IPCC Fourth Assessment Report

Expert Review of the First-Order Draft

Chapter 10

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
10-1	A	0	0			Good review of waste management and pollutants. However, more emphasis needs to be given to the links between waste management and climate change. Perhaps, each type of management technique could be reviewed in the context of SD (i.e environmental, social and economic) -- ref. (IPCC 2000) or (MMRS 2005). (Mohan Munasinghe, Munasinghe Institute for Development (MIND))	Taken into account – in waste management policy and regulation discussion, and also to be discussed in chapter 12.
10-2	A	0	0	0		As a general comment, I was surprised to see that the waste chapter was only 29 pages long (including 6 pages of References). From the areas I know something about, the treatment of issues seems to be fairly superficial. (Paul Ashford, Calebgroup)	Noted – but constrained to 20 pages total.
10-3	A	0	0			Yoshito Izumi pointed out that in Japan the cement industry developed a technology to allow municipal waste to be used in making cement. Offered to supply information. (Capetown Industry Expert Meeting, Industry)	Taken into account – have reviewed information and have agreed with Industry chapter to reference the technology.
10-4	A	0	0			FL gases should be mentioned in the potential magnitude of those gases compared to methane. Also, conversion of CFCs occur from bacteria. (Capetown Industry Expert Meeting, Industry)	Point 1: Taken into account – literature covering impact of these gases referenced. Point 2: Noted – already discussed.
10-5	A	0	0			no ties to the scenarios' in chapter 3. Chapter 3 waste estimates are heavily based on Delhotal et al. estimates. The top down studies use the MAC curves; the bottom up use the technology tables (both in Delhotal et al.) Have you reviewed the results? (Casey Delhotal, USEPA)	Noted – based on discussions with the reviewer, we have mutually decided that these are not relevant to the waste sector chapter.
10-6	A	0	0			The term "F-gases" is misused throughtout this section to denote CFCs and HFCs. These are ODS. (Nick Campbell, ARKEMA SA)	Accepted – need to be standardised throughout AR4
10-7	A	0	0			Comment in the Chapter 10 are mainly due to my colleague at the Politecnico di Milano, prof. Mario Grosso. I wonder if you could include him as an expert review in future. His email is mario.grosso@polimi.it (Stefano Caserini, Politecnico di Milano)	Noted
10-8	A	0	0			CFCs and HCFCs are not F-gases (in the normally accepted definition). Furthermore, "CFC's and HCFC's" is not good English, the apostrophes should be omitted. (Nick Campbell, ARKEMA SA)	Accepted – need to be standardised throughout AR4
10-9	A	0	0			Short and with lot of information very well distributed in the world and with clear perpspective for the future (Marco Mazzotti, Institute of Process Engineering)	Noted
10-86	B	0	0	0	0	The authors must be commended for conducting such an interesting analysis.	Noted.

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						(Luis Diaz, CalRecovery, Inc.)	
10-87	B	0	0	0	0	The analyses are only as good as the data that are used, the authors use information that are dated. For example, the information in Table 10.1 is from 1988 and that for Table 10.5 is from 1990 and 2001. Surely there is more current information that what is presented. (Luis Diaz, CalRecovery, Inc.)	Taken into account. Additional information will be included in the SOD.
10-88	B	0	0	0	0	It is so disheartening to read reports in which reliable data are not used. There are several studies and reports that have been conducted in various regions in the world that can be used to "calibrate" the estimates made on waste generated, and treated. I assume that a distinction is made between was generated and waste disposed particularly in economically developing countries. (Luis Diaz, CalRecovery, Inc.)	Taken into account. Additional information will be included in the SOD.
10-89	B	0	0	0	0	I would like to commend the authors for the effort on this draft document. Overall, the document is informative and detailed. It offers a concise and accurate summary of most technologies. (Dina Kruger, Environmental Protection Agency)	Noted.
10-90	B	0	0	0	0	Figure 10.2 b. This seems too simplified. See IPCC GL table. (Dina Kruger, Environmental Protection Agency)	Noted – we will consider replacing with IPCC 2006 Guidelines figure.
10-91	B	0	0	0	0	Figure 10.1. There is no need for percentages for each box. This varies so much. Some of the percentages seem high; i.e. 15-50% composting? (Dina Kruger, Environmental Protection Agency)	Noted – we believe the figures are needed., so percentages for all pathways will be justified by references.
10-92	B	0	0	0	0	Cost estimates for mitigation alternatives also are important. The data are dated and seem to be limited to EU countries. North America also has a rich history of operating various types of processing facilities which are not indicated in the material. (Luis Diaz, CalRecovery, Inc.)	Taken into account. Additional information will be included in the SOD.
10-93	B	0	0	0	0	Delete the first two sentences of Box 10.1 since they are unnnecessary and duplicative of the main text. Additionally, note that use of energy proxy data may be inaccurate compared to national data, especially for developed countries. (Dina Kruger, Environmental Protection Agency)	Accepted – we will remove redundancies in text. Noted – this study was validated using real data. The text will be re-written to emphasize successful applications of the methodology.
10-94	B	0	0	0	0	There are four major comments that I will refer to within the specific comments: 1) the use of opinion, 2) enclosure of information more relevant for the IPCC Guidelines effort, 3) misrepresentation of mitigation cost data and 4) insufficient description for wastewater, incineration, and air quality issues. (Dina Kruger, Environmental Protection Agency)	Noted.

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10-10	A	1	1	29	24	Emissions from landfills and from waste water (and incineration) are of a very different nature and so are the options for emission reduction. In the current chapter emissions and measured are integrated in a somewhat forced way that makes the whole chapter difficult to read. E.g. page 4, line 12 to 15 is about landfills, 15 to 19 is about waste water, figure 10.2a landfills, 10.2b waste water; lines 23-30 landfills, 30-34 waste water; 35-40 landfills, 40-46 waste water, etc. This continues throughout the document and makes it hard to read, especially because there is hardly common ground between landfills and waste water treatment with respect to sources and mitigation measures. Is it possible to put all the landfill-related stuff together in 10.1 and waste water in 10.3 (and C-incineration in 10.2)? (Hans Oonk, TNO)	Rejected – because of page constraints
10-96	B	2	15	2	20	Financial incentives should be added to flexible national policies and regulations (Dina Kruger, Environmental Protection Agency)	Accepted – incorporated into previous sentence as "…cost and financial incentives…transport issues, policy considerations, and local circumstances."
10-95	B	2	34	2	36	Joint Implementation (JI) should be included as another Kyoto mechanism. Countries with economies in transition (EITs) should be added to developing countries. Kyoto is also accelerating the introduction of financial incentives for CH4 recovery and utilization. (Dina Kruger, Environmental Protection Agency)	Accepted.
10-97	B	3	13	3	14	Suggest rewording to " …waste sector is dominated by non-CO2 gases with higher GWPs than CO2" (Dina Kruger, Environmental Protection Agency)	Accepted.
10-11	A	3	14	3	15	Please explain TAR and SRES, or refer to a chapter where these measures and scenario's are described. (Hans Oonk, TNO)	Noted – will follow TSU guidance and refer to Glossary of Terms.
10-12	A	3	19	3	21	Emissions of VOC, CFC's and HCFC's from landfills are not quantified in the current guidelines and (to my knowledge) will not be under the upcoming 2006 guidelines (VOC only as CO2). This makes it very hard to quantify the effects of measures for VOC, CFC and HCFC. Maybe the best you can do is to describe the effect of these measures as a PM-post. (Hans Oonk, TNO)	Noted.
10-13	A	3	44	3	45	prevention of soil surface- and groundwater pollution is THE thriving force for most of the landfill and wastewater related measures. E.g. in EU per tonne of waste landfilled several 10's of € are spent to avaoid pollution to soil and groundwater, where only several 0,10's of € are spent on gas collection or other mitigation	Taken into account – will add "...prevent soil and groundwater pollution..." to list of benefits.

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						measures. (Hans Oonk, TNO)	
10-98	B	4	4	4	4	Remove the word substantial. As noted, an IPCC methodology has not even been finalized yet, therefore, making such a statement when quantification tools are not yet available is inappropriate and more opinion than fact. (Dina Kruger, Environmental Protection Agency)	Accepted.
10-14	A	4	10			Figure10.1: *CO2 from landfill and composting are also biomass C? If so, please write it under *CO2 as same as *CO2 from incineration. (Toshiaki Ichinose, National Institute for Environmental Studies)	Accepted – Figure will be clarified by removal of "biomass C" label under incineration
10-15	A	4	15	4	15	I do not see how lateral migration or storage can be considered a full-grown long-term destination for CH4. Internal storage only leads to temporal variations in emissions (due to atmospheric pressure changes); also gas that migrates is ultimately captured, emitted or oxidised. So in the end there are only three possibilities (not five), and the mass-balance is; CH4-generation = emission + recovery + oxidation. (Hans Oonk, TNO)	Taken into account – Figure to be modified.
10-16	A	4	19	4	20	Since methane is released in a delayded way, the effect of interannual variations in amounts of waste deposited are not that important. I guess trends in amounts of waste landfilled and waste composition are far more important. (Hans Oonk, TNO)	Noted – see previous comment.
10-17	A	4	19			In the report the co-incineration is not mentioned as an option of energy recovery from waste. Energy recovery through production of RDF from MSW, via mechanical-biological treatment plants (MBT) and its subsequent co-incineration in existing industrial facilities (such as cement kilns) is a very effective option for greenhouse gases emission reduction. In fact a low-fossil carbon content fuel (the RDF) is utilised for a direct replacement of a high-fossil carbon content one, such as coal or petcoke. Based on reasonable hypotheses, we can assume that if 1 ton of MSW is processed into RDF which is subsequently fed to a cement kiln, this allows for a net saving of about 400 kg of CO2 equivalent (the calculation includes the emissions related to the RDF production, as reported in Grosso and Rigamonti, 2006). Despite the significant advantages of RDF co-incineration on the side of greenhouse gases reduction, this practice might lead to higher emissions of other pollutants (typically volatile heavy metals). So the co-incineration activity must be carried out under strict regulation and in state-of-the-art industrial plants, equipped with the Best Available Techniques (BAT) for flue gas cleaning.	Taken into account. RDF will be discussed as an extension to the Waste to Energy options. See also other response to cement kilns and reference to Industry chapter.

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						(Stefano Caserini, Politecnico di Milano)	
10-18	A	4	21			Figure10.2a: This figure is not well organized. Please fill in all of methane states(CH4 recoverd, CH4 emitted, CH4 oxidized, CH4 migrated, CH4 storage) to the boxes. (Toshiaki Ichinose, National Institute for Environmental Studies)	Accepted – will clarify figure.
10-99	B	4	36	4	40	Recommend inclusion of anaerobic and aerobic bioreactor landfill technology. Bioreactors are a potential source of greater CH4 emissions over a shorter duration as well as opportunity to reduce CH4 (aerobic significantly) and bring about additional recovery and utilization projects (see http://www.epa.gov/epaoswer/non-hw/muncpl/landfill/bioreactors.htm) (Dina Kruger, Environmental Protection Agency)	Noted – we considered adding this but decided this was not too relevant to GHG mitigation, since anaerobic bioreactors only alter the time relationship of gas production, and aerobic treatments can enhance N2O production.
10-19	A	4	40	4	45	Should discuss amount of energy produced - this is not discussed in the energy chapter. (Casey Delhotal, USEPA)	Accepted – will add energy equivalent in sentence.
10-20	A	4	48	3		Ocean thermal energy conversion (OTEC) is also an interesting energy resource with deep ocean water applications (DOWA) for building air conditionning for example (by the use of cold deep water pipe). Such installations are operating today (http://www.makai.com/p-pipelines.htm). Desalination could be another application of OTEC. Desalinated water can be produced in open- or hybrid-cycle plants using surface condensers. (MICHEL PAILLARD, IFREMER)	Noted – but this does not belong in this Chapter's comments.
10-103	B	5	0	0	0	Delete lines 20- 30, and 37-40 since they discuss inventory specific issues. (Dina Kruger, Environmental Protection Agency)	Taken into Account by above actions.
10-101	B	5	4	5	5	Organization of "technology gradient" approach not clear or evidenced in subsequent sections (Dina Kruger, Environmental Protection Agency)	Noted – but the Section 10.4.1 is where this is fully discussed. A pointer to this will be added in the introduction text.
10-21	A	5	9			The last sentence of this para makes reference to the need to ensure that waste management reduces GHG emissions and acheives SD. It would be clearer if a few sentences are given as to how waste management can contribute to sustainable development. I.e. the environmental, social and economic benefits of proper waste management. (Mohan Munasinghe, Munasinghe Institute for Development (MIND))	Taken into account – in waste management policy and regulation discussion, and also to be discussed in chapter 12.
10-102	B	5	15	6	15	The text is negative concerning the IPCC inventory guidelines methodology. The text suggest alternate methods for developing waste generation data. This is inappropriate as the scope of this document does not include inventory guideline	Noted – the text will be revised to remove the references to IPCC inventories.

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						development. This information should would have been relevant under the 2006 GHG Inventory Guidelines revision process, not within the assessment report. Suggest deleting major parts of this text concerning the quality of the inventory data and alternate methodologies. (Dina Kruger, Environmental Protection Agency)	
10-100	B	5	31	5	34	Overarching characterization is simplistic and not clearly supported e.g., no citation. While waste generation rates are related to affluence there's a number of other drivers impacting generation (e.g., integrated solid waste management systems). For example, source reduction and composting contribute to less waste generation. In the case of less affluent societies the conclusion that less waste is generated is broad/debatable and informal recycling/reuse is only one of the factors (e.g., some recycling occurs prior to waste reaching the curb but most is deposited in open dumps where it's further scavenged leaving a relatively large volume of organics) (Dina Kruger, Environmental Protection Agency)	Noted – we will add the reference for the first table to support our statements in regard of waste vs affluence. The other factors are also discussed in the text.
10-22	A	6	0			Table10.7 should include, under the heading "Emission reductions from waste water treatment", a technology described as "Use of aerobic waste water treatment systems" (Reid Miner, NCASI)	Accepted – add "aerobic" before activated sludge wastewater treatment.
10-106	B	6	0	6	0	Box 10.1 Suggest deletion of the calculation on landfill C storage. Not only does it mix data sources (proxy estimated waste generation and UNFCCC reported biodegradable C) but it is based on a biased literature search. There are sources that suggest that an assumption of 50% C storage is not conservative. It is unclear if this calculation is in line with the draft 2006 Inventory guidelines. This area of study is not well validated and making definitive conclusions as done here is misleading. If section is not deleted, emphasize uncertainty and provide alternate citations. (Dina Kruger, Environmental Protection Agency)	Noted – references will be added – see similar comment regarding numbers in Figure 10.1 – and the 50% value is in line with the 2006 guidelines.
10-105	B	6	20	6	25	Check statistics. North America is stated to have 100% sanitation coverage but Mexico does not have 100% access to wastewater treatment. (Dina Kruger, Environmental Protection Agency)	Noted – dealt with by clarification above.
10-104	B	6	25	6	26	It is unclear if septic tanks are considered sewerage. If not, the statistics could be even more inaccurate. In the US, a considerable percentage of the population still depend on septic tanks. (Dina Kruger, Environmental Protection Agency)	Agreed – the first set of figures applies to sanitation coverage including sewerage, latrines and septic tanks.
10-108	B	7	21	7	22	Consider clarifying this sentence. Looking at the reference, although the estimates	Taken into account – the text will be revised

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						are based on plant specific data for approximately 13 countries, the estimates for other countries are based on this subset. The sentence in the text is misleading. (Dina Kruger, Environmental Protection Agency)	to clarify the number of countries to which this applies. The clause "unlike estimates… economic models" will be deleted.
10-109	B	7	35	0	0	Suggest moving technology descriptions up. The next few sections on trends often mention mitigation technolgoies such anaerobic digestion and bioreactors, with no description for the waste novice. This would also limit repitition (Dina Kruger, Environmental Protection Agency)	Rejected – for consistency with chapter 4-10 template.
10-107	B	7	39	7	50	Recognize the challenge of characterizing a broad aray of "development trends" but certain statements and conclusions are insufficiently treated or misleading. There's a number of other drivers that dictate management choices (e.g., incineration not widely practiced in the U.S. due to poorer economics compared to landfilling, negative public perception). Since economics largely dictate the least costly solution briefly explain why more costly practices have been locally implemented. Compost comment not cited. Open space is not the primary driver for landfills, especially in a country like Korea where most of the country is mountainous and landfills are difficult to implement. While there is increasing interest in alternatives to conventional landfill dsiposal practices North America and Australia are not yet actively implementing "bioreactor" landfill designs. In the U.S. bioreactors can only be implemented in a very limited number by approved states under a EPA RD&D rule. Need citation for conclusion that local decisions regarding waste management are made based on least-cost environmentally-acceptable solution. (Dina Kruger, Environmental Protection Agency)	Noted – we don't disagree and we talk about multiple drivers. Noted – decisions made at the local level are usually least cost but more costly practices may be implemented due to a range of drivers including planning, regulation, and social. Accepted – compost quality will be referenced. Open space issues will be deleted. Accepted – US and Australia are pursuing bioreactor designs. Accepted – see note above, and references will be sought.
10-112	B	8	4	8	13	Statement that current landfill cover designs in the EU tend to retard infiltration (suggest including liquids or precipitation to clarify what's being retarded) to limit leachate generation leaves out this same strategy in the U.S. and Canada (and most likely in Australia). Need source of the statement that landfill CH4 rates will continue to decline for the next 2-3 decades. Incineration in the U.S. has not increased due to other factors: relatively cheaper landfill tipping fees, negative public perception of incineration, high capital costs associated with implementing pollution controls to meet EPA MACT standards under CAA. Terms aerobic and anaerobic landfill practices introduced but not explained. (Dina Kruger, Environmental Protection Agency)	Noted – we will revise the text on EU landfills to clarify what we meant. The phrase "declining rates" will be deleted. Accepted - The section on incineration has been dealt with in comment 10-110. Accepted – anaerobic (without air) and aerobic (with air) will explain these terms.
10-23	A	8	7	8	9	Is the explanation for the lack of incineration too simplistic? What about air permitting issues, NIMBY, etc. There was also no citation for the conclusion. (Casey Delhotal, USEPA)	Accepted – sentence deleted. More text to be added later in chapter.
10-110	B	8	7	8	9	The discussion of the US incineration trends is too simplistic. One, I am not sure	Accepted – Reference to Supreme Court

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						that the Supreme Court ruling denied flow to incinerators so much as it didn't restric flow to landfills. Secondly, there are many other reasons for the small % of incineration in the US. (Dina Kruger, Environmental Protection Agency)	decision deleted. More text to be added later in chapter (see also Response 10-23).
10-111	B	8	15	8	29	Suggest including statement that the shift to landfills for developing countries may be less drastic as many countries are installing landfill gas projects during landfill development. (Dina Kruger, Environmental Protection Agency)	Accepted.
10-113	B	8	33	8	36	If markets exist informal recycling by waste pickers at certain disposal sites often remove materials that contribute to landfill CH4 e.g., paper and cardboard, but other scavenged materials of value do not contribute to landfill CH4 e.g., ferrous/non-ferrous metals. (Dina Kruger, Environmental Protection Agency)	Noted – but we have no credible data on fractions scavenged. We will re-examine appropriate literature.
10-114	B	9	10	9	23	Suggest deleting lines 16-18 and 21-23. This paragraph is too lengthy and contains irrelevant information This section is on global emission trends. Discussion of specific landfill sites and life-cycle analysis of management strategies is not relevant. (Dina Kruger, Environmental Protection Agency)	Accepted.
10-24	A	9	36	9	40	Note that Scheehle and Kruger's baselines do NOT include adoption of additional mitigation projects. Because of this and because of developing countries switching to managed landfills, methane emissions increase in the baseline more than we would realistically expect. You note this later when you talk about subtracting out a 5% annum reduction, but it should also be explained with the graph comparing Konte, SRES, and Scheehle. (Casey Delhotal, USEPA)	Accepted – will add the suggested text from USEPA " Scheehle and Kruger (2006) project an increase in annual CH4 and N2O emissions of 33-36% from 1990-2020, however, these are business as usual scenarios and actual emissions could be much lower if additional measures are in place".
10-116	B	9	36	10	4	Suggest alternate text. Please see attached document entitled global.doc (Dina Kruger, Environmental Protection Agency)	Accepted.
10-115	B	9	38	9	38	Reference should be Scheehle and Kruger (2006) (Dina Kruger, Environmental Protection Agency)	Accepted.
10-25	A	9	44	9	45	Please show us where is (c) of Table 10.3. (Toshiaki Ichinose, National Institute for Environmental Studies)	Noted – but table 10.3 heading includes reference.
10-122	B	10	0	11	0	The section on regional trends is too euro-focused. The only real trends exmained are for the EU and a short mention of developing countries. (Dina Kruger, Environmental Protection Agency)	Accepted – a sentence on North America will be added.
10-26	A	10	5			Table 10.3: (a),(b),(c) should be placed after items like "Landfill CH4 (a)" because	Accepted – a new column with the reference

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						they show data source of items. (Toshiaki Ichinose, National Institute for Environmental Studies)	source will be added.
10-118	B	10	18	10	21	This first secntence is confusing. It mixes reasons for estimates of the size of the global estimate decreasing due to improved knowledge and the trend in decreasing emissions due to recovery and use of methane. Suggest rewording this section. (Dina Kruger, Environmental Protection Agency)	Accepted. We will reword this for clarity.
10-120	B	10	27	10	30	It is unclear why the dicussion is now switching back to the energy consumption method when this has not been discussed in the rest of the section. Additionally, the text should note that the inventory method is more appropriate on a country basis and that this method is always more accurate for countries with good national waste generation data such as OECD. (Dina Kruger, Environmental Protection Agency)	Noted – but there are limited data and the object of this discussion is to consider as much information as possible.
10-27	A	10	34	10	46	The problem I have with describing this normal LFG-recovery as too succesful is that it tends to divert landfill owners, legislators and policy makers from the real effective measures to reduce methane emissions from landfills. Our Dutch experience is that when you leave landfill gas reovery up to its economics (if you optimise for energy recovery), integral collection (collection efficiencies integrated over the life-time of the landfill) will remain poor (up to 20% integral efficiency in most cases). It is possible to design and operate landfill gas extraction as an effective measure to abate emissions. However this needs awareness and results in projects that are less cost-effective than the economy/energy-driven LFG-projects. See for this Oonk and Boom, 1995; landfill gas fromation, recovery and emissions, chapter 7), TNO-report 95-130, TNO, Apeldoorn, the Netherlands. it will also come back in some of my further comments (Hans Oonk, TNO)	Taken into Account – Elsewhere (p13 12) we will discuss the issure of lower lifetime collection efficiency. Add sentence on early and later losses of CH4 compared to high efficiency of collection during management phase.
10-28	A	10	34	10	46	(N.B. the full comment doesn't appear fully on my computer-screen, please scroll down) I have problems with the > 105 Mt CO2-eq. global recovery. Hans Willumsen comes to a conclusion that globally 1,6 million m3 hr-1 (=105 Mt CO2-eq) might be recovered, but also states that this number is uncertain, since it was difficult to get exact data. So at least object against the '>'-sign here. My personal judgement is that this is a huge overestimation, based on an overestimation of emissions from e.g. USA, Italy and UK. If you compare gas recovery rates and reported landfill CH4-emissions from the national communications, you conclude that in USA and Italy roughly 1/4 of all the gas is recovered and in UK even 50% of the gas. I only know the situation in the Netherlands as a reference. We have a limited number of landfills. LFG-recovery is obliged on all landfills in operation	Rejected – the 105Mt CO2e is metered production and so is not disputable. The greater than sign allows inclusion of flare gas projects not included in the number. See also the comment above with respect to lifetime collection efficiencies.

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						since about 1990. This is well monitored by legislators and stimulated by transfer of knowledge, so at the moment I think we have state-of-the-art LFG-recovery at all relevant landfills. State-of-the-art means that we extract as much as possible during exploitation, large number of wells per ha, and have a high frequent control of sub-pressure in individual wells. Still our national average recovery efficiency is a poor 15-20%. If your numbers are true I would like to know, what are we doing wrong over here? (Hans Oonk, TNO)	
10-121	B	10	35	10	35	Approximate >105 Mt CO2e/yr are recovered (insert for energy) globally. Recommend including flaring as a significant mitigation technique since the amount of gas flared globally may be greater than utilized. (Dina Kruger, Environmental Protection Agency)	Noted – we do not have flaring data and we mention it could be greater.
10-117	B	10	40	10	41	This sentence is more opinion than fact. In order for the recovery and use to stabilize emissions the annual growth in recovery and use must overcome the annual growth in emissions. Although I believe this could be the case, the explanation given here does not show that. If annual recoveyr and use in 2010 is only 5% per year higher than 2005, this does not overcome the growth in emissions in that time frame. (Dina Kruger, Environmental Protection Agency)	Taken into account – we will modify the statement to include the two elements of landfill methane recovery and other initiatives such as material recycling and incineration.
10-119	B	10	43	10	46	Suggest deleting these sentences (and maybe the whole paragraph) and refer to the cost section. Estimating future growth in landfill projects based on the past growth is too simplistic in this case, as it is not even certain if it is feasible givne the number of landfills and emission levels. (Dina Kruger, Environmental Protection Agency)	Taken into account – we will rephrase this to stare that historic trends have been linear at 5% growth.
10-127	B	11	0	12	0	The discussion on regional trends from wastewater needs revision. The discussion does not include the impact of industrial wastwater, which is not yet estimated on all developed countries, and non-centralized treatment such as latrines and septic tanks, which have higher emission rates thatn treatment plants. (Dina Kruger, Environmental Protection Agency)	Taken into account by response to comment 10-125.
10-29	A	11	4	11	5	Portugal is mentioned double, both for the 60% and the 75% reduction group (Hans Oonk, TNO)	Accepted – the correct percentage range will be used and the country only mentioned once.
10-30	A	11	4	11	5	I guess the UK reduction in methane emissions must be due to the estimated growth in landfill gas collection (50% of all landfill gas produced nationally is collected, see before). UK and Portugal certainly are not amongst the early implementors of the EU landfill directive. Until recently 80-90% of all waste landfilled over there. In Sweden traditionally a lot of waste is incinerated in local district heating and	Noted.

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						Finland made more recently huge efforts to separately collect and treat organic wastes from households. But I doubt whether this has such a big effect already on such a short term. In the netherlands we took the same measure in the '90's and its effect was limited to maybe 10-20% of total emissions. (Hans Oonk, TNO)	
10-123	B	11	16	11	17	This is opinion. There is no consensus that emissions from wastewater are small. This conclusion does not match the emissions data shown in Table 10.3, where wastewater is half of landfill emissions. This is not insignificant. Also this conflicts with statement on page 3, line 12 (Dina Kruger, Environmental Protection Agency)	Accepted – we will revise.
10-126	B	11	19	11	19	Septic tanks are also used in some developed countries and can be a source of CH4 emissions. (Dina Kruger, Environmental Protection Agency)	Accepted – we will add this sentence if not covered elsewhere.
10-125	B	11	31	11	31	Should explain that US emission estimates are high because they include industrial wastewater and septic tanks. Not all countries report this set of emissions currently. (Dina Kruger, Environmental Protection Agency)	Taken into account – we will add a sentence that the contribution of industrial wastewater to national statistics is uncertain.
10-128	B	11	33	0	0	Need a citation for the emission increase reference. (Dina Kruger, Environmental Protection Agency)	Accepted – Scheehle and Kruger (2006)
10-124	B	11	46	11	46	Suggest putting this conclusion in context to the global estimate of N2O. Include reference. (Dina Kruger, Environmental Protection Agency)	Accepted – FOD for WG1 data will be used for comparison.
10-35	A	12	0	12		In upper right corner of Figure 10.6., I would suggest to add “co-processing at industrial furnaces”difrent from “incineration” (E. Onuma et al., 2004) . Reference (E. Onuma et al., 2004): http://arch.rivm.nl/env/int/ipcc/docs/ITDT/ITDT%20Energy%20Intensive%20Industry%20Session.pdf (Page 169) “Consideration of CO2 from Alternative Fuels in the Cement Industry” (Yoshito Izumi, Taiheiyo Cement Corporation)	Taken into account – the label “incineration” on the figure to be changed to “thermal treatment” which is an EU landfill directive term covering pyrolysis, gasification, incineration +/- energy recovery, co-firing etc, and the meaning of thermal treatment will be described in the text. This terminology will need to be used consistently in the text.
10-129	B	12	13	12	17	Statement that detailed data on waste incineration are difficult to obtain for most countries is not accurate. For example, USEPA maintains a large amount of data and information on the subject <http://www.epa.gov/epaoswer/non-hw/muncpl/landfill/sw_combst.htm> and links to other sources. For the U.S., approximately 14% (not 15%) is incinerated (latest year 2003) - source: (USEPA, 2005 http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/msw05rpt.pdf) (Dina Kruger, Environmental Protection Agency)	Noted – but for the vast majority of countries data are either poor quality or not available. We will use the 2005 reference, which was not previously available for the writing of this FOD.

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
10-31	A	12	27	19	6	Lacks mitigation potential & costs by technology - could add to Table 10.4 (Francisco de la Chesnaye, USEPA)	Noted – based on discussions with the reviewer, there are difficulties with the existing "costs and potentials" in the waste sector and we are still formulating the way forward for the SOD in conformity with other chapters.
10-32	A	12	34	12	35	Toward sustainable development, the cement industry utilized many kinds of wastes generated form our society as alternative fuels. Those utilized technologies, so-called co-processing technologies, reduce CO2 emission from the society including the industry and waste management sector. Therefore, I would suggest to describe as follows: These technologies include post-consumer recycling, landfilling, composting of selected waste fractions, MBT with landfilling of residuals, anaerobic digestion, incineration and co-processing at industrial furnaces. (E. Onuma et al., 2004) Reference (E. Onuma et al., 2004): http://arch.rivm.nl/env/int/ipcc/docs/ITDT/ITDT%20Energy%20Intensive%20Industry%20Session.pdf (Page 169) "Consideration of CO2 from Alternative Fuels in the Cement Industry" (Yoshito Izumi, Taiheiyo Cement Corporation)	Accepted – reference needs to be checked, and the sentence revised accordingly.
10-33	A	12	44	13	44	I miss several options. First of all, landfill gas recovery might be distinguished into several fifferent options, with changing technological details (see below). But also options as choosing a less permeable top-cover (clay, specific residues) in combination with LFG-recovery is an option. Other options are separate gas-collection and flaring in slopes; in development are options as aerobic or semi-aerobic landfill or landfill bioreactors. See for an overview Luning et al., 2001 (Luning L., Boerboom R., Scheepers M., Oonk H., mathlener R., Evaluation of Effectivenesses of methane emission reduction, Sardinia 2001, vol II, pp. 425-434.) (Hans Oonk, TNO)	Accepted – to briefly discuss aerobic and semi-aerobic landfill management techniques, and to review and consider adding the reference Luning et al 2001.
10-34	A	12	50	13	4	(N.B. the full comment doesn't appear fully on my computer-screen, please scroll down) The range in measured whole landfill emissions is i.m.o. too low. In the Netherlands, we found much higher fluxes using mass-balance methods and plume measurements. Oonk and Boom (1995 see full reference in an earlier comment) measured average emissions on 21 landfills whole landfill fluxes in between 4-15 l m-2 CH4 hr-1 for landfills in exploitation; 0,2-3 l m-2 hr-1for closed landfills. Scharff et al (2003. Full reference: Scharff H., Martha A., van Rijn D.M.M., Hensen A., v.d. Bulk W.C.M., Flechard C., Oonk H., Vroon R., de Visscher A.,	Noted – reference to be checked and the ranges to be expanded if appropriate.

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
						Boeckx P., 2003: A comparison of measurement methods to determine landfill methane emissions, report by Afvalzorg Deponie B.V., Haarlem, the Netherlands.) measured more recently average emissions in between 0,4-3,3 l m-2 CH4 hr-1. Also LFG formation prognoses indicate potential fluxes to be higher, if you have a 10 m landfill, 1,3 tonne per m3 waste mass and a gas potential of about 120 m3 per tonne waste, you have a methane potential of 1600 m3 per m2. About 2-5% of this is released annually (a bit more in the beginning), which is a generation of 32-80 m3 gas per year or 90-220 l m-2 per day. Assuming half of this is methane and a density of 0,72 g/l, generation is 30-80 g m-2 d-1. Of course part of this may be recovered and part will be oxidised, but it is obvious fluxes have to be larger than the ones described here. If the range of 0.03-0.3 g m-2 d-1 would be correct, formation prognoses models would be completely be wrong and also emission models in the IPCC-guidelines should be revised. (Hans Oonk, TNO)	
10-132	B	13	4	13	5	Discussion of aerobic and anaerobic bioreactors should be introduced and described under CH4 management (for a good discussion see: http://www.epa.gov/epaoswer/non-hw/muncpl/landfill/bioreactors.htm) (Dina Kruger, Environmental Protection Agency)	Taken into account – we will discuss this in an added section on RD&D in the waste sector.
10-131	B	13	6	13	12	Flaring should be included. Globally, there's more flares in operation than the 1150 LFGE projects and represent a significant and often cheaper mitigation technology. While 90% recovery may be achievable this is certainly not the case at most landfills and even less so in developing countries. EPA uses a default 75% (85% possible) recovery under best conditions at modern engineered landfills. (Dina Kruger, Environmental Protection Agency)	Noted – however, we do not have flare data. Taken into account – we will clarify limits to the collection efficiency (as in comment 10-27 also)
10-36	A	13	9	13	13	In policy studies in the Netherlands we always distinguished two separate measures (sometimes more for further detail): (i) to promote landfill gas recovery as a way to generate energy from waste. This is a low-cost option (even negative costs), however not that effective. In these cases there is no drive to extract more gas than can be utilised. E.g. if you have formation of 5000 m3 hr-1, a gas-engine with a capacity of 1000 m3 hr-1, there is no economic incentive to maximise gas recovery to a level of 2500 m3 hr-1. adding an extra gas-engine is often not an option, because long-term gas supply can not be guaranteed and thus the investment is quite risky. (ii) to prescribe landfill gas recovery as a method to mitigate emissions. Part of the extracted gas can be utilised, the rest has to be flared. This is a higher cost option, but also more effective (Oonk and Boom, 1995, chapter 7) (Hans Oonk, TNO)	Taken into account. A sentence will be added after "... Europe, and Australia. Dependent on the nature of the waste, the design of the landfill, and the need for gas management for environmental control purposes, different recovery layouts may be required and different collection efficiencies achieved." References will be sought to justify this comment (see 2006 guidelines).

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
10-37	A	13	9	13	13	>90% can be recovered in cells with final cover. However this is of little importance for the effectivity of LFG-recovery as a measure to reduce methane. A final cover is made when there is no risk of settlements anymore and thus when biological activity has largely disapperaed. If you catch 90% of the last remaining 10%, you are talking only about 9% of the total methane emission. More important is how efficient LFG-extraction is during exploitation (when ~50% of the methane is formed) and in the closed unlined period (when ~40% is formed). Duing exploitation mostly no gas collection is present. In the closed unlined period Oonk and Boom (1995) measures efficiencies in between 10 and 80%, the average over Dutch 11 landfills being 37%. More recently Scharff et al (2003) measured efficiencies in the closed/unlined situation on 4 landfills to be 9%, 50%, 55% and 33%. The latter 4 landfills are all landfills where mr. Scharff and mr. van Rijn pay a lot of attention to design and operation of LFG-recovery and especially in the 55%-case are being followed closely by the local legislator. (Hans Oonk, TNO)	Noted – a sentence and references will be added discussing lifetime collection efficiencies and uncertainties, and collection efficiencies and uncertainties for active management systems which may only operate for a part of the landfill operational period. Consider adding a figure describing this.
10-38	A	13	9	13	13	(N.B. The full comment doesn't appear fully on my computer-screen, please scroll down) I do not agree with this efficiency. First of all, we have to define efficiency. To my opinion, the integrated efficiency is of importance here, so the average efficiency of the measure during the life-time of the waste. Waste is deposited during exploitation. Normally gas is not extracted during exploitation, and if it is, the collection efficiency is low (technically very difficult to do, e.g. due to easy air intrusion). Only when the landfill or the part of the landfill reaches its end-height, a system for gas collection is installed and extraction is effective to some extent. After longer times, landfills are lined and the efficiency will be close to 100%. For the evaluation of LFG-recovery as a mitigation measure it is not so important whether 5 or 8 years after closure collection efficiency is 80%. it is of more importance that the weighed average of efficiencies during exploitation, immediately after closure, longer time after closure and in the capped situation is high. This is the basis for e.g. Dutch legislation that requires landfills a.o. to minimise exploitation period (by filling small compartments every one or 2 years and not one big one in 10 years, and promoting recovery already during exploitation, even though efficiencies are poor and the gas is of bad quality). If you do not take this into consideration, you already loose about half of the methane in a time when you don't have collection system in place. During the closed situation, the efficiency as measured in the Netherlands in 25 landfills from 1993-2002 varied from about 20-80%, depending on a lot of factors that partially are not controlled.	Taken into account – see above.

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
						Our estimate of the integral collection efficiency of a landfill designed for maximising energy efficiency is about 20%; if you design your extraction system for minimising emissions integral efficiencies might be realised up to 50% (in Oonk and Boom, 1995). The 80% mentioned here refers certainly not to an integral efficiency, but a momentary efficiency a a certain moment in time, and is certainly not representative for all landfills with extraction. (Hans Oonk, TNO)	
10-39	A	13	20	13	24	relative oxidations are i.m.o. not that interesting. How much is 90% oxidation of a very low flux. I guess less than 20% of a high flux. How much atmospheric methane is oxidised in the landfill surface? Do you have info on amounts oxidised in g m-2 d-1 in normal, non engineered top-soils? (Hans Oonk, TNO)	Noted – see below.
10-40	A	13	26	13	29	The results here are as far as I can see lab-results and can not be translated to the field, due to more unfavourable temperatures and more troublesome humidity control. In the field about 1/4th (de Visscher et al, 1999; De Visscher A., Boeckx P., Van Cleemput O. (1999): Methaanoxidatie in stortgronden: experimentele studie en gevolgtrekkingen, Studiedag 'Stortgas in Vlaanderen', Pellenberg, 30 November 1999.) or about 50-100 g m-2 d-1 (Woelders et al, 2005; full: H. Woedlers, H. Oonk, A. Hensen, K. Mahieu, A. De Visscher, F. Van Velthoven and D. Overzet, enhancing methane oxidation in landfill top-covers: results of field trials, Sardinia 2005) is attainable in a well designed cover. It is good to indicate that these capacities are in the same order of magnitude of the fluxes normally encountered on closed landfills (see fluxes at the top of the page) (Hans Oonk, TNO)	Accepted – we will review these references and will explore the ranges in uncertainty in these values further.
10-41	A	13	29	13	29	Maybe interesting to add that the key to efficient oxidation is to make sure that the pattern of emissions is homogenised by adding a distribution layer under the top-layer (Humer, 1999, Oonk et al., 2005, Bogner et al., 2005) (Hans Oonk, TNO)	Accepted – but this should be discussed in a way that decision makers can understand.
10-130	B	13	41	13	47	Suggest alternate text as provided in attached document storage.doc. This section is full of opinion. Although the last sentence has lots of references, it is not clear and leans toward opinion. Storage makes landfills more competitive than what? I do not think it is more competitive than reducing or reusing. Other impacts of landfills would support the fact that it is not environmentally benign. Strongly suggest deleting this last sentence. The storage estimates also need to be caveated and the uncertainty emphasized. (Dina Kruger, Environmental Protection Agency)	Noted – we will be consistent with IPPC 2006 Guidelines.

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
10-42	A	13	43	13	43	what is the basis for the minimum of 50%. This can not be the content of lignin in e.g. putrescibles, which is not that high. I think that under favourable conditions more than 50% might be decomposed. Think about landfills in wet warm climates, where large part of the organic material consists of putrescibles. (Hans Oonk, TNO)	Taken into account – references to be added to justify 50% and uncertainty considered.
10-43	A	13	43	13	43	In the IPCC guidelines for quantifying emissions a default value of dissimilation is 50%. I agree with you that especially in arid regions or maybe also nordic countries carbon storage may be much higher. To my opinion, this is not a result of lignin but more of local conditions in the landfill that are limit progress of biodegradation of all organic components (too dry, too cold, VFA-inhibition). (Hans Oonk, TNO)	Taken into account – see above.
10-44	A	14	1	14	2	References for comments on Chapter 10: S. Consonni, M. Giugliano, M. Grosso (2005), "Alternative strategies for energy recovery from municipal solid waste. Part A: mass and energy balances". Waste Management, 25, 123-135 S. Consonni, M. Giugliano, M. Grosso (2005), "Alternative strategies for energy recovery from municipal solid waste. Part B: emission and cost estimates". Waste Management, 25, 137-148 M. Grosso, L. Rigamonti (2006), "Bilancio delle emissioni climalteranti dai processi di recupero energetico dei rifiuti" Greenhouse gases emission balances in the sector of energy recovery from waste (in italian). Rifiuti Solidi, vol. XX n. 1 gennaio-febbraio 2006, 340-348 (Stefano Caserini, Politecnico di Milano)	Noted – references will be checked and included where relevant.
10-45	A	14	1	14	2	On page 14, line 1-2 it is stated that in the incineration process "GHG emissions are avoided except for a small contribution from fossil C". Despite waste incineration with energy recovery is an advantageous option for greenhouse gases emission reduction, it is not correct to state that there is only a small contribution from fossil carbon in waste. In fact in the typical waste produced in developed countries the content of fossil carbon is generally included in the range of 40 to 50% of the total carbon content, thanks to the relevant amount of plastic in the waste (S. Consonni et al., 2005). This leads to a fossil-CO2 emission factor in the range of 400 – 450 kg per ton of waste incinerated (which is, of course, still lower than the typical emission factors from fossil fuels). If we consider the utilisation of Refuse Derived Fuel (RDF) instead of residual waste, the content of fossil carbon is even higher, because of the lower presence of organic matter (Grosso and Rigamonti, 2006). (Stefano Caserini, Politecnico di Milano)	Accepted – the comment will be included in the text.

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
10-134	B	14	14	14	14	Since 1996 large and small MSW incinerators have been subject to emission standards (40 CFR part 60) (Dina Kruger, Environmental Protection Agency)	Taken into account – we will combine the sentences so that standards are discussed only once in this paragraph.
10-133	B	14	42	14	43	Source, % or actual number of MPT plants or tons of waste treated "…widely implemented in Germany, Austria and other EU countries" (Dina Kruger, Environmental Protection Agency)	Accepted – will add reference from Matthias Kuhle-Weidermeir (Sardinia 2005) on MBT.
10-46	A	15	15	15	17	The text should make it clear that the GHG benefits of recycling are highly dependent on the specific materials be recycled, the recovery rates, and the local conditions affecting GHG emissions associated with other options for managing used materials. (Reid Miner, NCASI)	Accepted – text will include comment on this.
10-47	A	15	37	15	35	Combine the sentence in line 37 with the paragraph ending in line 35 (Casey Delhotal, USEPA)	Accepted.
10-137	B	16	38	17	28	Section 10.4.7 lacks comprehensive, quantitative mitigation potential & costs. Table 10.4 is qualitative only, while table 10.5 & 10.6 show data only from the U.K and the Netherlands. Suggested reference that could be used to illustrate U.S. mitigation costs: US EPA, 2003: International Analysis of Methane and Nitrous Oxide Abatement Opportunities: Report to Energy Modeling Forum, Working Group 21, U.S. Environmental Protection Agency. (Dina Kruger, Environmental Protection Agency)	Noted – we have discussed the EMF data with Casey Delhotal, and are deciding if some of the base data will be included in chapter 10.
10-135	B	16	42	16	45	This sentence is misleading and misrepresentative. First, marginal abatment curves are often applied to non-CO2 sources that are small, dispersed, and influenced by site specific conditions. Second, pointing out one reference and then not using it but using older data based on a similar analysis is inappropriate. Suggest rewording: Although marginal abatement curves contain uncertainties and should be used with caution when considering a specific landfill, the curves can provide valuable data on average national, regional, or global costs of abatement. (Dina Kruger, Environmental Protection Agency)	Noted – based on discussions with Casey Delhotal, we have decided that the existing MACs are not relevant to the waste sector chapter. We should retain the reference and comment on why we didn't use the modeling results.
10-136	B	16	43	16	43	Reference is misspelled - should be "Delhotal" (Dina Kruger, Environmental Protection Agency)	Accepted.
10-48	A	17	2	17	2	I don't think recovery and utilisation is that effective (see other comments). We need to work hard on additional measures! (Hans Oonk, TNO)	Noted – we will attempt to replace Table 10.4 with more quantitative data from country reports in the literature.
10-138	B	17	5	17	30	Please refer to the EMF data provided at: http://www.epa.gov/methane/appendices.html. This data is a collboration of international experts and is more representative than the Dutch and Uk data	Noted – we have discussed the EMF data with Casey Delhotal, and are deciding if some of the base data will be included in chapter 10.

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
						referenced. The experts from UK were included in the EMF study. In addition to being more representative, it is also more up to date. (Dina Kruger, Environmental Protection Agency)	
10-49	A	17	7	17	7	The 85% efficiency here is way too high. It is an momentary efficiency during the post-closure period in a limited number of landfill sites (3), determined with closed chambers, a method that are at discussion because of its reliablility in estimating methane emissions (they might miss hot-spots in emissions). I guess you should incorporate an integrated efficiency here (average over the life-time) which is much more optimistic (see my previous comments). (Hans Oonk, TNO)	Accepted – the numerated value for methane recovery will be removed from the Table 10.4 but see also above comment.
10-50	A	17	14	17	14	The statement that Bates and Haworth assume 70% over the life-time of a landfill site is true. It is in their report. However I checked the report and there is no information in it that backs this high efficiency. I guess it has to be considered less reliable and in my view it is way too optimistic (see earlier comments). (Hans Oonk, TNO)	Noted – will re-evaluate inclusion of reference with more complete survey of literature for SOD.
10-51	A	17	16			Table 10.5. Unit 1990 per t waste should be 1990 US dollars per t waste? (Matti Melanen, Finnish Environment Institute)	Accepted – USD symbol lost in document conversion. Will be added (but see above).
10-52	A	17	25	17	25	Add US cost estimates to one of the tables (Casey Delhotal, USEPA)	Noted – plan to re-evaluate cost data for SOD.
10-53	A	17	26	17	28	The conclusion does not have a citation. I would suggest looking in Delhotal et al. for suggested citations or reference EMF 21 study. (Casey Delhotal, USEPA)	Accepted – appropriate references will be sought out.
10-54	A	17	30			In Section 10.4.8, I was surprised that the section focuses primarily on CFCs and HCFCs. Although this is where most work has been done to date (Kjeldsen et. al), it is unusual for IPCC documents to extend to CFCs and HCFCs unless the subject matter specifically necessitates it (e.g. in the IPCC/TEAP Special Report). In addition, although the term “F-Gases” (used in the title of the section and elsewhere) would technically include all fluorinated gases including CFCs and HFCs, it has only been used in practice to describe HFCs, PFCs and SF6. Therefore, the title of the section is ‘at odds’ with the content. (Paul Ashford, Calebgroup)	Accepted – we will follow the IPCC/TEAP report terminology throughout.
10-139	B	17	30	18	20	The statement "End-of-life [f-gas] issues in the waste sector are only relevant for the foams." is not entirely true. Pressurized, in tact refrigeration equipment can enter into a landfill, and there is certainly some refrigerant entrained in oil that remains in other parts that get discarded in the landfill. Please see the following reference: Maione et al. from Environmental Sciences Journal of Integrative	Noted – we are discussing the numbers in this Italian reference with this author, and will modify if appropriate.

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
						Environmental Research -- a special issue of some papers from the 4th Non-CO2 conference in Utrecht last July. It appears to confirm emissions of f-gases not used in foams (CFC-113 and CFC-114) from at least a couple landfills in Italy. The high levels of some of the other gases calls into doubt some of the conclusions in the last paragraph of attenuation of f-gases in landfills, but there's already a caveat at the end of that paragraph. (Dina Kruger, Environmental Protection Agency)	
10-55	A	17	32			"High GWP F-gases have been used for more than 70 years; the most important are the chlorofluorocarbons(CFCs), hydrochlorofluorocarbons (HCFCs), and the hydrofluorocarbons (HFCs) with the existing bank of CFCs and HCFCs estimated to be >1.5 Mt and 0.75 Mt, respectively (TFFEoL, 2005). These gases have been used as refrigerants, solvents, blowing agents for foams, and as chemical intermediates." Comment: 1) The draft is confused without distinguishing ODS and F-gases: ODS is the (stratospheric) ozone depleting substances that include CFCs, HCFCs which are regulated by the Montreal Protocol. F-gases are strictly HFCs, PFCs, and SF6 that were defined by the Kyoto Protocol. 2) First fluorinated compound used as a refrigerant was CFC-12 (or Freon-12) which was synthesized in 1928 by Thomas C. Midgley. CFC-12 was commercialized in 1930. 3) ODS (mainly CFC-12) has been used also in propellants for spray cans. Recommended Revision: "High GWP fluorinated compounds have been used for more than 70 years; the most important are the chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and the hydrofluorocarbons (HFCs) with the existing bank of CFCs and HCFCs estimated to be >1.5 Mt and 0.75 Mt, respectively (TFFEoL, 2005). These gases have been used as refrigerants, solvents, blowing agents for foams, propellants, and as chemical intermediates." (Koichi Mizuno, National Institute of Advanced Industrial Science and Technology)	Accepted.
10-56	A	17	33			Although it is gratifying to see the TFFEoL Report (UNEP TEAP Task Force on Foams End-of-Life Report) liberally referenced, it might be worth considering the referencing of the IPCC/TEAP Special Report preferentially, where the data exist in both reports. This would seem more appropriate for an IPCC Report.	Accepted – both will be referenced.

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
						(Paul Ashford, Calebgroup)	
10-143	B	18	24	18	27	Broad and unfounded statements. No citation. (Dina Kruger, Environmental Protection Agency)	Accepted – we will cite the Landfill Directive and Incineration Directive for EU and appropriate North American, Chinese, etc refs.
10-140	B	18	29	18	31	While many of the latest enclosed flares can achieve >99% destruction efficiency the majority of operational flares are lower depending on type (e.g., many existing candlestick with lower efficiencies) and disposal conditions (e.g., quality of the gas, open dump site, O&M). (Dina Kruger, Environmental Protection Agency)	Noted – but the text says open flares are lower efficiency.
10-141	B	18	32	18	35	Source of VOC removal and H2S to comply with manufacturer's warranty? VOCs typically not removed and H2S removal only necessary due to odor issues. However, certain manufacturers' may require removal of siloxanes (primarily derived from household beauty and health care products) due to operational issues in engines in boilers that may result without proper maintenance. For better description of air quality issues associated with landfill gas and suggested improved text, see: http://www.epa.gov/lmop/faq-3.htm (Dina Kruger, Environmental Protection Agency)	Rejected – all engine manufacturers have standards for the acid gases Cl, F, H2S and siloxanes.
10-142	B	18	41	18	50	Focus on VOC fluxes through cover soils is interesting but does not merit such discussion in this chapter without proper treatment of other VOC control measures, mainly efficient combustion of landfill gas and as required by regulation in the U.S., Canada, and Europe. (Dina Kruger, Environmental Protection Agency)	Noted – but combustion is dealt with elsewhere.
10-57	A	19	18	19	18	Please explain contexts of Table10.7. (Toshiaki Ichinose, National Institute for Environmental Studies)	Noted – the table heading will be changed to "Examples of…" and footnotes may be added. Within the limitations of space no additional explanation will be possible.
10-146	B	19	25	20	8	Much of the mitigation efforts described, while generally effective, apply primarily to developed countries. Recommend expanding discussion of how to apply certain mitigation options to developing countries/EITs. (Dina Kruger, Environmental Protection Agency)	Accepted – we will highlight the role of CDM as a developing country initiative.
10-144	B	19	27	19	28	The US landfill rule should be moved to non-climate initiatives. (Dina Kruger, Environmental Protection Agency)	Rejected – the text does not tie the landfill rule to a climate initiative
10-145	B	19	45	19	50	Revise: "…in parallel, the U.S. EPA Landfill Methane Outreach Program provides technical support, tools, and resources to facilitate landfill gas energy projects in the U.S. and abroad. Also, periodic tax incentives in the U.S. have provided…" (Dina Kruger, Environmental Protection Agency)	Taken into account – we will state that the USEPA LMOP program provides technical support and tools to facilitate landfill gas energy projects in the US and abroad.

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
10-151	B	20	1	20	1	Additional and important drivers include state renewable requirements that a portion of energy be derived from renewable energy and green power programs that allow consumers to select renewable energy options. (Dina Kruger, Environmental Protection Agency)	Noted – but this comment relates to US and the text relates to developing countries.
10-147	B	20	2	20	3	No citation to support opinion. (Dina Kruger, Environmental Protection Agency)	Noted – we will seek relevant references to support this statement.
10-150	B	20	3	20	5	Conclusion is overly simplified and not entirely accurate. The U.S. trend to deregulate and decentralize it's electricity generation, transmission, and distribution system has both benefited and negatively impacted renewables e.g., since deregulation started around 1999 little significant growth in renewables has occurred but more options exist from renewables. Major barrier is economics. Regulated electricity markets can allow landfill CH4 recovery and use projects e.g., Mexico's state-owned utility is interested in buying landfill CH4 energy. (Dina Kruger, Environmental Protection Agency)	Noted – we shall say this can provide a strong driver.
10-152	B	20	6	20	8	Add Joint Implementation after CDM. Include November 2004 launch of the Methane to Markets Partnership (www.methanetomarkets.org) as a recent example of a international voluntary-based approach by 17 countries to reduce landfill CH4 by facilitating recovery and use projects. (Dina Kruger, Environmental Protection Agency)	Accepted. JI and Methane to Markets will be added.
10-58	A	20	8	20	8	Suggest adding: Another significant programmatic incentive is a recent U.S. initiative. The U.S. government initiated the Methane to Markets Partnership in 2005 in order to facilitate activities that recover and reuse methane emissions in participating countries. The goal of the Partnership is to reduce global methane emissions in order to enhance economic growth, strengthen energy security, improve air quality, improve industrial safety, and reduce emissions of greenhouse gases. It focuses on four types of methane emissions, including landfills. (Mark Heil, U.S. Environmental Protection Agency)	Accepted. Methane to Markets will be discussed.
10-149	B	20	21	20	21	Explanation for "remaining questions related to its long term sustainability" (Dina Kruger, Environmental Protection Agency)	Accepted – we shall clarify this.
10-148	B	20	44	20	44	In the U.S., the Energy Policy Act of 2005 was signed into law and includes provisions for renewed and expanded tax credits for landfill CH4; provides bond financing, tax incentives, grants, and loan guarantees; and extends renewable energy production incentives to landfill CH4 (Dina Kruger, Environmental Protection Agency)	Noted – but not applicable to incineration discussion.
10-153	B	21	32	21	33	Source missing	Accepted – a source reference will be

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Considerations by the writing team
						(Dina Kruger, Environmental Protection Agency)	identified
10-59	A	22	8	22	10	I.m.o. too optimistic. With regards to LFG-reovery you can design a project to maximise its economics (energy recovery), but the result is a reduced efficiency. Or you can design a project with optimised efficiency but with reduced ecomomics. The latter project will not be profitable (Oonk and Boom, 1995) (Hans Oonk, TNO)	Rejected – we know of many more sites where this is not the case, and appropriate references will be added.
10-154	B	22	10	22	13	Simplistic analysis. For suggested text see <http://www.methanetomarkets.org/events/2005/all/breakout-landfill.htm> and more specifically the presentation U.S. Perspectives on Global Opportunities for Landfill Methane Capture and Use (slides 9-16) (Dina Kruger, Environmental Protection Agency)	Noted – but CDM is a much larger driver than Methane to Markets and there are constraints on space in this document. Methane to Markets is previously mentioned in comment 10-152 above.
10-155	B	22	26	22	27	Significant conclusion/opinion with no citation to support. (Dina Kruger, Environmental Protection Agency)	Taken into account – the word completely will be removed. Humer's PhD (2003) will be cited.
10-156	B	24	36	24	36	Reference is misspelled - should be "Delhotal" (Dina Kruger, Environmental Protection Agency)	Accepted.