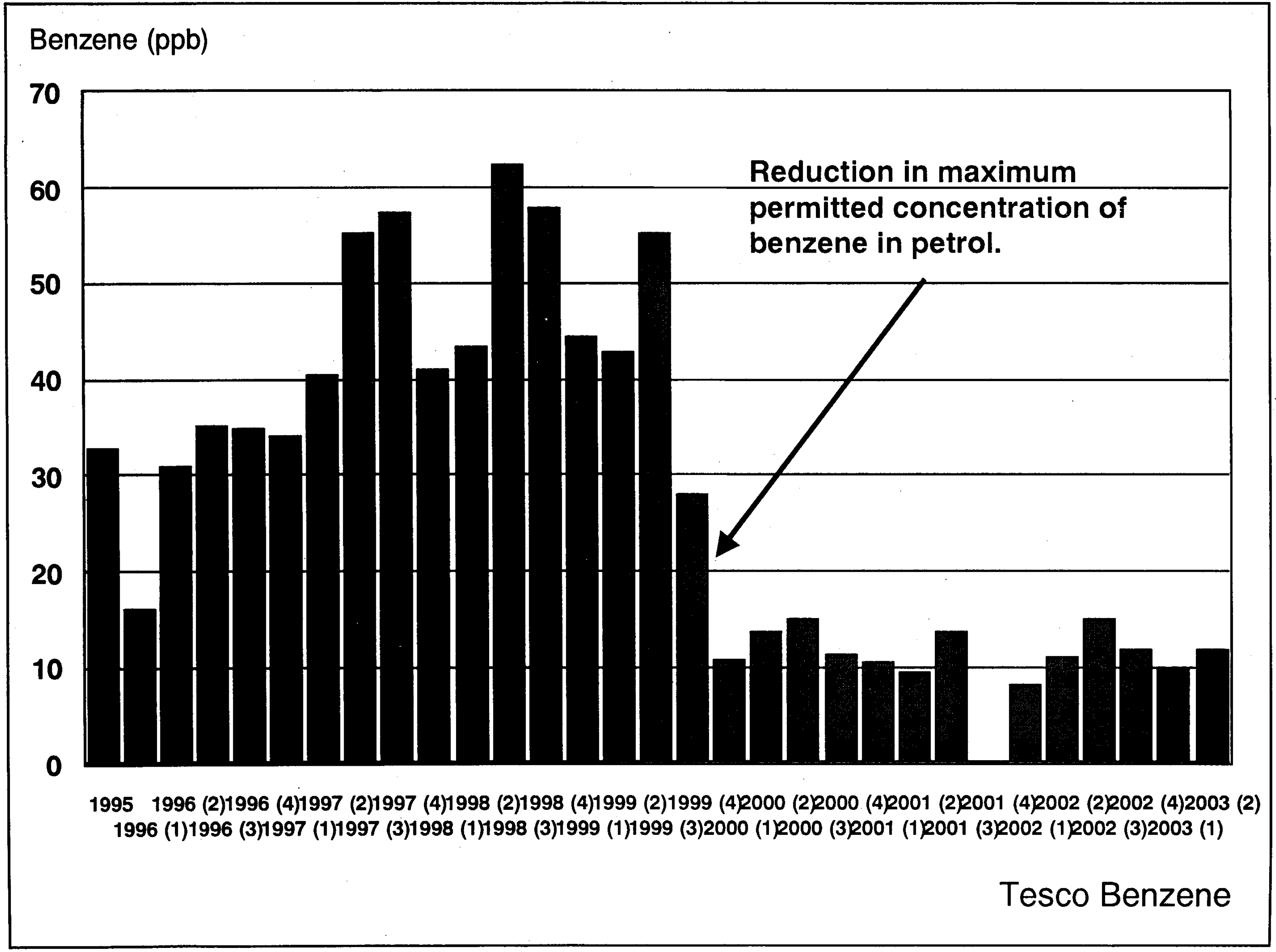
Approximately 70% of total processes.

VOC emissions in Bristol

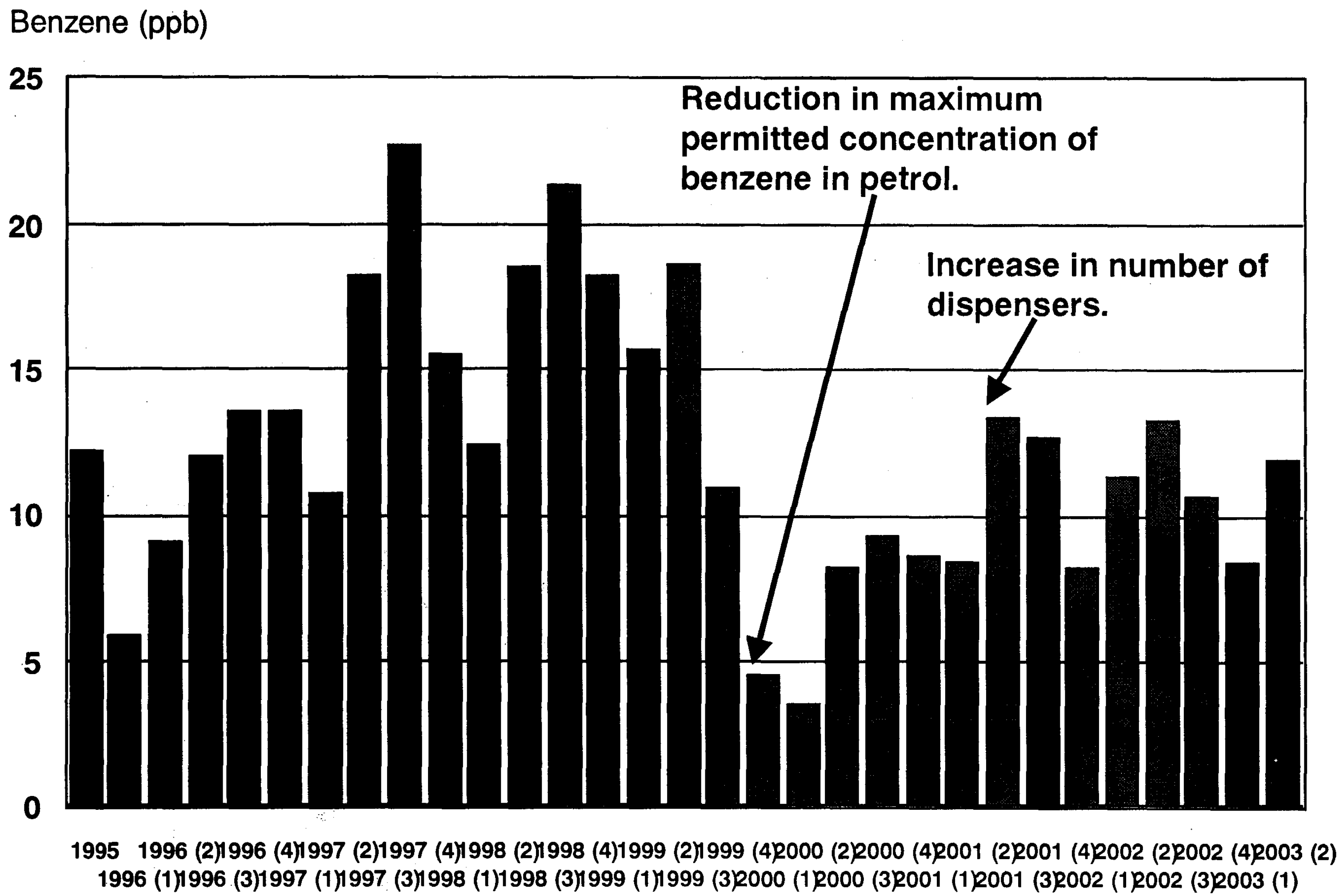
NMHC's - coating, gasification and road traffic.

Benzene - terminals, petrol filling stations and road traffic.

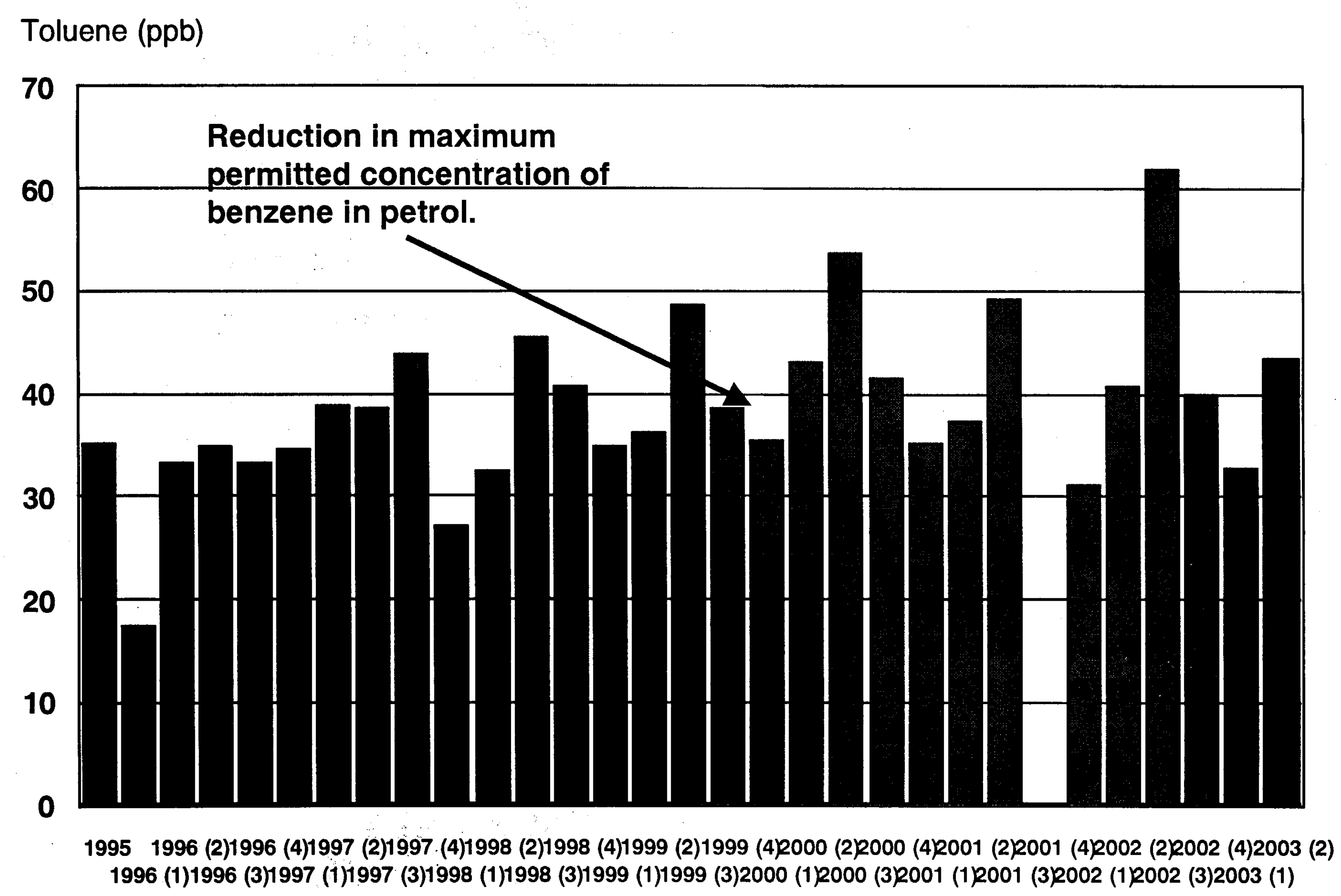
1,3 Butadiene - road traffic.



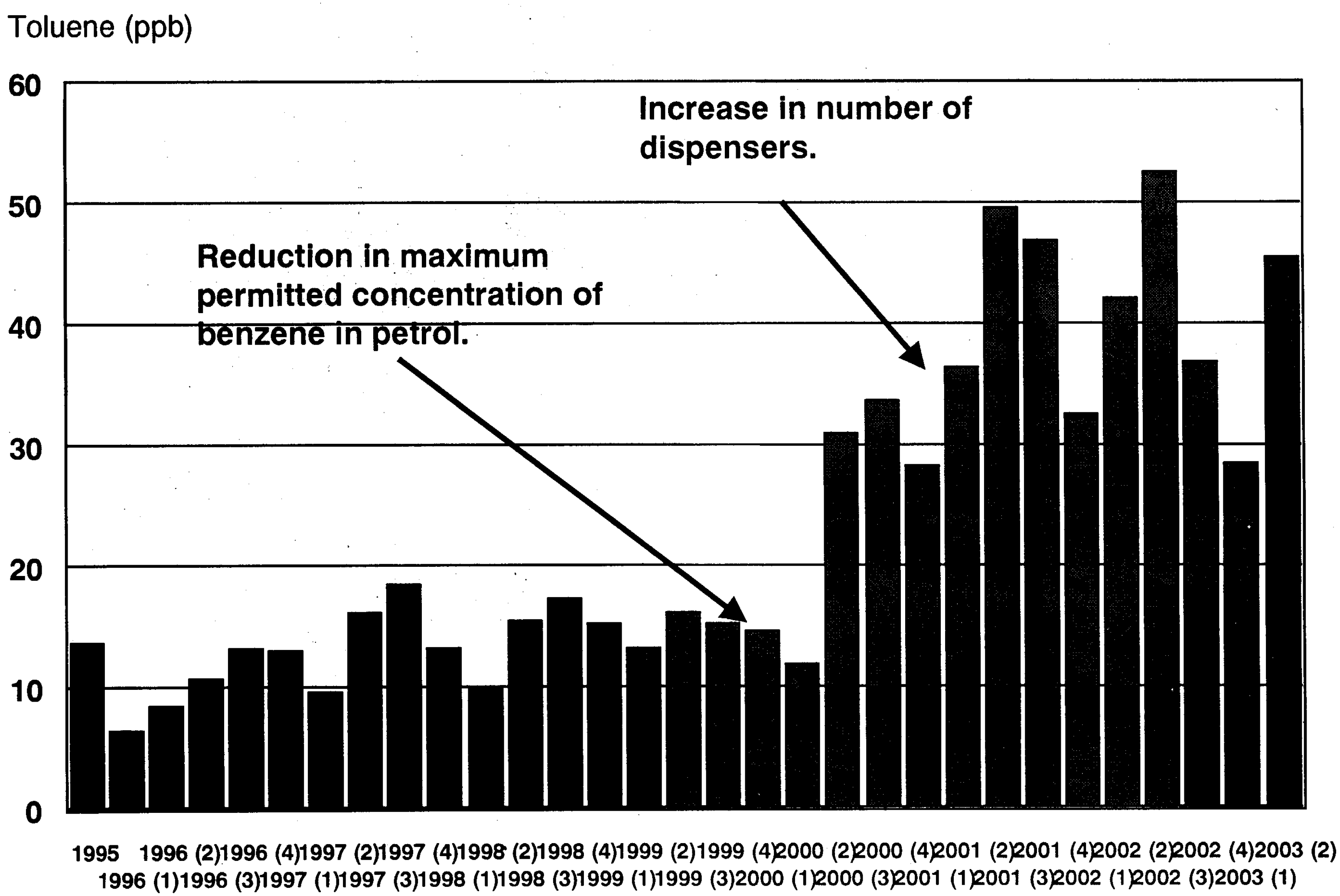
Reduction in maximum permitted concentration of benzene in petrol.



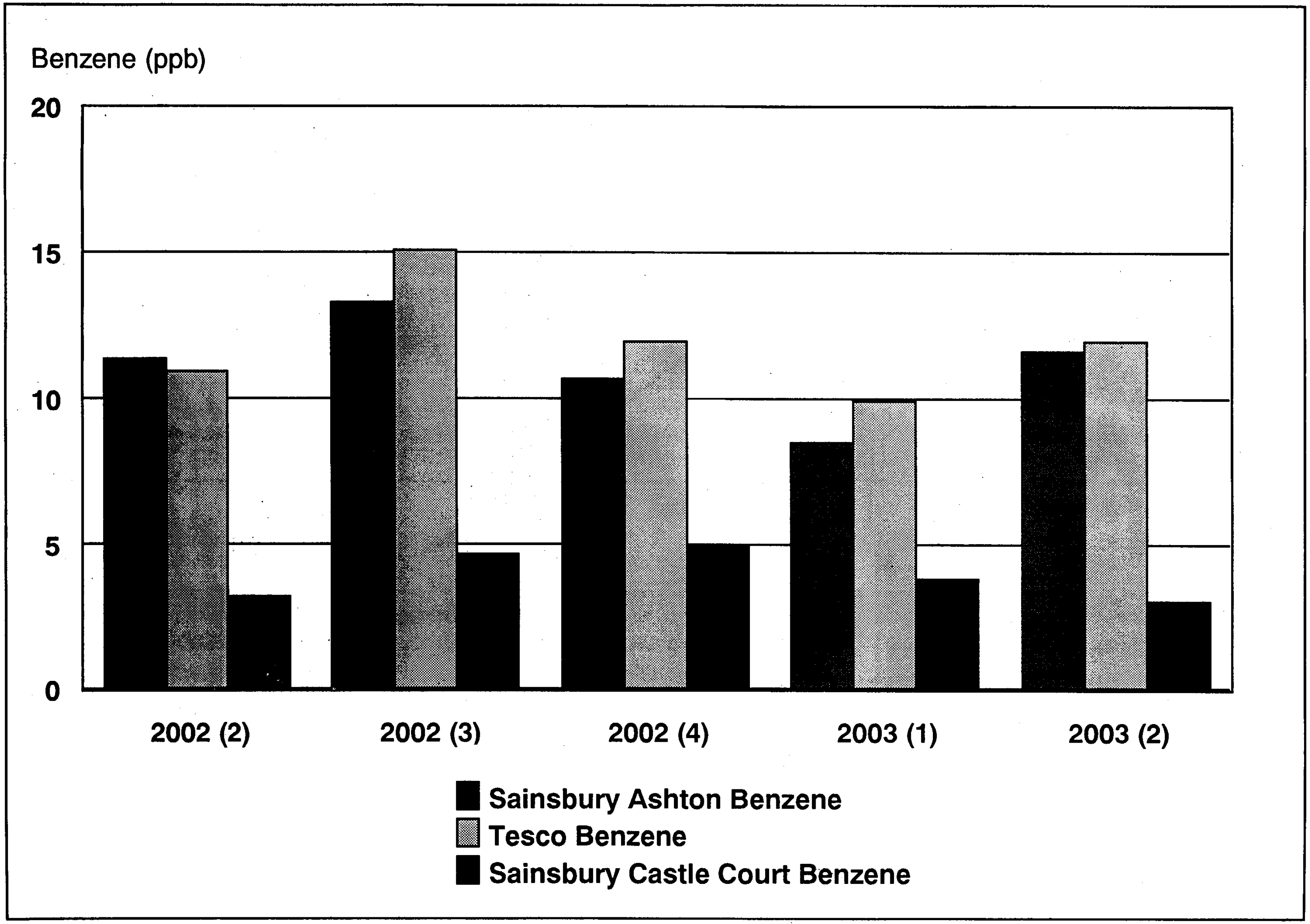
Sainsbury Ashton Benzene

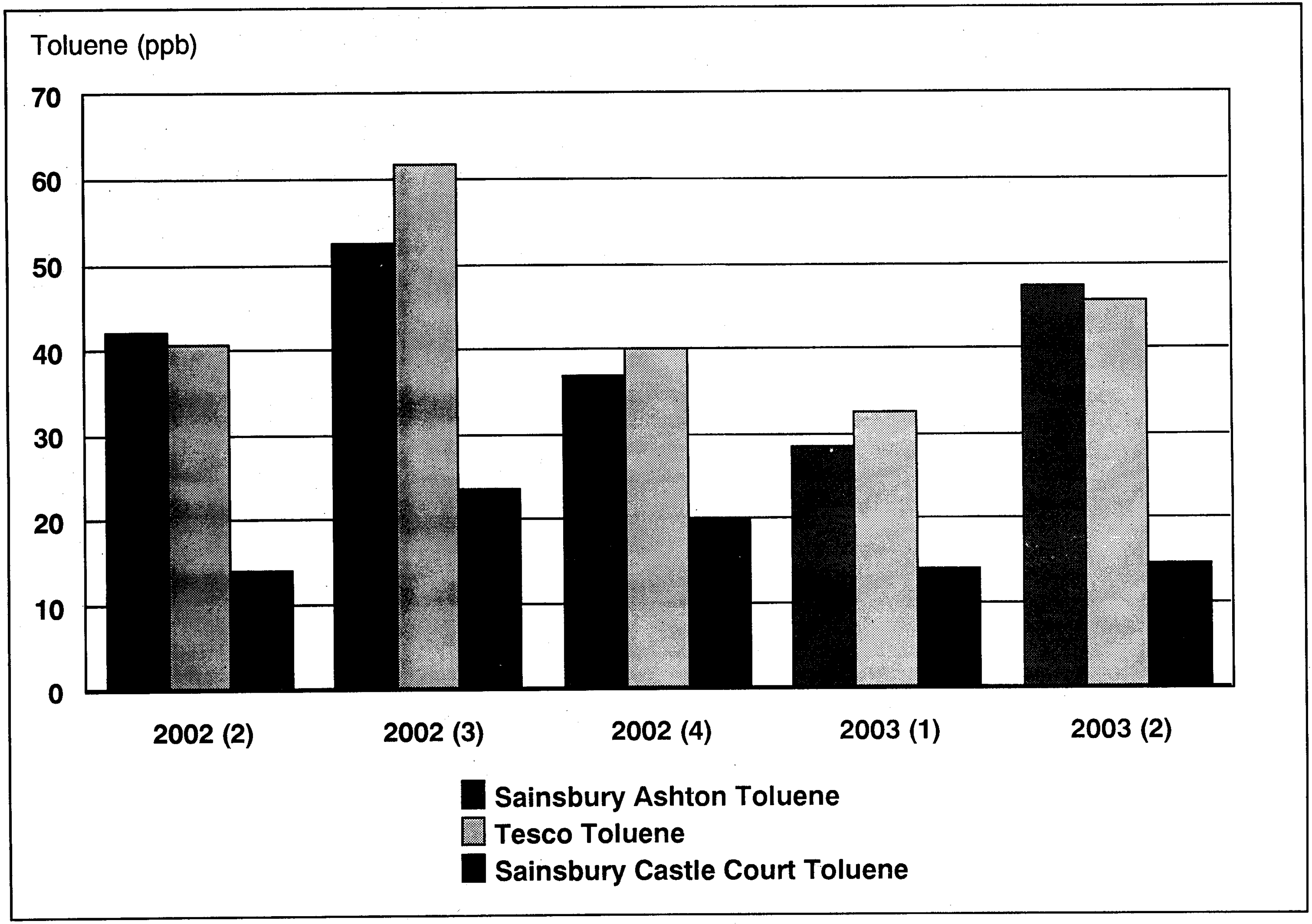


Tesco Toluene



Sainsbury Ashton Toluene

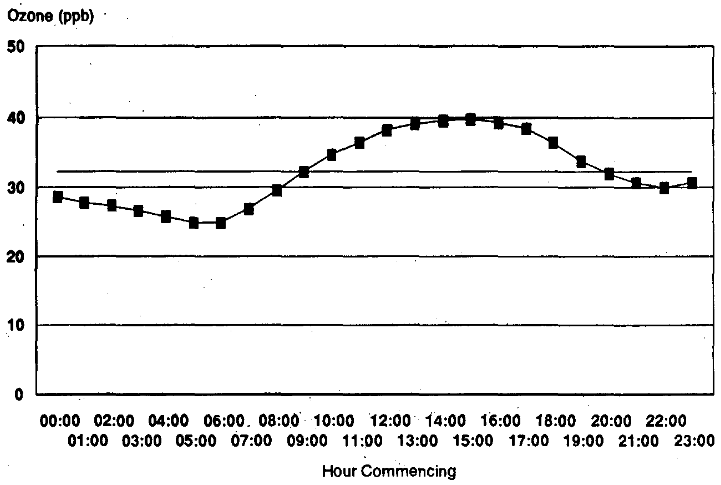

Benzene (ppb)
20
15
10
5
0
2002 (2)
2002 (3)
2002 (4)
2003 (1)
2003 (2)
■ Sainsbury Ashton Benzene
▨ Tesco Benzene
■ Sainsbury Castle Court Benzene


Toluene (ppb)
70
60
50
40
30
20
10
0
2002 (2)
2002 (3)
2002 (4)
2003 (1)
2003 (2)
■ Sainsbury Ashton Toluene
▨ Tesco Toluene
■ Sainsbury Castle Court Toluene

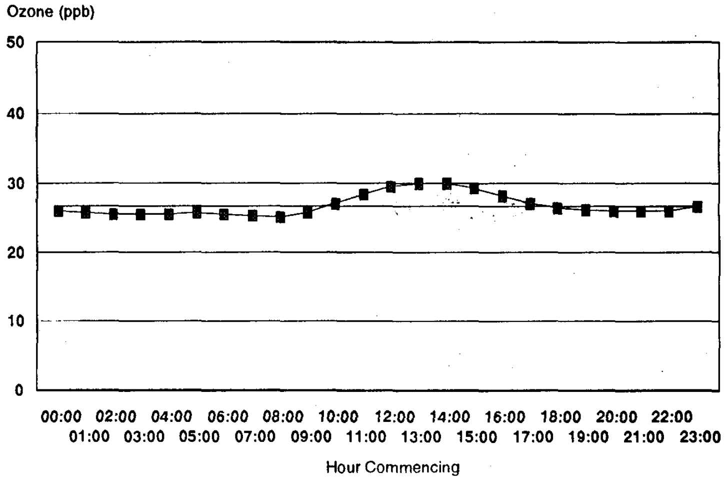
Pollution Prevention and Control and Local Air Quality Management

1. Few AQMA's declared on industrial emissions (4 of 120+).

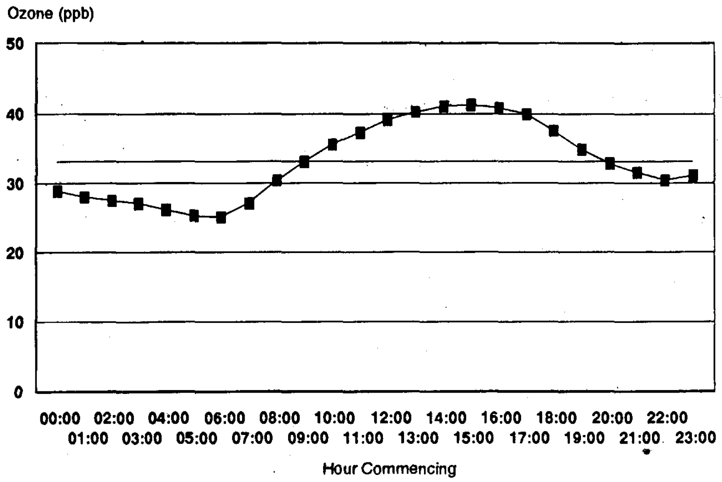
2. No AQMA's declared on VOC's



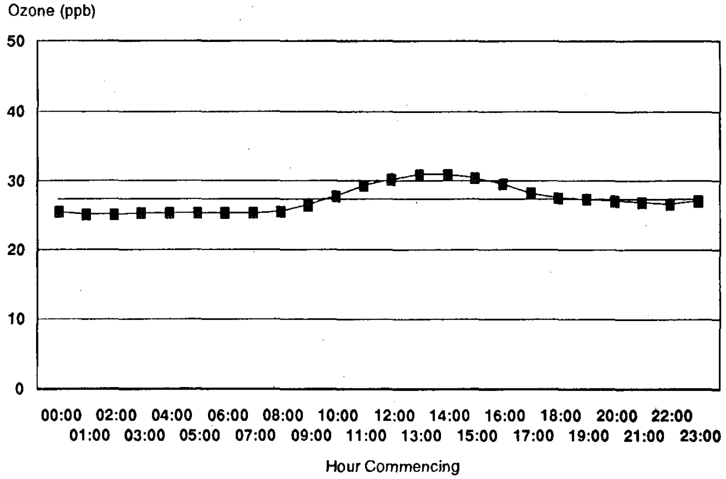
Yarner Wood Summer Weekdays



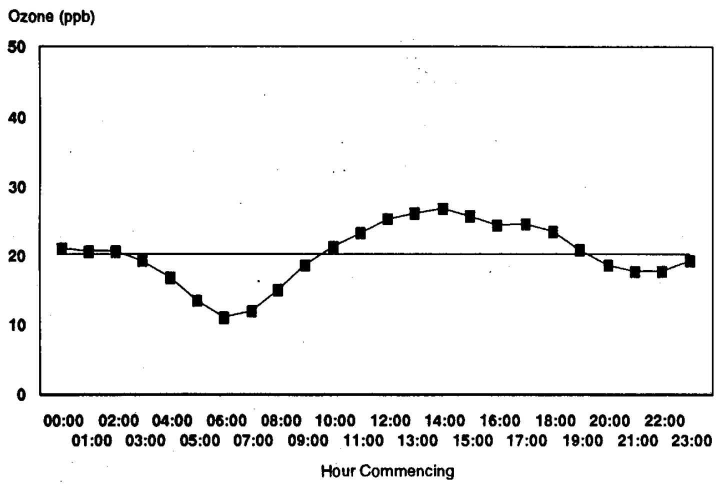
Yarner Wood Winter Weekdays



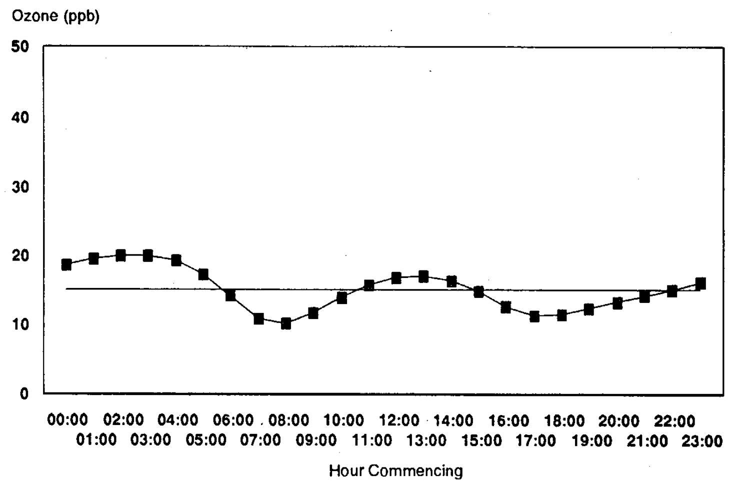
Yarner Wood Summer Weekend Days



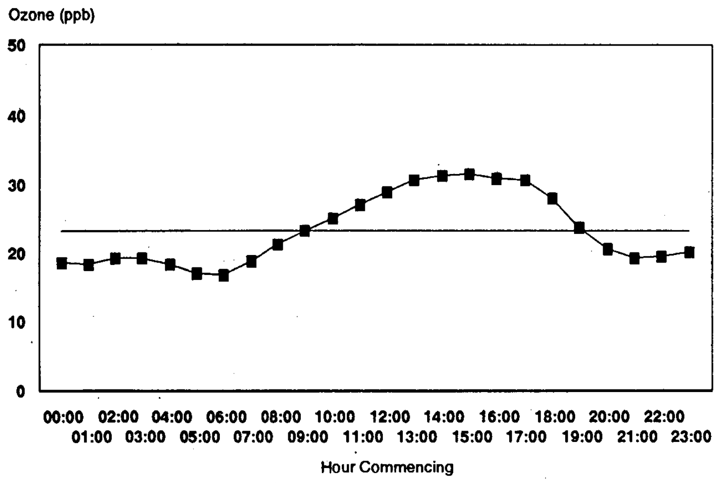
Yarner Wood Winter Weekend Days



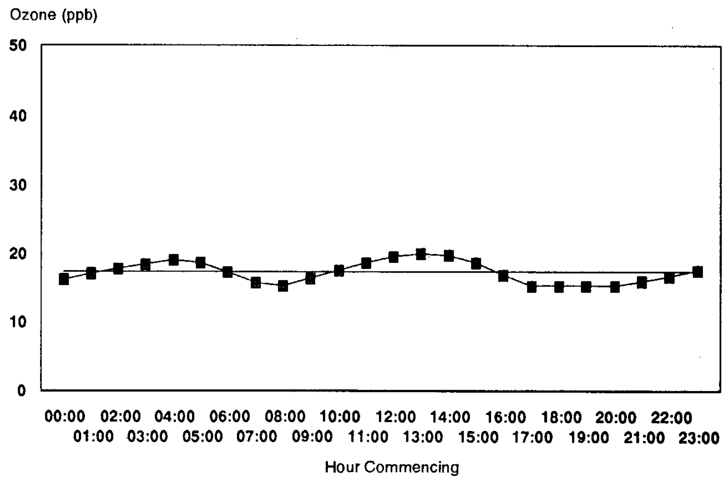
Bristol Centre Summer Weekdays



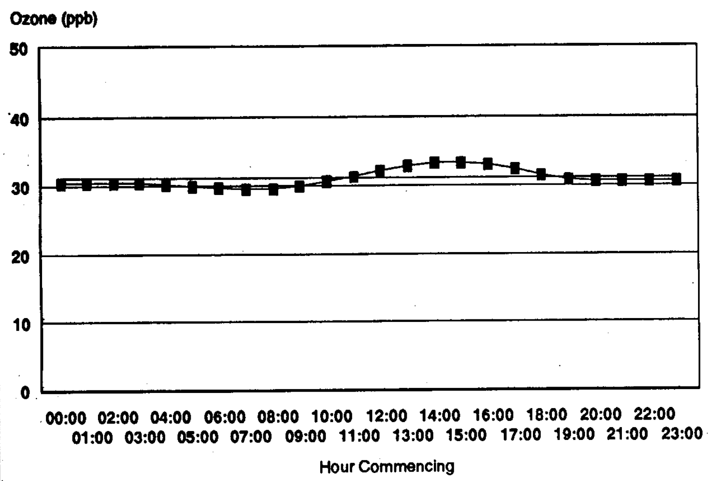
Bristol Centre Winter Weekdays



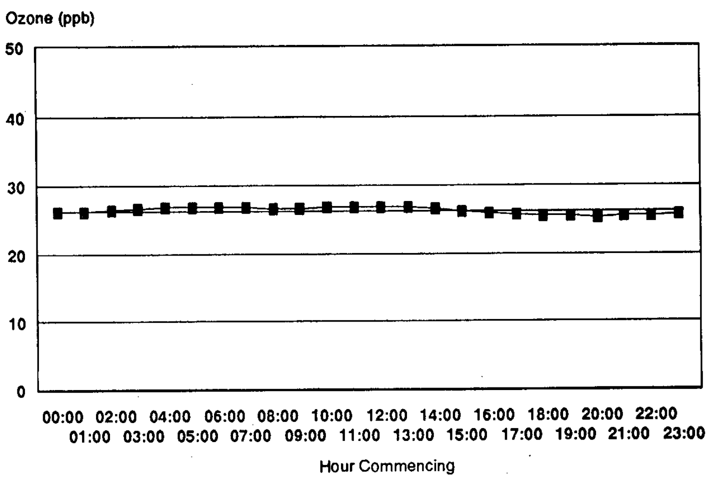
Bristol Centre Summer Weekend Days



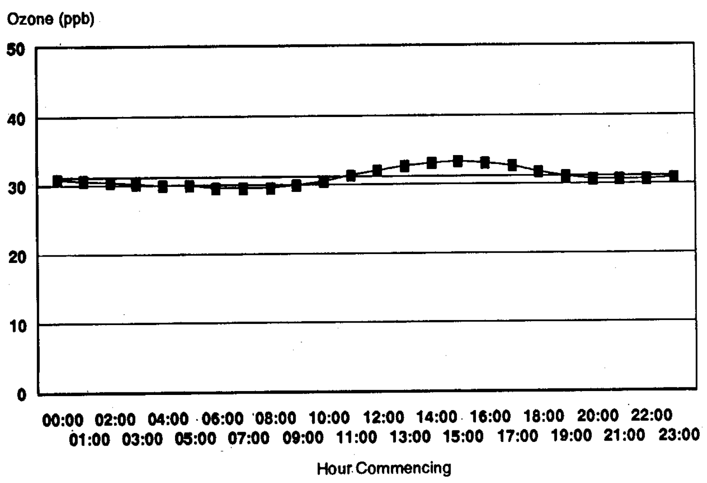
Bristol Centre Winter Weekend Days



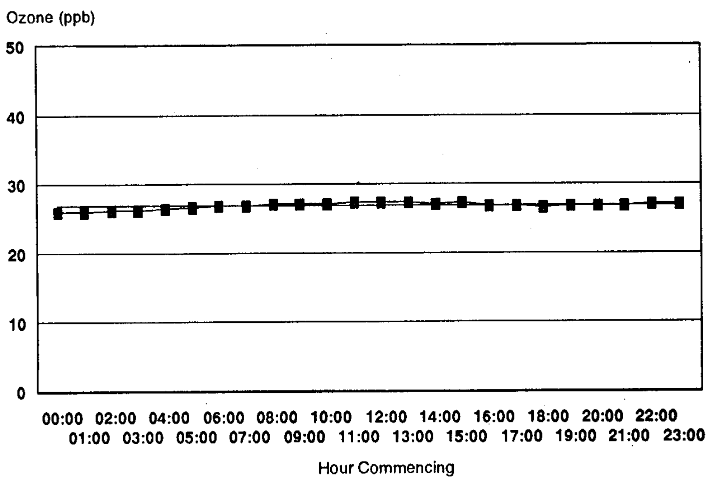
Great Dun Fell Summer Weekdays



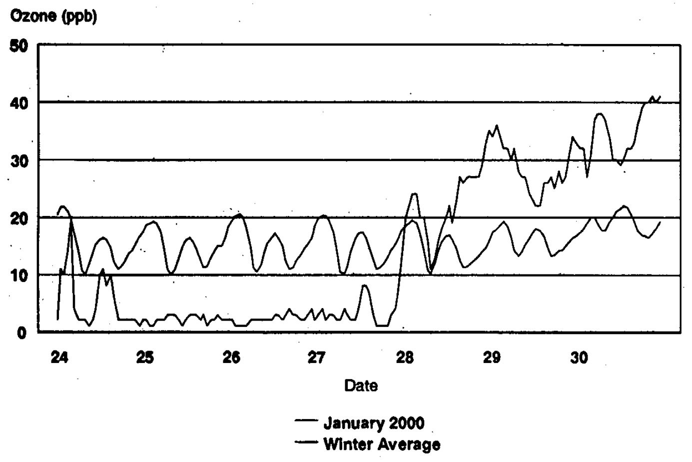
Great Dun Fell Winter Weekdays



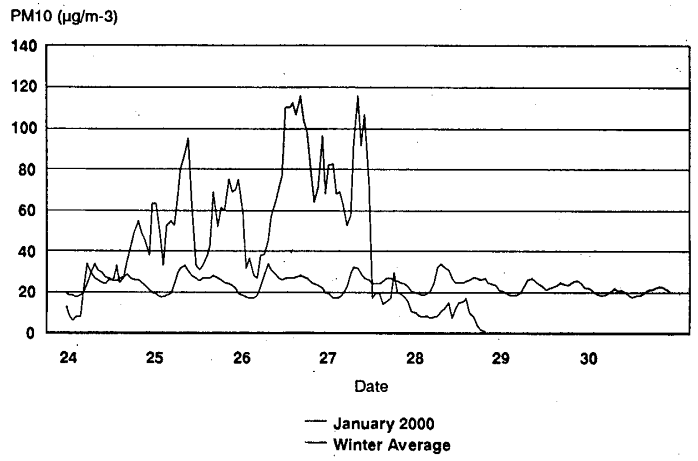
Great Dun Fell Summer Weekend Days



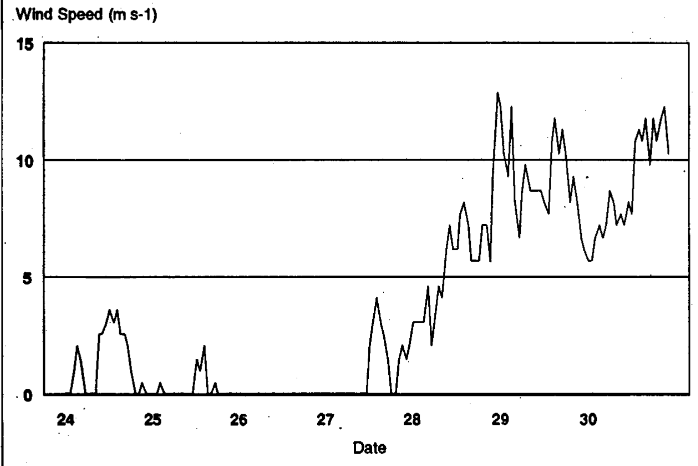
Great Dun Fell Winter Weekend Days



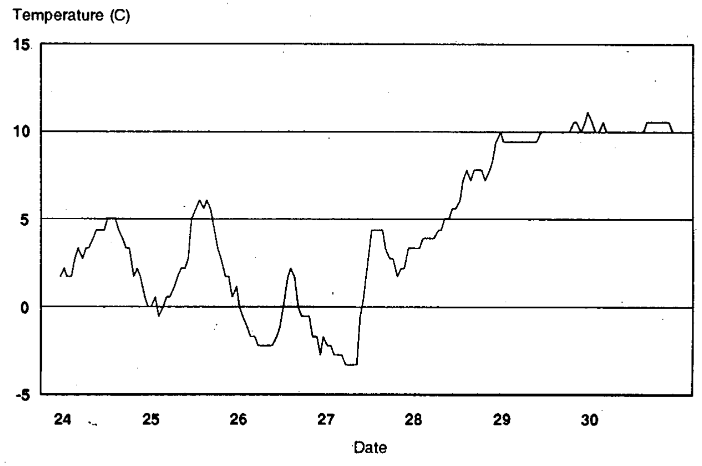
Bristol Centre Ozone, January 2000.



Bristol Centre PM_{10}, January 2000



Bristol Wind Speed, January 2000



Bristol Temperature, January 2000