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环 境 规 划 署

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执行蒙特利尔议定书
多边基金执行委员会
第三十八次会议
2002 年 11 月 20 日至 22 日，罗马

项目提案：印度

本文件载有基金秘书处关于下列项目提案的评论和建议：

气雾剂		
•	气雾剂行业结束性总体项目	开发计划署
反应剂		
•	在 Kedia Organci Chemicals, Vapi 公司将四氯化碳（CTC）反应剂转换为水反应剂	工发组织
•	在氯化橡胶次级行业淘汰 CTC 消费的行业计划	世界银行
制冷		
•	在 Subros Limited 公司完成淘汰 ODS (CFC-12)技术，转用无 ODS 技术 (HFC-134a)制造机动空调（第二阶段）	世界银行
•	在制冷（制造）行业淘汰 CFC 计划	开发计划署/工发组织
溶剂		
•	在 Navdeep Engineering, Palghar 公司将四氯化碳（CTC）洗涤剂转换为三氯乙烷	工发组织

项目评价表
印度

部门： 气雾剂 本行业的 ODS 消费量（2001 年）： 132.5 ODP 吨
次级行业成本效益阈值： 4.40 美元/公斤

项目名称:

(a) 气雾剂行业结束性总体项目

项目数据	合同外包商
	结束性
企业消费量（ODP 吨）	132.50
项目影响（ODP 吨）	132.50
提议的项目期限（月）	24
原申请经费数额（美元）	667,309
最后项目经费（美元）：	
增支资本费用(a)	530,000
酌处资金(b)	53,000
增支经营费用(c)	
项目费用总额（a＋b＋c）	583,000
地方所有权（％）	100%
出口比重（％）	0%
申请经费数额（美元）	583,000
成本效益值（美元/公斤）	4.40
对应出资是否已经确认？	
国家协调机构	环境和森林部臭氧小组
执行机构	开发计划署

秘书处的建议：	
建议供资额（美元）	583,000
项目作用（吨 ODP）	132.50
成本效益值（美元/公斤）	4.40
执行机构支助费（美元）	74,130
多边基金的费用总额（美元）	657,130

项目说明

气雾剂行业结束性总体项目

1. 本项目的目的，是在除计量吸入器应用之外的气雾剂产品制造中淘汰 132.5 ODP 吨作为推进剂的 ODS（103.2 ODP 吨 CFC 和 29.3 ODP 吨 CTC）。这是印度政府请多边基金援助举办的最后一个气雾剂行业（不包括计量吸入器应用）项目。

2. 1993 年以来，执行委员会共核准了 23 个投资项目和一个技术援助方案（在 50 家中小型气雾剂装灌工厂安全使用碳氢化合物），总共将淘汰 865.5 ODP 吨 ODS。该技术援助方案包括了 70 多家气雾剂装灌厂，导致若干中小企业用自己的资金改造为采用无 ODS 技术，其淘汰量估计为 125 吨。现在已将几乎所有杀虫剂产品和若干其他个人卫生用品改造为采用液态丙烷推进剂。当前，仅有一些医药产品和工业产品以及某些香水和化妆品仍然使用 ODS 推进剂。

3. 印度政府已经颁布了从 2003 年 1 月 1 日开始禁止把 CFC 作为气雾剂推进剂的规定。有些气雾剂装灌厂仍然使用 ODS，原因是它们设在出于安全理由，无法使用液态丙烷作为推进剂的地点。其中很多装灌厂将或是关闭，或是把装灌工序包给外厂。

4. 2000 年，印度政府命令所有 CFC 用户都在小企业部下登记（登记时间于 2002 年 7 月 19 日截止）。通过登记，查明总共有 19 家气雾剂装灌厂符合改造条件。所有这些企业都参加了技术援助方案，并接受了开发计划署顾问的视察，通过视察核对了这些企业的基准状况和在财务上的存活能力；此外，所有企业都同意利用自己的资金搬迁到另一个能够安全地使用碳氢化合物的地点。印度政府表示，如果发现其他气雾剂装灌厂，将利用在本项目下核准的经费对其进行改造（即，按比例在各家公司之间分配资金）。

5. 与改造工作有关的资本费用据估计总共为 569,000 美元，其中包括为安全使用碳氢化合物所需要的基本设备（将根据每家工厂的基准设备提供）、质量控制和培训的费用。此外，还申请提供 98,400 美元，以便由臭氧小组举办一个后续管理计划，该计划将包括监督、支助、技术援助和监测活动。

秘书处的评论和建议

评论

6. 秘书处通知开发计划署，根据项目提案中关于基准设备的介绍，装灌工序非常原始，使用的是人工卷边机和人工充气机，项目提议将其更换为气动充气机和气动卷边机。然而，在计算项目费用时没有把设备的技术升级考虑在内。开发计划署的顾问说，“该项目并没有指明使用先进的高科技设备，而是采用最起码的设备。为了根据第 25/50 号决定进一步减少费用，本项目查明并建议采用本国制造的气动设备”。秘书处还获悉，大多数将接受

援助的气雾剂装灌厂将用自己的资金搬迁生产设施，并无法提供改造工作的对应出资。

7. 秘书处还指出，在 19 家企业中，有 5 家从执行委员会第十九次会议核准的一个示范项目接收了新的人工卷边机和充气机（该项目示范了一个新的人工推进剂装灌机，该机器尚未通过商业渠道提供给市场）。然而，有关报告指出：“卷边机和充气机不能平稳运行，没有通过试验，无法依靠这些机器进行生产。只有通过不切合实际和不合算的维护，才能够使这些机器持续运转”。开发计划署进一步表示，在评估每个装灌厂所需要的设备时已尽了最大努力来避免重复计算。

8. 秘书处请求澄清以下问题：为什么质量控制和安全培训的费用在 3,500 美元至 6,500 美元之间不等。开发计划署表示，拟议的质量控制和安全培训是根据每家装灌厂的需要设计的，这样做也是为了减少项目费用。然而，印度政府申请允许其于项目执行期间在所涉各家装灌厂之间灵活地使用这些资金。

9. 根据秘书处的请求提交了一份公函，其中解释了在一家企业（Industrial Automiser）使用 HCFC-141b 的理由。

10. 秘书处指出，如果把项目的管理组成部分（98,400 美元）计算在内，项目的成本效益值为 5.03 美元/公斤。由于这超过了气雾剂行业的阈限（4.40 美元/公斤），开发计划署同意对项目费用进行相应的修订。

建议

11. 基金秘书处建议一揽子核准该项目和相关的支助费用，供资数额如下表所示，并有一项谅解是，印度政府将不再请求多边基金为除计量吸入器应用之外的气雾剂行业提供更多的援助：

	项目名称	项目经费（美元）	支助费用（美元）	执行机构
(a)	气雾剂行业结束性总体项目	583,000	74,130	开发计划署

项目评价表
印度

部门： 反应剂 本行业的 ODS 消费量（2000 年）： 4,067 ODP 吨
次级行业成本效益阈值： 不适用

项目名称:

(a) 在氯化橡胶次级行业淘汰 CTC 消费的行业计划
(b) 在 Kedia Organci Chemicals, Vapi 公司将四氯化碳（CTC）反应剂转换为水反应剂

项目数据	流程改造	流程改造
		Kedia
企业消费量（ODP 吨）		187.10
项目影响（ODP 吨）	382.00	187.10
提议的项目期限（月）	36	24
原申请经费数额（美元）	2,200,000	1,256,731
最后项目经费（美元）：		
增支资本费用(a)		1,061,373
酌处资金(b)		106,137
增支经营费用(c)		89,221
项目费用总额（a＋b＋c）	10,587,627	1,256,731
地方所有权（%）	100%	100%
出口比重（%）	30.4%	0%
申请经费数额（美元）	2,200,000	1,256,731
成本效益值（美元/公斤）	27.80	6.72
对应出资是否已经确认？		是
国家协调机构	环境和森林部	
执行机构	世界银行	工发组织

秘书处的建议：		
建议供资额（美元） 项目作用（吨 ODP） 成本效益值（美元/公斤） 执行机构支助费（美元）		
多边基金的费用总额（美元）		

行业概况

12. 印度政府报告，2000 年反应剂行业使用的 CTC 最新数字为 4,067 ODP 吨。印度反应剂行业迄今已获批准的所有项目的 CTC 总淘汰量为 1,134 ODP 吨。2001 年期间，所有这些项目均在执行之中。因此，印度反应剂行业经确定仍有待处理的 CTC 消费量为 2,933 ODP 吨 。

项目说明

在氯化橡胶次级行业淘汰 CTC 消费的行业计划

背景

13. 世界银行以印度政府的名义向第 37 届会议提交了一份为在印度氯化橡胶制造过程中完成淘汰作为反应剂的 CTC 次级行业计划草案。世界银行提出，该次级行业计划的目标是全部淘汰大约 382 ODP 吨的剩余 CTC 消费量，并避免 2,878 ODP 吨的预计 CTC 消费量。

14. 该计划提议在两个工厂，即 Rishiroop Rubber International Limited (RRIL) 公司和 Rishiroop Polymers Limited (RPL)公司改造流程并关闭两个较小的工厂。提议的改造和关闭的总增支费用为 19,942,183 美元，成本效益值为 52.20 美元/公斤。印度第五个氯化橡胶厂（Rishiroop Organics Limited (ROL)）淘汰 249 ODP 吨 CTC 一事已通过第 34 次会议批准的一个项目加以处理。

15. 项目提案说明以及全部项目文件和秘书处对项目的评论都以 UNEP/OzL.Pro/ExCom/37/39 号文件向执行委员会第 37 届会议分发。

16. 秘书处在评论中得出的结论是，秘书处可支持要求执行委员会根据第 34 次会议批准的 Rishiroop Organics Limited (ROL)公司氯化橡胶项目的成本效益值批准经费，在此之前应调整已通过 ROL 项目支付的技术转让费用。经调整的成本效益值为 7.38 美元/公斤。在考虑到已批准的 ROL 淘汰量之后，该成本效益值可适用于过去三年印度所有余留氯化橡胶厂的平均总 CTC 消费水平。该消费数字为 275.2 ODP 吨。因此产生的增支费用水平为 2,030,976 美元。秘书处指出，该方法将为仍在生产但提议关闭的企业按相同的成本效益值提供经费，如同这些工厂改造流程一样，从而为每一企业决定是关闭还是改造提供了最大程度的灵活性。

17. 世界银行答复说，该方法并没有包括同工厂关闭有关、符合资助条件的费用，只反映了印度该行业承担的总增支费用的一部分。这种方法也没有反映满足未来对无 CTC 氯化橡胶的需求的必要生产能力。世界银行希望同秘书处进一步探讨该问题，以确保行业计划下的供资水平允许印度该行业在生产能力和今后的需求方面保持平衡。

18. 在第 37/56 号决定中，执行委员会决定在未决问题解决之前推迟审议该项目。

当前形势

19. 2002 年 10 月 12 日，秘书处收到世界银行提出的关于在印度氯化橡胶行业淘汰 CTC 的说明，载于本文件附件。该说明提出了新的淘汰提案，涉及要点如下：

（a） 按年产量 3000 吨改造 RRIL 工厂（先前按年产量 4,500 吨申请费用）；

（b） 不运作的 RPL 工厂的拆除费用（先前申请改造费用）；

（c） Tarak 工厂改造（先前申请关闭费用）；

（d） Pauraj 工厂关闭费用（与原先提案相同）。

20. 新提案的拟议总费用为 10,575,627 美元，而原先提案申请的总费用为 18,066,845 美元。

21. 根据原先提案提出的总 CTC 淘汰量（380.6 ODP 吨），新提案的成本效益值为 27.8 美元/公斤，而在原先提案中为 47.5 美元/公斤。

秘书处的评论和建议

评论

22. 如在提交第 37 次会议的文件 中所讨论，印度氯化橡胶制造业的名义生产能力是 6,050 吨。最近三年的平均产量为 971 吨。自 1993－94 年建立名义生产能力以来，达到的最高产量是 1996－97 年的 1392 吨氯化橡胶，即不到名义生产能力的四分之一。提交第 37 次会议的提案原本为改造 5,600 吨的氯化橡胶总名义生产能力提供经费。新提案将为印度 3,850 吨的总名义年生产能力提供经费，包括已经按 550 吨的充分生产能力供资的 Rishiroop Organics Limited 公司项目。该总数仍然是目前生产水平的四倍，是该行业达到的最高产量的 2.8 倍。

23. 同关闭和改造的增支费用有关的环境和资料与秘书处提交第 37 次会议的评论中报告的情况相同。考虑到多边基金的规则和政策，秘书处只能支持采取先前提出的同样的淘汰方式，即根据成本效益值提供经费，在此之前应调整已通过 ROL 项目支付的技术转让费用。经调整的成本效益值为 7.38 美元/公斤。在考虑到已批准的 ROL 淘汰量之后，该成本效益值可适用于过去三年印度所有余留氯化橡胶厂的平均总 CTC 消费水平。该消费数字为 275.2 ODP 吨。因此产生的增支费用水平为 2,030,976 美元。该方法仍能够为仍在生产但提议关闭的企业按相同的成本效益值提供经费，如同这些工厂改造流程一样，从而为每一企业决定是关闭还是改造提供了最大程度的灵活性。

建议

24. 待增。

次级行业简介

25. 项目文件中报告，Kedia 公司是印度生产氯含量为 70%或更高的氯化石蜡（CP-70）的唯一厂家。生产较低氯含量的 CP 在生产过程中不需要使用 CTC。

项目说明

在 Kedia Organci Chemicals, Vapi 公司将四氯化碳（CTC）反应剂转换为水反应剂

26. 该项目将在 Kedia Organic Chemicals Pvt. Ltd, Vapi 公司（Kedia）淘汰使用 187.1 ODP 吨的 CTC。CTC 在生产 CP-70 过程中被用作反应剂，而 CP-70 是一种阻燃添加剂，用于涂料、油墨、塑料、泡沫塑料、黏合剂、油漆、纸张和织物等产品。现有工厂于 1979 年开始生产，安装的年生产能力为 900 吨。过去三年的平均 CP-70 生产水平为 582 吨，相应的 CTC 消费量为 187ODP 吨。

27. 将通过采用该企业发展的利用水而不是 CTC 的新流程生产 CP-70 的方式，实现淘汰 CTC。据说为发展该新流程进行了广泛的实验室试验和工厂试验。项目文件简略阐述了排放控制备选办法，指出该备选办法需要相当大的投资和熟练人员。项目文件的结论是改变流程是优先备选办法。

28. 改造之后的企业生产能力将为每年大约 600 公吨 CP-70。因为新流程的需要，据说现有工厂的大部分将被取代。项目中申请的主要资本费用物品为化工厂所需流程设备物品，即反应堆和储存罐、一台氮发生器、一个真空系统、一台干燥机、一台冷凝器、一个废水中和系统、安全设备、一台焚化炉、一个流程控制系统。该流程设备的总费用为 850,000 美元。辅助设备装配设施和技术援助另外还需要资本费用 200,000 美元。申请的总资本费用为 1,061,373 美元。申请提供增支业务费用 89,221 美元，为期一年。该费用发生的原因主要是因为化学品用量增加和维修费用增加，该费用因没有 CTC 费用而部分抵销。成本效益值为 6.70 美元/公斤。

秘书处的评论和建议

评论

29. 执行委员会第 33 次会议为工发组织批准了 79,100 美元，为世界银行批准了 146,900 美元，用于编写一份有关印度反应剂的行业淘汰计划。工发组织将负责制药行业，世界银行负责氯化橡胶和农用化学品行业。秘书处请求说明预计何时向执行委员会提交该行业淘汰计划，本项目与该计划是何种关系。

30. 工发组织表示，它已收到印度政府的咨询意见，即世界银行正在编制一项反应剂次级行业战略，包括氯化橡胶、氯化石蜡（CP-70）和 CTC 作为反应剂的其他用法。工发组织也一直在编写制药行业部分。印度政府通知说，“次级行业战略报告很可能在 2003 年 3 月完成。有鉴于此，为了实现削减 85%的指标，已批准将 Kedia Chemicals 公司的提案提

交执行委员会下次会议审议。该项目肯定将构成反应剂行业战略的组成部分。”

31. 关于工发组织的项目筹备资金，工发组织通知说，已利用批准的筹备援助资金 79,100 美元对制药业兽医产品和某些其他化学品进行调查。各公司发展了无 ODS 解决办法并设计了流程。在各独立实验室进行了实验室和微型工厂规模的试验和废液分析，并从律师处获得证书。此外还派出核查团去证实 ODS 消费者的现状，为新的运用进行个案研究。迄今大约用去 38,000 美元。这些活动结束后，剩余经费将归还多边基金。

32. 注意到据说 Kedia 是印度唯一的 CP-70 生产厂家，因此请工发组织证实，印度政府将不再为 CP-70 生产厂家的改造寻求资助。工发组织后来提供了印度政府 2002 年 10 月 17 日的一份函件副本，其中指出，因为世界银行正在进行调查，作为反应剂行业战略拟定过程的一部分，因此“要印度政府证实这是最后一个项目尚为时过早”。反应剂项目框架准则要求，各国在提出第一个项目的同时，必须对所有企业进行彻底行业调查，说明各国打算为哪些企业从多边基金寻求资助（第 27/78 号决定）。因此，该项目呈件不符合准则。

33. 秘书处指出，基准 CTC 流程看来是将每批用过的 CTC 全部排放进大气，并不试图回收。请提供资料，说明企业营运所在地管辖当局适用的同工厂气体或液体排放有关的环境或工业条例，以确定工厂的运作是否符合有关条例规则。为促使一企业遵守所在管辖区的现有条例需要采取的干预措施可能不符合作为增支费用的资助条件。

34. 工发组织提供的文件显示，企业拥有排放生产过程产生的废物的适当许可证，但须遵守对排放物成份的某些限制。许可证并不处理向大气排放的问题。正在请工发组织澄清此事。

35. 迄今反应剂行业批准的所有项目均采用流程改造作为实现淘汰的手段。框架准则要求在项目中包括对排放控制费用的评估。该项目中的此种评估非常简略。但是如上文所提，该项目基准流程并没有规定对 CTC 作任何回收。提议的新流程同原先的流程共同之处甚少，原先工厂的多数物品必须替换。此外，“水流程”从资本和运作费用而言是复杂昂贵的流程。因此，看来必须考虑有何种排放控制备选办法。例如，一个简单的 CTC 回收装置可以较低的费用、高达 90％效率，回收目前消费的 CTC。秘书处建议工发组织，需要向执行委员会提出这样一项备选办法，供其审议。

36. 工发组织以叙述方式指出，在现有流程上增加排放控制，以便减少排放，使其符合公认的标准，这样做费用高昂，需要有熟练的管理才能成功。工发组织指出，它没有考虑以比较基本的控制措施回收较少数量（例如 90％）的 CTC 涉及的费用，因为剩余的排放（10％）仍然不符合《蒙特利尔议定书》或其他公认标准。

37. 看来替代技术是企业自己和项目顾问发展起来的。请工发组织说明该技术的发展情况，包括为证实同拟议的反应条件有关的基本数据而进行的测试情况，以及已进行的任何实验室或小规模试验情况。需要显示对工厂设计的成功具有高度信心。

38. 工发组织指出，该技术是工发组织和该企业合作发展的，以世界上最大的 CP-70 生产厂家 Dover Chemical Corporation (USA)公司使用的专利技术为方向。新工厂的设计吸收了

同技术发明者的讨论结果，并经过大量实验室和小规模试验。工发组织提供了一位印度专利律师进行专利研究之后撰写的文件，拟议的流程不违反印度任何现有的专利。项目文件显示，Kedia 并不向非第 5 条国家出口，预计这种情况不会改变。

39. 该项目的增支经营费用高，相当于每生产一吨 CP-70 成本为 153 美元。请工发组织说明目前 CP-70 的市场价格（当地和进口），并提供关于新工厂和新流程经济适存性的评估。工发组织提供的计算显示，在采用新流程生产成本增加之后，CP-70 目前的价格仍然有利可图。工发组织还指出，新产品因为不含 CTC 残留，售价可能会较高。

40. 经营费用高主要是因为必须中和流程中产生的大量盐酸。秘书处寻求专家协助，专家的意见是，可能可以修改流程，避免产生如此大量不需要的酸，从而避免中和酸产生的经营费用。工发组织提供了补充技术细节，显示潜在的更有效率的流程在实践中无法实现。

41. 秘书处也通知工发组织说，废水处理系统的设计似乎并非根据数据，而是根据一般原理和对将存在的成份的假设。秘书处获悉，这些原理是有根据的，假设并非不合理，但是此种方式的结果是工厂的设计保守，费用极其高昂。秘书处指出，基本上以采用中和方式作为主要处理方式来计算所有已批准异丁苯丙酸项目的增支费用。工发组织通知说，该废液不同于异丁苯丙酸流程的废液，它更难处理，只能用所提议的流程处理。

42. 在确定增支费用时，如果流程改造提案被接受，必须考虑到技术升级和以新换旧因素。请工发组织评估每一项因素及其对增支费用的影响。秘书处注意到，鉴于基准工厂和新流程之间的技术和环境控制差别，技术升级将非常显著。工发组织概述了旧流程和新流程之间的一些差别，但是没有对技术升级和以新换旧提出评估。

43. 秘书处注意到，执行委员会批准的任何溶剂或反应剂项目中均不包括维护费用。秘书处请工发组织从增支费用中删除这些费用。

44. 由于印度政府不能肯定该项目意味着次级行业（即，CTC 用于生产 CP-70 行业）改造工作的完成，所以现阶段可能不能批准该项目，因为这不符合反应剂项目的框架准则。不过秘书处将继续审查技术和费用问题，供在适当时间审议，并将其他进展情况通知项目审查小组委员会。

建议

45. 待增。

项目评价表

印度

部门：	制冷	本行业的 ODS 消费量（2000 年）：	2,297 ODP 吨
次级行业成本效益阈值：		商用	15.21 美元/公斤
		家用	13.76 美元/公斤

项目名称:

(a) 在 Subros Limited 公司完成淘汰 ODS (CFC-12)技术，转用无 ODS 技术(HFC-134a)制造机动空调（第二阶段）
(b) 在制冷（制造）行业淘汰 CFC 计划
(c) 在制冷（制造）行业淘汰 CFC 计划

项目数据	机动空调	多次级行业	多次级行业
	Subros		
企业消费量（ODP 吨）			
项目影响（ODP 吨）	0.00	0.00	0.00
提议的项目期限（月）	12	48	48
原申请经费数额（美元）	2,861,610	2,000,000	1,000,000
最后项目经费（美元）：			
增支资本费用(a)	4,868,384	5,299,000	1,224,000
酌处资金(b)	287,671	472,400	122,400
增支经营费用(c)		1,126,290	177,673
项目费用总额（a＋b＋c）	5,156,055	6,897,690	1,524,073
地方所有权（%）	7400%	100%	100%
出口比重（%）	0%	0%	0%
申请经费数额（美元）	2,861,610	2,000,000	1,000,000
成本效益值（美元/公斤）			
对应出资是否已经确认？	是		
国家协调机构	环境和森林部		
执行机构	世界银行	开发计划署	工发组织

秘书处的建议：			
建议供资额（美元） 项目作用（吨 ODP） 成本效益值（美元/公斤） 执行机构支助费（美元）			
多边基金的费用总额（美元）			

项目说明

行业背景

CFC (附件 A 第一组) 消费量和淘汰简介

根据第 35/37 号决定，印度选择备选办法 2 作为起点，数量为：	**2,317.2 ODP 吨**
- 截至第 38 次会议符合资助条件的 CFC 消费量（根据第 35/37 号决定）（根据第 35/57 号决定， 但书 B）	1,530.4 ODP 吨
- 提交第 38 次会议申请经费的所有 CFC 项目的影响	667.52 ODP 吨
- 提交第 38 次会议的项目批准之后符合资助条件的最大余留 CFC 消费量	862.88 ODP 吨

制冷行业简介

- 2000 年制冷行业报告的 CFC 消费量*	2,297.0 ODP 吨
- 进行中制冷项目将淘汰的 CFC 数量	1,490.2 ODP 吨
- 提交第 38 次会议申请经费的制冷项目对剩余 CFC 消费量的影响	535.0 ODP 吨

* 根据报告基金秘书处的数据

在 Subros Limited 公司完成淘汰 ODS (CFC-12)技术，转用无 ODS 技术(HFC-134a)制造机动空调（第二阶段）

46. 印度政府正在提交一个项目提案，以便在 Subros 公司制造机动空调过程中全部淘汰 CFC-12。该项目将改造使用 CFC-12 的机动空调压缩机和冷凝器，转用 HFC-134a 技术。

47. Subros 制造整个机动空调系统，包括压缩机、冷凝器、蒸发器、过滤器干燥机、软管、管子和其他附件。1985 年，年生产能力为 50,000 台机动空调。由于 1990 年代初期对机动空调系统的需求增加，生产能力扩大到 200,000 台，其中 50,000 台使用 HFC-134a 制冷剂，用于出口。200,000 台的总生产能力在 1995 年 7 月 25 日之前安装完毕。

48. 在扩张期间（1992 至 1994 年），Subros 接受了多边基金（执行委员会第 11 次会议）的财务援助，将其部分生产能力改造为使用无 CFC 的替代物（15,000 套机动空调系统）。不过 Subros 提供了额外资源，总共将 50,000 套机动空调系统的生产能力改造为使用 HFC-134a 技术。后来在 1999 至 2000 年期间，Subros 再次增加生产能力，每年增加 50,000

台。

49. 提交第 38 次会议的项目目的是将 Subros 其余的 CFC-12 机动空调生产线改造为使用 HFC-134a 技术，以供应国内市场。改造过程涉及工厂和设备的修改，以生产压缩机、热交换器、接受干燥机、管子和其他附件。日本母公司 Denso Corporation 将提供技术援助。

50. 申请的资助水平不包括同扩大生产能力（从每年 150,000 台增加到 200,000 台）有关的费用。

在制冷（制造）行业淘汰 CFC 计划

51. 在制冷行业，印度政府向基金秘书处报告的 2000 年 ODS 消费量为 2,297 ODP 吨 CFC-12，包括制造新设备使用 690 ODP 吨 CFC-12，维修服务使用 1,607 ODP 吨 CFC-12。未报告制冷行业的 CFC-11 消费量。

52. 起初提出两项提案供执行委员会第 38 次会议审议：一项是开发计划署提出的关于商业制冷次级行业的余留制造能力提案（535 ODP 吨）和德国提出的关于印度制冷行业维修服务提案（1,233 ODP 吨）。向执行委员会第 37 次会议报告的符合资助条件的剩余 CFC 消费量（根据 UNEP/Ozl.Pro/ExCom/37/66/Corr.1/Rev1，并按照第 37/66 号决定）为 1,530.4 ODP 吨。这两项提案的累积影响超过了上述文件计算的最大剩余可资助消费量。后来，秘书处于 2002 年 10 月 9 日收到了印度国家臭氧机构一份电子邮件的信息副本，其中指出，德国 GTZ 公司的提案将撤回，不在第 38 次会议上审议，并将重新提交给以后一次会议。

53. 在家用制冷次级行业，所有七家制造厂商都曾接受多边基金的援助，淘汰了 1,742 ODP 吨。执行委员会为该次级行业拨款 1,120 万美元。

54. 商业制冷次级行业包括主要是中小型企业的众多企业。这些企业的特点是对工厂和机器的投资水平非常低，采用劳动密集型作业。许多企业采用当地装配和（或）定制的泡沫注入机，以尽量降低投资。许多企业还进行手工搅拌和浇注作业。制冷剂灌装和抽空作业主要由半自动设备或手动器械进行。运输制冷次级行业包括卡车和拖车的冷藏柜和冷藏集装箱制造厂商。

55. 执行委员会批准了商业制冷次级行业 33 个项目，共包括 60 个企业，资助额为 730 万美元，淘汰 602 ODP 吨。商业制冷行业的所有企业主要是中小型企业，多数企业的 CFC 消费量低于每年 20 ODP 吨。

56. 印度政府通过提交两项全行业淘汰计划处理制冷行业剩余 CFC 消费量问题。这两项计划如下：制冷制造业的全行业淘汰计划，制冷服务业全行业淘汰计划。

57. 为了解决制冷制造业次级行业的 CFC 淘汰问题，开发计划署在当地专家和印度政府协助下进行了一次调查。查明的剩余企业总数为 240 家，获得了这些企业的基准资料。在这些企业中，199 家符合多边基金的资助标准，即这些企业基于 CFC 的生产能力是在 1995 年 7 月 25 日以前建立的。中型企业大多数采用当地制造的泡沫塑料机。小型企业主要采用

手动化学品搅拌。总共约 80%的企业以某种方式采用聚氨酯泡沫塑料；其余企业或者使用其它隔温材料，或者同隔温材料无关。 在小型企业中，年 CFC 消费量低于 2.5 ODP 吨的 117 家企业有泡沫塑料业务，就产品增值而言，或就可持续性而言，可忽略不计。中型企业的典型情况是，拥有适合 CFC-12 的半自动注入机、真空泵和测漏仪。小型企业则多数拥有适合 CFC-12 的各种注入工具和真空泵。

58. 该计划的目的是协助印度政府达到附件 A 第 1 组物质的 2007 年遵守目标。199 家企业消费的总共 535 CFC 吨将在 2007 年 1 月之前淘汰。

技术选择

59. 涉及的所有企业在其硬质聚胺脂泡沫塑料业务中将转用无 CFC 系统。在商业性采用成熟的小规模零 ODP 泡沫塑料系统之前，将需要采用基于 HCFC-141b 的系统，作为一种暂时技术以维持产品标准和可接受性。将分别用 HFC-134a 和 R-404a 代替 CFC-12 和 R-502 制冷剂。

计划组成部分和申请费用

60. 该计划的投资部分为所有企业提供生产设备，包括泡沫机和制冷剂注入机，费用为 6,542,800 美元，包括按 10%计算的酌处经费。技术支助部分包括建立产品和质量标准，通过技术讲习班和会议、以及培训和证书方案提供技术援助，费用为 175,000 美元。政策和管理支助部分为项目执行提供当地支助，费用为 400,000 美元。

61. 因为泡沫化学品和制冷剂成本较高，要求提供两年的增支经营费用，经计算，增支经营费用为 1,303,963 美元。

62. 该提案的成本效益值为 15.73 美元/公斤 ODP，超过为商业制冷次级行业规定的阈值。

63. 该计划的总体管理将由印度政府在开发计划署支持下执行。运输制冷次级行业 18 个企业的 CFC 淘汰活动将由工发组织执行。符合资助条件的所有剩余企业的 CFC 淘汰活动将由开发计划署执行。

64. 环境和森林部臭氧机构将负责监测淘汰计划的执行、政策/法律的颁布和强制执行，并协助开发计划署编写年度执行计划和提交执行委员会的进度报告。开发计划署每年将进行独立审计，核查 CFC 消费水平，包括现场检查和随机视察,监督执行活动。

业绩和付款时间表

年度 (截至 12 月 31 日)	ODS 淘汰指标(ODP 吨)			制冷(制造业)行业剩余 ODS 消费量 (ODP 吨)	付款 (美元)		
	从经批准的进行中项目	从淘汰计划	共计		工发组织	开发计划署	共计
2002	0	0	0	1,373	1,000,000	2,000,000	3,000,000
2003	200	0	200	1,173	524,073	2,000,000	2,524,073
2004	200	181	381	792	0	1,250,000	1,500,000
2005	200	180	380	412	0	1,250,000	1,000,000
2006	209	203	412	0	0	397,690	397,690
共计	809	564	1,373		1,524,073	6,897,690	8,421,763

供资安排

65. 印度政府通过开发计划署请求执行委员会预先批准 2002 年和 2003 年的资助经费，并请求在提交有关 2003 年所进行活动的满意报告之后，在执行委员会 2003 年最后一次会议之前支付 2004 年的资助经费。将在开发计划署批准年度执行计划并确定商定的前一年削减指标和相关业绩里程碑已经达到之后，在执行委员会 2005 年和 2006 年第一次会议上请求按照上表列出的数额拨发这两年的经费。

使用 HCFC-141b 的理由

66. 项目文件提供了在对每一企业业务情况进行技术和经济分析基础上使用 HCFC-141b 的理由。开发计划署指出，在同企业讨论现有替代办法和执行委员会关于使用 HCFC-141b 作为泡沫发泡剂暂时替代品的相关决定之后，这些企业选择 HCFC-141b 作为暂时技术。

67. 根据执行委员会关于使用 HCFC 的相关决定，已提交印度政府同意这些公司使用 HCF-141b 的送文函，该函件附后。

秘书处的评论和建议

评论

在 Subros Limited 公司完成淘汰 ODS (CFC-12)技术，转用无 ODS 技术 (HFC-134a)制造机动空调（第二阶段）

68. 秘书处根据执行委员会第 11 次会议批准的早先关于改造 Subros 供出口的机动空调生产线项目、基金秘书处编写供执行委员会第 38 次会议审议的印度机动空调项目（第 37/5 (c)号决定的后续行动）（UNEP/OzL.Pro/ExCom/38/6）、以及其他第 5 条国家迄今批准的类似投资项目，审查了该项目提案。

69. 在机动空调投资项目评价方面，印度政府安排秘书处两名工作人员在一名国际机动空调制造专家的陪同下访问多边基金提供援助的机动空调制造企业，即 Sanden Vikas、Pranav Vikas 和 Subros 这些工厂。秘书处感谢印度政府和制造厂商管理人员为这些访问提供便利。

新生产能力安装日期

70. 在关于机动空调项目评价报告的文件（UNEP/OzL.Pro/ExCom/38/6）中，秘书处提出关于提议改造的生产能力的安装日期问题。

71. Subros 公司 1994－1995 年度报告证实，在 1995 年 3 月以前，已安装并获得许可证、基于 CFC-12 的机动空调系统年生产能力为 50,000 台。涉及 1995 年 4 月至 1996 年 3 月期间的下一份年度报告显示，因为执行了 Subros 公司出资的扩张方案，年生产能力增加到 150,000 台。是否如 Subros 所声称，由于 1992－1994 年期间的扩张，增加的生产能力在 1995 年 7 月 25 日之前就已经安装到位，对这一点并不完全清楚。1994/1995 年年度报告说，“资本设备定单已经发出，主要机器已经收到”；第二年的报告证实完成了生产能力的扩大，产能增加到每年 200,000 台机动空调系统。虽然 1995/1996 年期间的 CFC-12 机动空调系统的产量增加到 100,006 台（前一年的产量为 65,319 台），比前一年增加的 35,000 台也可能是在 1995 年 7 月、而不是如 Subros 现在所声称是在 1995 年 3 月新增生产能力投产后生产的。工厂和机器增加的主要部分，包括马达风扇生产能力翻番的投资，是在涉及 1995/96 年期间和 1996/97 年期间的报告中提到的（见表 1），如上文所述，CFC-12 机动空调系统生产能力的增加仅在 1995/96 年度报告中提到（见表 2）。

表 1 Subros 公司的工厂和机器增加情况

年份	百万卢比	汇率(1 卢比 = 美元)	价值 (百万美元)
94/4-95/3	31.2	0.0318	1.0
95/4-96/3	113.8	0.0284	3.2
96/4-97/3	174.8	0.0278	4.9
共计	319.8		9.1

来源: Subros 年度报告

表 2. Subros 公司的机动空调生产能力和产量

年份	已安装能力		实际产量	
	CFC-MAC	HFC-MAC	CFC-MAC	HFC-MAC
93 年/4 月- 94 年/3 月	50,000[1]		43,300	
94 年/4 月- 95 年/3 月			65,319	3,620
95 年/4 月- 96 年/3 月	150,000[2]		100,006	13,544
96 年/4 月-97 年/3 月			109,263	19,352
97 年/4 月-98 年/3 月			124,280	25,560
98 年/4 月-99 年/3 月		50,000[3]	131,555	13,508
99 年/4 月-00 年/3 月			165,906	15,340
00 年/4 月-01 年/3 月		100,000[4]	136,334	48,865
01 年/4 月-02 年/3 月			126,313	61,122

[1] 1990 年代中期以来已安装的生产能力。
[2] 1995-1996 年年度报告中报告的由 Subros 出资扩大的生产能力。
[3] 多边基金出资的改造项目，1995 年开始执行，1998 年 11 月完成。
[4] 1999 至 2001 年期间 Subros 出资扩大的生产能力。
来源: Subros 年度报告和项目完成报告。

72. 1993 年 11 月批准了转产 HFC-134a 机动空调机的改造项目，1995 年 6 月签署赠款协定同时签发合同。根据项目完成报告，1998 年 11 月项目完成，比计划完成日期晚三年。该项目新建立了一条 HFC-134a 机动空调生产线，与原有的 CFC-12 机动空调生产线并行运作。从这个意义上说，并没有进行改造，而是该公司得以满足本国一家汽车制造商（Maruti）对用于口汽车的 HFC-134a 机动空调系统的需求。与此同时，CFC-12 机动空调系统的生产在 1994/1995 年和 1997/1998 年期间翻了一番，并在以后数年继续保持该水平，在 1999/2000 年达到高峰（见表 2）。

73. 秘书处注意到，项目提案和项目完成报告都没有提供有关生产能力的明确数字。当时预期，1994－1995 年期间 Maruti 将需要 12,000 台供出口汽车用的 HFC-134a 机动空调，并且还需要 11,000 台 HFC-134a 压缩机，出口供应 Nippondenso 在各地的分公司。不过经计算，间接的 ODS 淘汰量为 84 ODP 吨，假定每台机动空调机首次灌注制冷剂 1.0 公斤，每年维修加注 0.35 公斤，总产量 50,000 台机动空调机。根据项目完成报告，报告的实际淘汰只有 23 ODP 吨，涉及计划供出口的 23,000 台 HFC-134a 空调机，没有计算维修灌注量，也没有考虑 HFC-134a 机动空调机的实际产量，项目完成那年，即 1998－1999 年，实际产量为 13,508 台。

74. 在这方面，世界银行报告说，供应出口市场的 HFC-134a 机动空调机生产线的年生产能力扩大情况如下：

（a） 从 1994 年的 15,000 台扩大到 1998 年的 50,000 台。多边基金提供了总改造费用的一部分（Subros 项目第一阶段）；

（b） 从 1999 年的 50,000 台扩大到 2001 年的 100,000 台，多边基金没有提供资助（该公司将不要求资助）。

75. 关于供应国内市场的 CFC-12 机动空调系统生产线，生产能力在 1993－1994 会计年度和 1994－1995 会计年度期间（该财政年度涉及 1994 年 4 月至 1995 年 3 月期间）从 35,000 台增加到 150,000 台。1995 年 4 月开始试运作和生产。该公司计划在 2002 年期间进一步扩大到 200,000 台。Subros 请求为改造 1995 年 3 月安装并投产的每年 150,000 台的生产能力提供资助。

76. 世界银行还指出，1995－1996 财政年度的报告显示生产了 114,250 台机动空调机。根据年生产能力 150,000 台计算，实际生产 114,250 台需要 8 个月时间。因为 1995－1996 财政年度在 3 月份结束，所以生产必需在 1995 年 7 月或以前开始。新工厂的登记日期为 1995 年 2 月 14 日。此外，Subros 公司 1995 年 3 月提出招股书（经印度工业开发银行认证），从印度金融市场募集资本支持该扩张过程，该招股书指出，CFC-12 生产线设备的安装和投产于 1995 年 3 月完成。另外，如 Subros 公司项目提案所陈述，所有基准设备项目均在 1995 年 7 月以前采购。

77. 世界银行证实，项目完成报告未列入对应资金；不过 Subros 可提供审计报告，显示实际设备费用约为 650 万美元。关于“已按照第二期计划建立设施基础机构”的陈述显示，

已经划出额外的厂房面积，以保证安全和良好的工作环境（该公司将不要求资助与这些项目有关的费用）。虽然 Subros 公司确实增加了投资，但是目标是改造现有的 CFC 机动空调机生产能力，转用基于 HFC-134a 的技术。

78. 世界银行还报告说，在年产 50,000 台的生产能力完全安装之前，通过进口零部件补充生产能力的不足。第 11 次会议批准的项目包括的基准设备在 1997 年 7 月撤除时仍然可以使用。不过该企业无法为这些基准设备找到任何用途，因为其 CFC-12 机动空调系统生产能力的扩张在 1995 年 7 月之前已经完成，比第一阶段项目的完成早两年多。

79. 世界银行还指出，1999 年至 2001 年，Subros 将出口生产线的生产能力扩大到 100,000 台 HFC-134a 机动空调系统，该生产线的初期（部分）经费由多边基金提供，将不向多边基金要求更多的资助。

压缩机生产线

80. 该项目提议从“10P 型”压缩机转产“10S 型”压缩机。秘书处指出，10S 型压缩机是 10P 型压缩机的新升级型号（比 10P 型压缩机体积小，重量轻，制冷能力大），同改变制冷剂无关。此外，在美国出售的 10P 型压缩机仍用于 HFC-134a 制冷剂。因此，该压缩机生产线要求的设备不属增支费用。

81. 世界银行指出，该公司通知说，目前生产的 10P 型压缩机只适合 CFC-12。该公司应或者修改 10P 型号的设计，或者用 10S 型号取代 10P 型号。Bubors 公司同其技术合作者审查了这两种备选办法，结论是，对于较小的 10P 型压缩机和印度的气候条件而言，性能将显著下降。世界银行还证实 10S 型压缩机较小较轻，提议不要将新的 10S 型压缩机的较小体积错误地理解为技术升级。实际上这是优化新压缩机成本，以保持产品竞争力。

82. 自收到世界银行的答复以来，秘书处收到了其他咨询意见，证实 10P 压缩机不仅出售到美国，还出售到科威特和沙特阿拉伯，用于 CFC-12 机动空调系统。

蒸发器生产线

83. 秘书处还指出，该企业决定安装性能高、体积小、重量轻的多层蒸发器，取代现有的螺旋型蒸发器。虽然该企业并不寻求多边基金资助蒸发器生产线的改造(这不属增支费用)，但是该企业请求资助一台弯管机和一台旋转机（340,000 美元）和模具（735,000 美元），这些均同蒸发器核心设计的改动和/或汽车制造商的要求直接有关。因此，为这些设备提出的要求不符合资助条件。世界银行报告说，为了保持新的 HFC-134a 机动空调系统的性能，需要将螺旋型蒸发器改为多层蒸发器; HFC-134a 蒸发器的接口必须改变才能改善油环的配合，从而使用所提议的设备降低流失率。

费用问题

84. 秘书处指出，要求为一些设备物品提供资助是以追溯方式提出的。如执行委员会所决定，追溯项目的行政支助费水平应为 6%（第 29/72 号决定）。后来，世界银行对机构费作了相应调整。

85. 秘书处和世界银行正在结束关于项目费用的讨论。讨论结果将通报项目审查小组委员

会。

制冷（制造业）行业 CFC 淘汰计划

行业 CFC 消费量

86. 秘书处同开发计划署讨论了在审查提案过程中确定的一些问题。提议的淘汰量为 535.4 ODP 吨：泡沫塑料业务 364.9 ODP 吨 CFC-11，制冷剂业务 170.5 ODP 吨 CFC-12。秘书处提到第 36/17 号决定，“如果提出关于编制多行业淘汰项目的请求，在提交第一个行业淘汰计划同时，必须提出明确的执行计划，包括参与的各执行机构之间的协调，并详细说明将淘汰的剩余 ODS 吨位在各行业之间如何分配，国家消费总量的减少如何核实”。在编写本报告之时尚未收到所要求的资料。

87. 在审查剩余的符合资助条件的 CFC 消费量时，秘书处分析了印度政府报告的 2000 年 CFC-11 消费量，即 3,002 ODP 吨，其中泡沫塑料行业为 2,898 ODP 吨。在这方面，秘书处指出，印度从未单独报告制冷制造次级行业的 CFC-11 消费量，而总是将其列入泡沫塑料行业的消费量。因此，秘书处审议了泡沫塑料制造业使用的 CFC-11 总消费量，无论是在泡沫塑料行业还是在制冷行业。扣除 2000 年年底执行之中项目的 CFC-11 消费量、考虑到第 37 次会议商定的对印度起始点的修正，并扣除第 33 次至第 37 次会议批准的项目的 CFC-11 泡沫塑料消费量（包括泡沫塑料行业的淘汰计划），在此之后，看来资助的 CFC-11 淘汰量超过报告的 2000 年消费量 300 ODP 吨以上。

88. 该项目显示的 CFC-11 消费量为 364.9 ODP 吨。该消费量看来不符合资助条件，因为根据报告，印度没有剩余的 CFC-11 消费量需要处理。后来，同泡沫业务有关的大约 345 万美元的资本和经营费用看来不符合资助条件。

89. 秘书处还查明一些比较不重要的费用和资助资格问题，同计算涉及项目制冷剂部分 CFC-12 淘汰的资本和经营费用有关。

90. 秘书处仍在同开发计划署讨论所有尚未解决的问题。将向项目审查小组委员会通报讨论结果。

建议

在 Subros Limited 公司完成淘汰 ODS (CFC-12)技术，转用无 ODS 技术(HFC-134a)制造机动空调（第二阶段）

91. 待增。

制冷（制造业）行业 CFC 淘汰计划

92. 待增。

项目评价表
印度

部门： 溶剂 本行业的 ODS 消费量（2000 年）： 8,080.6 ODP 吨
次级行业成本效益阈值： 不适用

项目名称:

（a）在 Navdeep Engineering, Palghar 公司将四氯化碳（CTC）洗涤剂转换为三氯乙烷

项目数据	CTC
	Navdeep
企业消费量（ODP 吨）	53.90
项目影响（ODP 吨）	53.90
提议的项目期限（月）	24
原申请经费数额（美元）	836,177
最后项目经费（美元）：	
增支资本费用(a)	567,300
酌处资金(b)	56,730
增支经营费用(c)	37,812
项目费用总额（a＋b＋c）	661,842
地方所有权（%）	100%
出口比重（%）	0%
申请经费数额（美元）	661,842
成本效益值（美元/公斤）	12.28
对应出资是否已经确认？	是
国家协调机构	环境和森林部
执行机构	工发组织

秘书处的建议：	
建议供资额（美元）	
项目作用（吨 ODP）	
成本效益值（美元/公斤）	
执行机构支助费（美元）	
多边基金的费用总额（美元）	

行业背景

93. 印度报告的溶剂行业最新 CTC 消费量数据 2000 年为 8,080.6 ODP 吨。

94. 当时，总消费量为 11 ODP 吨的三个 CTC 溶剂项目正在执行之中。后来批准了三个 CTC 溶剂项目，总淘汰量为 57.5 ODP 吨，这样，印度溶剂行业尚有已经报告的 8,012.1 ODP 吨 CTC 有待处理。

95. 2001 年 12 月，向环境规划署提供了 169,000 多美元，以协助印度政府同国家一级的行业协会合作，为综合性培训和相关的非投资活动制订行动计划，支助溶剂行业的淘汰工作。该计划将包括同工发组织和世界银行合作。

项目说明

在 Navdeep Engineering, Palghar 公司将四氯化碳（CTC）洗涤剂转换为三氯乙烷

96. Navdeep Engineering 公司每年消费 53.9 ODP 吨 CTC，用于同制造冰箱部件和分组合件有关的金属清洗。在 1995 年 7 月之前建立了该企业并安装了相关设备。该企业采用从槽罐到蒸汽去油机等各种清洁系统，分别在两个车间清洁铜管和冷却盘管的外部和内部。

97. 工发组织提议淘汰 CTC 消费，用三氯乙烯取代。现有的清洁槽罐将被带盖和通风系统的类似槽罐取代，以降低溶剂排放暴露水平。增支费用将以改造费用为依据，因为现有槽罐已经到了使用年限。此外，提议总共用五台低排放蒸汽去油机取代现在使用的四台去油机和两套浸涂槽。现有的两套其他清洁系统将被改造。将提供一台溶剂回收机，以减少溶剂消费。运输、安装和技术援助等其他增支资本费用总数为 51,300 美元。

98. 请求四年提供 88,947 美元的增支经营费用，用于支付新设备增加的电费，该项增加的费用因溶剂用量减少 60％因此降低费用而有所抵销。

秘书处的评论和建议

评论

99. 秘书处注意到，该项目淘汰的 53.9 ODP 吨仅仅是对整个行业淘汰工作的微小贡献（已报告的剩余消费量为 8,012 ODP 吨）。环境规划署在 2001 年 12 月收到 169,000 美元，用于印度溶剂行业的项目筹备援助，但是尚未收到同溶剂行业淘汰工作总体方式有关的资料，或印度如何履行其 2005 年 CTC 控制义务的资料。

100. 秘书处同工发组织讨论了将提供的新设备的处理能力问题。工发组织提供的资料显示，新设备符合企业目前的生产水平。

101. 秘书处还讨论了该项目的总体成本效益及环境和技术升级设备费用的对应出资情况。对于取代浸涂槽的三台新机器（共计 400,000 美元），企业将支付设备费用的 50%，作为对环境费用和技术升级的贡献。对于取代现有去油机的两台新机器（共计 320,000 美元），企业将支付环境过滤器的费用和现有接近使用年限的旧设备替换费用（共计 59,000 美元）。

102. 在此基础上，该项目的成本效益值为 12.28 美元/公斤，而原先提交的方案为 15.51 美元/公斤。成本效益部分取决于企业原来的消费量。该企业的消费量看来低于可比规模的其他企业的消费量，原因可能是，浪费较少，在基准和开放槽罐中有数台蒸汽去油机。基于同样理由，改造之后溶剂用量的减少幅度（约 60%）低于其他项目最高达 85%的幅度。

建议

103. 基于以下理由将该项目提出供单独审议：

（a） 对印度溶剂行业总体 CTC 淘汰要求的贡献微小；

（b） 缺少关于该行业总体计划或战略的资料；

（c） 成本效益值（12.28 美元/公斤）。

Usha Chandrasekhar
Director (O)

भारत सरकार
पर्यावरण एवं वन मन्त्रालय
ओज़ोन सैल
Government of India
Ministry of Environment and Forests
Ozone Cell

D.O.No.:
24th October, 2002

OFFICE MEMORANDUM

Subject: Submission of commitment letters of enterprises to the Multilateral Fund for consideration of Aerosol Sector Plan at the 34th Executive Committee in November, 2002

In continuation to our OM No.5/1/2002-OC dated 25th September, 2002, a copy of the commitment letter received from Industrial Atomizer is enclosed for necessary action.

With reference to the use of HCFC in this industry we would like to confirm the following:-

- The specific situation involved with this enterprise have been reviewed in light of the Executive Committee Decision 27/13 and the HCFC commitments under Article 2-F and it has been determined that the use of HCFC technology is required in these projects for an interim period.
- The enterprise has been fully briefed about the various technologies that are available to phase out CFCs. It is understood that HCFCs constitute an interim solution and we aware that additional funding may not be available to them for future conversion to fully Ozone Depleting Substances-free technology.

We confirm that to the best of our knowledge the enterprise in projects mentioned above, are financially viable.

With regards,

Yours sincerely

(Usha Chandrasekhar)

Ms.Suely Carvello
Principal Technical Adviser and Chief
Montreal Protocol Unit, EAP/SEED
UNDP, New York, USA

INDUSTRIAL ATOMIZER CO.

D-112, Ghatkopar Industrial Estate, L.B.Shastri Marg,
Ghatkopar (West), Mumbai - 400 086. • Phone : 500 7275 • Fax : 91-22-5969022

Date : 12.10.2002

ENTERPRISE COMMITMENT

INDUSTRIAL ATOMIZER Co,represented by Mr.Harish A.Vadodaria (Proprietor) having agreed to the preparation of a project for the consideration of the Executive Committee of the Multilateral Fund for the implementation of the Montreal Protocol to phase out the use of ODS at the enterprise,has received sufficient information on all alternative technologies from the implementaing agency,in consideration of which it has selected HCFC 141b, HCFC 22,Carbon dioxide as the most appropriate substances to be used to replace the CFCs presently in use.It further agrees :

a) That it will use HCFC 141b,HCFC 22 for an interim period allowed by current legal international agreements or any future modifications thereof,to which India is a party,or in accordance with any local regulation pertaining to the same,if applicable.

b) To bear by itself the cost of subsequent conversion to non HCFC substances.

FOR INDUSTRIAL ATOMIZER Co.

Harish Vadodaria(Proprietor)

Usha Chandrasekhar
Director, Ozone Cell
Ministry of Environment & Forests
Government of India
New Delhi

THE WORLD BANK GROUP
Headquarters: Washington, D.C. 20433 U.S.A.
Tel. No. (202) 477-1234 • Fax (202) 477-6391 • Telex No. RCA 248423

FACSIMILE COVER SHEET AND MESSAGE

DATE: October 12, 2002 **NO. OF PAGES:** #Pgs (including cover sheet) **MESSAGE NO.:** Msg. #

TO: Tony Heterington **FAX NO.:** +1 514 282 0068
Title: Deputy Chief Officer
Officer-in-charge
Organization: Multilateral Fund Secretariat
City/Country: Montreal, Canada

FROM: Erik Pedersen **FAX NO.:** +1 202 522 3258
Title: Technical Advisor Telephone: +1 202 473 5877
Dept/Div: ENVGM, MP unit Dept./Div. No.: ENVGM

SUBJECT: **Indian Chlorinated Rubber Sector**

MESSAGE:

Dear Mr. Hetherington

Attached the note on incremental costs calculation for the chlorinated rubber sector in China. The note has been send by email as well. We look forward to continue the discussions.

Best regards

Erik Pedersen

Attachment

Transmission authorized by: Authorization

If you experience any problem in receiving this transmission, inform the sender at the telephone or fax no. listed above.

August 2002

Note on:
Phasing out CTC consumption in the chlorinated rubber sector in India.

1. Introduction.

A sector plan for chlorinated rubber in India was submitted for consideration at the 37th meeting of the ExCom. The project was deferred as the negotiation on incremental costs associated with the phaseout was not resolved before the deadline for the 37th meeting. During the discussions on the project, the Secretariat, based on the guidelines for the process agent sector, (Decision 27/78), did not considered compensation for closure of production as an eligible incremental costs and funding should be based on either emission control or conversion. However, the PA guidelines calls for consideration of industrial rationalization, which is understood as transferring production from one producer to another producer. It seems to the Bank that closure therefore would be an option under the guidelines as transfer of production would result in closure of one of the participating two parties.

In order to move forward, the Bank has analyzed the CTC phaseout costs based on the conversion approach suggested by the Secretariat. The outcome is shown in the table below and it compared with the closure costs as calculated in the original proposal as submitted to ExCom.

The Bank has also reviewed the issue of fundable capacity for RRIL. In accordance with ExCom guidelines as referred to in the decision on process agents, conversion of the existing capacity is consistent with existing ExCom rules and guidelines. Due to the specific decision taken on RRIL, 550 tons of capacity should be deducted as called for in the Decision. However, after discussing the issue, RRIL has agreed to convert only 3,000 tons of capacity. The rational behind the 3,000 tons capacity is that it is technically possible without creating additional cost implications and that CR market projection carried out by the company shows that 3,000 tons will be needed within the coming 8 years.

The Secretariat has also pointed out that RPL would not be eligible for funding as it has been idle for more than 5 years and has not resumed production. The Bank has reviewed the issue with India. India has agreed to request dismantling costs for full closure and clean up of the site only.

Name of enterprise	**ODP consumption**	**Total closure costs**	**Total conversion costs**	**Least costs option**	**CE conversion**
Tarak	68	4,149,427	**1,538,757**	1,538,757	22.62
Parauj	40	**929,618**	1,023,245	929,618	23.24
RPL	0	**350,000**	350,00	350,000	NA
RIIL	384	30,344,878	**8,053,100**	12,989,370	20.97
	492	35,573,923	10,765,102	**15,807,745**	21.68
RRIL	Adjustment	Export	(30..28%-10%)	**2,634,244**	
		Technical Upgrade	20%	**2,597,874**	
Tarak		Technical Upgrade	0%	**0**	
			Adjustment	**5,232,118**	

TOTAL INCREMENATL ELIGIBLE COSTS	**10,575,627**	

Rishiroop Rubber International

Rishiroop Rubber (International) Ltd. (RRIL) started in 1993. The company is owned by about 20,000 shareholders, and its shares are listed in the Bombay Stock Exchange. It was anticipated that production capacity would be fully utilized by 2000. The company currently has about 120 employees. The average production level of chlorinated rubber for the last three years was 507 MT of which, 283 MT was exported to non-Article 5 countries. The export to non-Article 5 countries constitutes 56% of the total production.

Tarak

Tarak is 100% owned Indian enterprise with an installed annual production capacity of 300 MT of chlorinated rubber. The company started its operation in October 1998. The average chlorinated rubber production for the last three years was 140 MT. About 8.57% of the total production was for exporting to non-Article 5 countries. Currently, Tarak has about 40 employees working at its production facility.

Pauraj

Pauraj Chemicals set up its chlorinated rubber production facility at Tarapur in the State of Maharashtra in 1980. This chlorinated rubber plant has a production capacity of 150 MT per annum. The company is 100% owned by Indians and its current facility employs about 30 workers. The average level of production of chlorinated rubber for the last three year was 78 MT. The total production was for the domestic market.

Rishiroop Polymer Limited

RPL is a 100% Indian owned private limited company, and was incorporated in 1971, with a production facility at Nasik (Maharashtra state), mainly for the manufacture of CR, and also for a small quantity of aromatic resin. The production facility started commercial production in 1973, with an initial installed production capacity for CR of 150 MT per annum; the plant was debottlenecked and expanded in 1988 to increase the installed production capacity to the current level of 550 MT per annum calculated on a three shift basis (continuous production), to meet growing market demand. The maximum production of CR attained by RPL was 532 MT in the fiscal year 1990-91. RPL is a pioneer in developing the indigenous technology for manufacture of CR in India, and have received a national Government award in 1978 for import substitution for developing the process for CR indigenously.

Production at RPL was suspended in September 1995 because of a labor dispute, which was referred to an Industrial Court. It was resolved in October 1999, and RPL has serviced its plant and kept it ready to restart production at short notice.

RPL uses CTC as an inert solvent in the manufacture of CR. The conventional process for production of CR involves using CTC as a solvent medium for chlorination of the rubber. The dry rubber is first dissolved in CTC, and this rubber solution is reacted with chlorine gas to produce chlorinated rubber which stays dissolved in CTC. The solvent CTC is then recovered from this CR solution by flashing it in hot water and recycling it. Because CTC is required to be used as a process solvent and is handled in large quantities, the process causes emissive losses during storage, handling, and reaction, and there is also some presence of CTC as an impurity in the finished product; these factors cause CTC 'consumption'. The various stages of the manufacturing process include feedstock preparation, chlorination, recovery of solvent, filtration, drying, blending and packing. They require media resistant equipment (glass-lined reactors, lead bonded carbon steel reactors, etc.) The facility has utility sections, comprising boilers for steam generation, refrigeration systems, diesel-based generating power sets for standby power generation, air compressors, cooling towers, etc. Finally, the facility also has primary and secondary effluent treatment systems for waste water treatment and solid waste disposal.

The details of CR production and CTC consumption for RPL for the last three years of production are as follows:

Table I: Average Production and CTC Consumption

RPL		
Year*	CTC consumed (MT)	CR Produced (MT)
92-93	222.	376.
93-94	219.	365.
94-95	235.	372
Average	**225**	**371.**

*****: The production and consumption data for RPL are for 3 years prior to Sept. 95 when the industrial lock-out began.

The total average consumption of CTC for RPL, based on their average consumption for the last three years of operation as mentioned above, is 225 MT per annum.

ANNEX A
RISHIROOP RUBBER INTERNATIONAL Ltd.

INCREMENTAL CAPITAL COST SUMMARY FOR 3000 TPA CR PLANT AT RRIL, ANKLESHWAR

Sr.No.	Item	Unit Cost (USD)	Nos	Total (USD)
A	**PROCESS FACILITY**			
1	FRP Storage tanks (50KL)	16500	4	66,000
2	Air operated PTFE - Lined Diaphragm pump	10670	6	64,020
3	Stainless Steel Storage Tank 40 KL	35200	1	35,200
4	Air operated PTFE - Lined Diaphrgram pump	10670	15	160,050
5	Stainless Steel Blending Reactor 1 KL	11000	6	66,000
6	Air operated PTFE - Lined Diaphrgram pump	10670	2	21,340
7	Agitator modifications to the existing Glass lined Carbon Steel Reactor	44000	6	264,000
8	Glasslined Carbon Steel Reactors	98000	12	1,176,000
9	PVDF Lined Carbon Steel Housing for photo chemical systems	3300	24	79,200
10	Photochemical Lamp Systems	25300	24	607,200
10A	Spares for photchemical system Lump sum	49500	1	49,500
11	Cooling System for photo chemical systems			
11.1	Stainless Steel Heat Exchanger	770	24	18,480
11.2	Stainless Steel Centrifugal Pump	770	24	18,480
12	Static Mixer	4400	12	52,800
13	Graphite Heat Exchanger(10 m^2)	15400	12	184,800
14	Air operated PVDF lined diaphragm pump	13200	24	316,800
15	Glasslined stirred tanks	66000	6	396,000
16	FRP Belt filter (250 kg/hr)	357500	2	715,000
16.a	S.S.Slurry hold tanks(10Kl)	41500	4	166,000
17	Paste Conveying system	60500	2	121,000
18	Stainless Steel 316Feed Bins (30KL)	40000	2	80,000
19	Two stage PTFE-Lined SS316 fluidised bed dryer system	385000	2	770,000
20	PVDF lined magnetic pump 2m^3/hr, 20MH (heads in meters	4400	4	17,600
21	Piping - PVDF, SS, FRP, PP Pipes, valves and fittings	385000	1	385,000
22	Pneumatic conveying system	330000	1	330,000
23	Stainless Steel 316 feed bins (25 kl)	25000	2	50,000
24	UPS system for photo chemical systems	15400	24	369,600
25	Stainless Steel Blender (5 kl)	27500	2	55,000
26	FRP Fume Extraction system with alkali scrubber	110000	1	110,000
	Sub-total group A			**6,745,070**

B	**EFFLUENT TREATMENT FACILITY**			**200,000**
C	**PROCESS UTILITY & PIPINGS**			
	Utility			
1	Air dryers 25m^3/min	30000	2	60,000
2	Air Compressors 8m^3/min	60500	2	121,000
3	Cooling Tower 800 MT	22000	1	22,000
4	Underground Water Storage	22000	1	22,000
5	OverheadTank	11000	1	11,000
6	Chilling plant 150TR	110000	2	220,000
7	Diesel Generators 17000 KVA	220000	2	440,000
8	Water softners	16500	2	33,000
9	Air Receiver	16500	1	16,500
10	steel pipes valves & fittings for above	88000	1	88,000
	sub-total			**1,033,500**
D	**ELECTRICALS**			
1	Transformer	33000	1	33,000
2	Powerline cost	33000	1	33,000
3	Power Control Centre	55000	1	55,000
4	Capacitors	22000	1	22,000
5	Electricals Cables,switches starters etc.	88000	1	88,000
	sub-total group			**231,000**
E	**INSTRUMENTATION** Control Panels, instruments (including rotameters, pressures gauges, temperature gauges, control valves) misc items and labor charges		250000	**250,000**
F	**ERECTION & DISMANTLING**		120000	**120,000**
G	**INSULATION & PAINTING**		100000	**100,000**
H	**SAFETY EQUIPMENTS** Continous chlorine monitoring system, ETC.		80000	**80,000**
I	**CIVIL WORKS**		200000	**200,000**
	. Equipment foundations, tank farms, acid-proof tile lining and civil costs of power control center process control room and modification of warehouse, architect's fee, etc.			
J	**STRUCTURAL WORK**		300000	**300,000**
	TECHNICAL KNOW HOW FEE		344000	**344,000**

K	**Consultants fees for detailed engineering**	220000	**220,000**
L	**Pre operative Cost**		
	Insurance	75000	
	Travelling	50000	
	Training	25000	
	Salaries of project team	100000	
	Communication expenses	25000	
	sub-total group		**275,000**
M	**Changeover costs**		**0**
	Fixed Overheads for twelve months	0	
N	**Startup & Commissioning**		**300,000**
	TOTAL		**11,663,070**
	Contingencies @10%		**1,166,300**
	TOTAL INCREMENTAL CAPITAL COSTS		**12,829,370**
	IOC		**160,000**
	TOTAL INCREMENTAL COSTS		**12,989,370**
	ODP		**384**
	CE		**20.97**

ANNEX B

Tarak Chemicals

A category	Unit costs	Existing Baseline	Standard layout for 550 tons	Prorating factor for 300 tons facility: 0.654231	Start of operation: 1996
PRF Storage tank	3,500		4	300	300
HCl pumps PVDF kined manetic pumps	3,000		6	2	7000
SS Latex Storage vessel	15500		1	2	6000
Air Operated pump for latex	6000		5	0.65	10075
S.S Primary Latex Blending rective	7200		1	2	12000
AOD Chlorinated latex feed air operted ptfe	6000		2	0.65	4680
Pre-conditioning vessel G.L Reactor	60000		1	0.65	3900
Chlorinated glass lined G.L Reactor	98000		2	0.65	39000
PVDF Lined GRP housing	3000		4	0.65	63700
Photochemical sytem	23000		4	2	6000
Photochemical Spares	15000		1	2	46000
Spare pumps, 1 year				0.65	9750
Cooling System					
S.S Heat exchangers	700		4		
SS Pumps	700		4	2	1400
GRP Static mixer	4000		2	2	1400
Graphic Chlorinated cooler HE	14000		2	0.65	2600
PVDF lined Mag pump	5700		7	0.65	9100
G.L. Stirr tank	60000		2	2	11400
FRP Belt filter	185000		1	0.65	39000
Pask Conveyor System	29000		1	0.65	120250
SS Feed Bins	8000		2		0
Two Stage Fluid bed dryer	167000		1	0.65	5200
				0.65	108550
PVDF FRF tank	21000		2		
HCl PVDF map pumps	2000		2	0.65	13650
Piping, PVDF, FRP, valves and fitting	60,000		1	0.65	1300
Pneumatic conveying ssyete	68000		1	0.65	39000
SS Feed Bins	8000		2	0.65	44200
UPS	14000		4	0.65	5200
Blender	15000		1	2	28000
Stack	4800		1	0.65	9750
FRP Fume syetem	31000		1	0.65	3120
Process equip.				0.65	20150

B: Effluent Treatment Facility				
Neutralizer	6000	2		
Settling tank	3000	2	0.65	3900
Aerotator	8000	1	0.65	1950
Sludge pumps	300	10	0.65	5200
Sludge drying bed	2000	2	4	1200
Storage	4000	1	0.65	1300
Eff tank	6000	2	0.65	2600
Flowcalculator	3000	1	0.65	3900
Consultant fee	2000	2	0.65	1950
ETP			0.65	1300
C: Process utilities				
Air Dryers 8m3/min	10000	2		
Air compressors 8m3/min	20000	2	0.65	6500
Underground water storage	8000	1	0.65	13000
Overhead Water Tank	5000	1	0.65	5200
Chilling Plant	20000	2	0.65	3250
Diesel generator	90000	1	0.65	13000
Water softners	10,000	2	0.65	58500
Air service	7000	1	0.65	6500
Mild Steel Pipes & Piping	15000	1	0.65	4550
Utilities			0.65	9750
D Electricals				
Transformer	8000	1		
power line costs	8000	1	0.65	5200
PCC	15000	1	0.65	5200
Capacity	4000	1	0.65	9750
Electrical	20,000	1	0.65	2600
Electricals			0.65	13000
Total costs: A+B+C+D				
Instrumentation	80,000	1		
Erection/dismantling	20000	1	0.65	52000
Insulation/painting	20000	1	0.65	13000
Safety	20000	1	0.65	13000
Civil work		1	0.65	13000
Structural work	20,000	1	0	0
Total costs			0.65	13000
Technology transfer costs				
Know how	238000	1	0.65	154700
Engineering company	85000	1	0.65	55250
Pre-operative costs	133000	1	0.65	86450
Change over	71500	1	0.65	46475

Trial and Start up costs	71500	1		0.65	46475
			ICC		1344325
			Cont.		134432.5
			IOC		60000
TOTAL INCREMENTAL COSTS					**1,538,758**
ODS					**65**
CE					**23.67**

ANNEX C

Pauraj Chemicals Pvt. Ltd.

Pauraj Chemicals set up its chlorinated rubber production facility at Tarapur in the State of Maharashtra in 1980. This chlorinated rubber plant has a production capacity of 150 MT per annum.

A category	Unit costs	Baseline costs	Standard layout for 550 tons	Prorating factor for 150 tons: 0.403	Start of operation : 1982
PRF Storage tank	3,500		4	150	150
HCl pumps PVDF lined magnetic pumps	3,000		6	2	7000
SS Latex Storage vessel	15500		1	4	12000
Air Operated pump for latex	6000		5	0.4	6200
S.S Primary Latex Blending reactor	7200		1	3	18000
AOD Chlorinated latex feed air operated ptfe	6000		2	0.4	2880
Pre-conditioning vessel G.L Reactor	60000		1	0.4	2400
Chlorinated glass lined G.L Reactor	98000		2	0.4	24000
PVDF Lined GRP housing	3000		4	0.4	39200
Photochemical system	23000		4	2	6000
Photochemical Spares	15000		1	2	46000
Spare pumps, 1 year				0.4	6000
Cooling System					
S.S Heat exchangers	700		4		
SS Pumps	700		4	2	1400
GRP Static mixer	4000		2	2	1400
Graphic Chlorinated cooler HE	14000		2	0.4	1600
PVDF lined Mag pump	5700		7	0.4	5600
G.L. Stirr tank	60000		2	4	22800
FRP Belt filter	185000		1	0.4	24000
Paste Conveyor System	29000		1	0.4	74000
SS Feed Bins	8000		2		0
Two Stage Fluid bed dryer	167000		1	0.4	3200
				0.4	66800
PVDF FRF tank	21000		2		
HCl PVDF map pumps	2000		2	0.4	8400
Piping, PVDF, FRP, valves and fitting	60,000		1	0.4	800
Pneumatic conveying system	68000		1	0.4	24000
SS Feed Bins	8000		2	0.4	27200
UPS	14000		4	0.4	3200
Blender	15000		1	2	28000
Stack	4800		1	0.4	6000

FRP Fume system	31000	1	0.4	1920
Process equip.			0.4	12400
B: Effluent Treatment Facility				
Neutralizer	6000	2		
Settling tank	3000	2	1	6000
Aerator	8000	1	1	3000
Sludge pumps	300	10	0.4	3200
Sludge drying bed	2000	2	6	1800
Storage	4000	1	0.4	800
Eff tank	6000	2	0.4	1600
Flocculator	3000	1	0.4	2400
Consultant fee	2000	2	0.4	1200
ETP			0.4	800
C: Process utilities				
Air Dryers 8m3/min	10000	2		
Air compressors 8m3/min	20000	2	0.4	4000
Underground water storage	8000	1	0.4	8000
Overhead Water Tank	5000	1	0.4	3200
Chilling Plant	20000	2	0.4	2000
Diesel generator	90000	1	0.4	8000
Water softeners	10,000	2	0.4	36000
Air service	7000	1	0.4	4000
Mild Steel Pipes & Piping	15000	1	0.4	2800
Utilities			0.4	6000
D Electricals				
Transformer	8000	1		
power line costs	8000	1	0.4	3200
PCC	15000	1	0.4	3200
Capacity	4000	1	0.4	6000
Electrical	20,000	1	0.4	1600
Electricals			0.4	8000
Total costs: A+B+C+D				
Instrumentation	80,000	1		
Erection/dismantling	20000	1	0.4	32000
Insulation/painting	20000	1	0.4	8000
Safety	20000	1	0.4	8000
Civil work		1	0.4	8000
Structural work	20,000	1	0	0
Total costs			0.4	8000
Technology transfer costs				
Know how	238000	1	0.4	95200

Engineering company	85000	1		0.4	34000
Pre-operative costs	133000	1		0.4	53200
Change over	71500	1		0.4	28600
Trial and Start up costs	71500	1		0.4	28600
			ICC		902950
			Cont.		90295
			IOC		30000
TOTAL INCREMENTAL COSTS					**1,023,245**
ODS					**26**
CE					**39.36**

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY	INDIA	**IMPLEMENTING AGENCY**	UNDP, UNIDO
PROJECT TITLE	Plan for Phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India		
PROJECT IN CURRENT BUSINESS PLAN		Yes	
SECTOR		Refrigeration (Manufacturing)	
SUBSECTOR		All sub-sectors (excl. Servicing &MAC)	

ODS USE IN SECTOR	Baseline (Average of 1995-97)	2,770	MT ODP
	Current (2001)	1,373	MT ODP
	From approved ongoing projects	809	MT ODP
	From remaining non-eligible enterprises	29	MT ODP
	From remaining eligible enterprises	535	MT ODP
	Net remaining	564	MT ODP
PROJECT IMPACT	Reflecting the net ODP value	535	MT ODP
	Including approved ongoing projects	1,344	MT ODP

PROJECT DURATION 4 years

PROJECT COSTS

		UNDP portion	UNIDO portion	Total
Incremental Capital Costs	US$	5,299,000	1,224,000	6,523,000
Contingencies	US$	472,400	122,400	594,800
Incremental Operating Costs	US$	1,126,290	177,673	1,303,963
Total Project Costs	US$	6,897,690	1,524,073	8,421,763

LOCAL OWNERSHIP		100%
EXPORT COMPONENT		0%
REQUESTED GRANT	US$	**8,421,763**
COST EFFECTIVENESS	US$/kg/y	N/A
IMPLEMENTING AGENCY SUPPORT COSTS	US$	TBD
TOTAL COST OF PROJECT TO MULTILATERAL FUND	US$	TBD

STATUS OF COUNTERPART FUNDING	N/A
PROJECT MONITORING MILESTONES	Included
NATIONAL COORDINATING BODY	Ministry of Environment & Forests

PROJECT SUMMARY

This Phase-out Plan will eliminate all the remaining eligible CFC consumption in the Refrigeration (Manufacturing) Sector in India upon completion. The Phase-out Plan will be implemented through four annual implementation programmes and together with the implementation of the approved ongoing projects, will result in the complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India in four years. The Phase-out Plan will cover the technology conversions in the remaining eligible enterprises in the Refrigeration (Manufacturing) Sector, excluding the MAC sector, and ensure timely, sustainable and cost-effective phase-out through a combination of investment, technical support and policy/management support components. The Refrigeration (Servicing) sector is being addressed through a separate phase-out plan being submitted to the 38th EC Meeting. The total eligible incremental costs and the requested grant for the Plan for phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India are US$ 8,421,763.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules.

PREPARED BY	UNDP (in consultation with MOEF and UNIDO)	**DATE**	July 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

PROJECT OF THE GOVERNMENT OF INDIA
Plan for phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India

1. PROJECT OBJECTIVES

The objectives of this project are:

a) To achieve complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India within four years.
b) To enable India to meet its obligations of phased ODS reductions in accordance with the control schedule of the Montreal Protocol.
c) To ensure timely, sustainable and cost-effective CFC phase-out in the Refrigeration (Manufacturing) Sector, through development and implementation of a combination of investment, technical support and policy/management support components.

2. INSTITUTIONAL FRAMEWORK

India ratified the Vienna Convention in March 1991 and the Montreal Protocol in June 1992. In 1993, India prepared a detailed Country Programme to phase out ODS in accordance with its national industrial development strategy and in line with the Montreal Protocol control schedule. The Country Programme was aimed at ensuring that the phase out will be effected without undue economic burden to both consumers and industry and provided India with the opportunity to access the Montreal Protocol Financial Mechanism. The guiding principles of the Country Programme are, to minimize economic dislocation as a result of ODS phase-out, minimize industrial obsolescence, maximize indigenous production, promote one-step phase-out and to emphasize decentralized management.

The Government of India has entrusted the work relating to ozone layer protection and implementation of the Montreal Protocol, to the Ministry of Environment and Forests (MOEF), which is the coordinating Ministry in India for all matters concerning the Montreal Protocol. The MOEF has set up an Ozone Cell, as the national unit to manage and coordinate India's country programme for ODS phase-out.

The MOEF has established an empowered Steering Committee, which comprises of high-level representation from other line ministries and is primarily responsible for formulating and implementing policies and procedures pertaining to India's compliance with the Montreal Protocol. The Steering Committee is supported by three Standing Committees, namely the Technology and Finance Standing Committee (which reviews and endorses ODS phase-out proposals and activities), Standing Committee for Small Scale Industry (which is entrusted with advising on ODS phase-out and compliance by the crucial small industries sector) and Standing Committee for Monitoring and Evaluation (which advises and monitors implementation).

Recognizing the importance of establishing an effective policy framework for the successful implementation of the Country Programme, MOEF has initiated an aggressive action plan to create such a framework to reinforce the various ODS phase out measures:

2.1 Regulatory Measures

a) The Steering Committee, since its inception, has instituted an elaborate legal procedure for review and endorsement of project proposals, for submission to the Multilateral Fund for funding. Each enterprise seeking assistance is required to make a formal application to MOEF in a prescribed format along with legally binding documentation and certifications for establishing its eligibility, CFC consumption and financial viability. Each proposal is reviewed by the Technology and Finance Standing Committee for technical and policy issues and if acceptable, recommended for acceptance and formal endorsement.

b) Trade in controlled substances with countries not party to the Montreal Protocol has been prohibited.

c) Export of Annex A and Annex B substances to Non-Article 5 Parties has been prohibited.

d) The import and export of all Annex A and Annex B substances are subject to licensing.

2.2 Fiscal Measures

a) Full exemption from payment of Customs and Excise tariffs on capital goods required to implement ODS phase out projects funded by the Multilateral Fund. The exemption from Customs and Excise tariffs has been extended to ODS phase-out projects, which were eligible for funding under the Multilateral Fund, whether or not such enterprises actually sought assistance from the fund. This will also cover projects submitted for retroactive financing. The benefit was available subject to the condition that enterprises should give a clear legal commitment to stop using ODS in all future manufacturing operations after the projects were implemented.

b) The duty exemptions were also extended to items of recurring use, including non-ODS alternatives for a duration for which, incremental operating costs were committed by the Multilateral Fund in approved projects.

c) The duty exemptions were also extended to capital goods required for establishing new capacity with non-ODS technology.

d) Indian financial institutions have been advised not to finance/refinance new ODS producing/consuming enterprises.

e) The Tariff Advisory Committee (a statutory body under the Insurance Act, 1938) has decided to grant suitable discounts on fire insurance premiums if alternative agents are used to replace halons.

2.3 Legislation

In exercise of the powers conferred under sections 6, 8 and 29 of the Environment Protection Act of 1986, Government of India formulated the draft Ozone legislation called the Ozone Depleting Substances Rules, which were published in the Gazette of India in 1998 for public comments and also circulated in the industry for advance intimation and comments. These have since been officially notified and have formally come in to effect from January 2000. The provisions of this comprehensive legislation are summarized as below:

ODS Production

- Mandatory registration with MOEF
- Restriction on production levels as per "base level" and specified time-bound reductions.
- Prohibition on creating new capacity or expansion of capacity
- Export restricted to countries who are signatory to the Montreal Protocol

ODS Consumption

- Ban on new capacity or expansion of capacity for production of ODS based equipment.
- Mandatory registration with designated authorities
- Declaration requirement in prescribed format, to the seller, at the time of procurement of ODS

ODS Trade

- Mandatory registration for Exporters & Importers with designated authorities

- No sales without license to persons/organizations which have not intimated the Government of India about use of ODS based equipment (including compressors).

General

- Mandatory registration for reclamation and destruction of ODS. All registrations will be valid for specified periods, after which, they are required to be renewed.
- Every person who produces, uses, imports, sells, stocks, reclaims or destroys ODS has to maintain records and file reports as specified.
- Every entity, which has received technical and/or financial assistance from any international agency or financial assistance from Government of India including duty exemptions, is required to maintain records and file reports as specified.

3. SECTOR BACKGROUND

3.1 Background of the Refrigeration Sector

The range of products manufactured in the sector includes, household refrigerating appliances such as domestic refrigerators and freezers, commercial refrigeration equipment such as display cabinets, bottle coolers, chest freezers, hot and cold water dispensers, visi-coolers, ice-candy machines, water coolers, reach-in refrigerators, walk-in coolers and freezers, industrial refrigeration equipment such as cold storage, process chilling and transport refrigeration units, and commercial air conditioning applications such as central air conditioning systems and mobile air conditioning units. The sector has experienced substantial growth in the past decade, due to the trade liberalization and tariff reduction policies, increased rural electrification, increased emphasis on agriculture-based food processing industries, consistent growth in the per capita income, indigenous availability of chemicals, all round growth and diversification in the various industrial sectors and applications, particularly in sectors such as automotive, transportation, construction, etc., growing predominance of the service industry, the relatively low market penetration of domestic, commercial and industrial appliances and expansion due to the replacement market. The sector, with the exception of domestic refrigerators and to some extent central air conditioning plants, comprises of a large number of small/medium sized enterprises and tiny/unorganized enterprises, which could pose a challenge to be reached, educated and addressed in respect of the ODS phase-out. CFCs are consumed as blowing agents (CFC-11) and refrigerants (CFC-12, R-502, etc) in the manufacture of refrigeration and air-conditioning products.

India will need to make tremendous efforts to comply with the next control step of the Montreal Protocol, i.e. 50% reduction by 2004/2005. The Indian industry will also need to comply with the new legislations. The sector phase-out approach would contribute to such compliance in a timely and cost-effective manner.

3.2 Structure of the Refrigeration Sector

There exist capacities in India for manufacturing the chemicals and components required by the Refrigeration (Manufacturing) Sector.

3.2.1 Supply Industry

Compressors

There are a few manufacturers, both indigenous and multinational, of hermetic and semi-hermetic refrigeration compressors in India; the domestic demand of compressors is met through these manufacturers and complemented with imports from North America, Europe, Japan and Southeast Asia. Three indigenous manufacturers have been assisted by MLF for conversions and for facilitating CFC phase-out in the downstream users.

Chemicals

Refrigerants and blowing agents required in manufacturing refrigeration appliances, equipment and systems, are manufactured in India and the domestic requirements are met mainly through indigenous sources. The other refrigeration system components are partly produced indigenously and partly imported.

Equipment and tooling

There are a few indigenous manufacturers in India, of the processing equipment and tooling required for this sector. These manufacturers are engaged in fabricating and assembling low-pressure polyurethane foam dispensers, refrigerant charging and evacuation equipment and other tooling. Most of the major multinational equipment manufacturers are represented in India, however, given the size and geography of the country, the level of technical support and after-sales service available from them is quite inadequate. The presence of indigenous manufacturers is directly related to the relatively high investment costs of imported equipment, to the unsatisfactory quality and level of support available and to the high cost of spare parts and consumables.

On the whole, considering the geography and size of the country, the availability of upstream supplies in general is satisfactory, however the quality and level of customer service and technical support is quite limited, mainly due to inadequate infrastructure and due to insufficient availability of trained and qualified staff.

3.2.2 User Industry

In the domestic refrigeration sub-sector, there are a few large manufacturers of household refrigerators and freezers, who either have license or joint venture agreements multinational corporations or have wholly owned subsidiaries. There are also a few indigenous manufacturers of domestic refrigeration equipment. Seven manufacturers have been assisted under the MLF.

The commercial refrigeration sub-sector comprises of a large number of predominantly small and medium-sized enterprises, which are geographically scattered and with relatively little access to sophisticated technology and practices. These enterprises are typically characterized by very low levels of investments in plant and machinery and resulting labor-intensive operation. Many enterprises opt for locally assembled and/or custom-built foam dispensers, typically single-ratio and low-pressure type, to minimize investments. Many also engage in hand-mixing/pouring operations. The refrigerant charging and evacuation operations are predominantly carried out by semi-automatic equipment or by manual kits.

The transport refrigeration sub-sector comprises of manufacturers of refrigerated bodies for trucks and trailers and refrigerated containers. As a critical element in the cold chain, this sub-sector serves an important function.

Although general awareness about quality assurance, training, environment and safety-related issues exists, it does not receive much emphasis in practice, due to low levels of operating capital, because of the low scale of operation and the pressures on profitability exerted by the very competitive domestic market as well as relatively cheap imports. In general, the knowledge of the latest chemicals and technologies is limited in these enterprises.

There is a significant existing population of domestic and commercial refrigeration appliances and equipment and also of mobile air conditioning units. Due to the rapid economic growth in the past two decades, there is a significant number of office buildings and complexes served by central air conditioning centrifugal chillers, which require servicing. As a result, there is a large and fast growing servicing sector comprising of a large number of servicing establishments.

3.3 History of ODS Phase-out

The baseline ODS consumption for all sectors in India, as reported by the Government of India is as tabulated below:

Table-1
India: Baseline ODS Consumption (1995-97)

SECTOR	1995 (MT)	1996 (MT)	1997 (MT)	Average (ODS MT)	Average (ODP MT)
Aerosols	1,626	1,788	983	1,466	1,466
Foams	6,203	6,384	6,812	6,466	6,466
Refrigeration	2,521	2,818	2,973	2,770	2,770
Solvents	154	26	12	64	53
Halons	295	234	221	250	1,245
TOTAL	**10,799**	**11,250**	**11,001**	**11,016**	**12,000**

The Refrigeration and Air Conditioning Sector in India accounts for about 25% of India's baseline CFC consumption. Since 1994, until December 2001, a total of 40 investment projects in the Refrigeration (manufacturing) Sector have been funded under the Montreal Protocol mechanism, implemented by UNDP, UNIDO or the World Bank. The detailed list of investment projects approved in this sector until end-2001 is attached in Annex-1. The summary of approved investment projects is as below:

Table-2
India Refrigeration Sector - Historical investment project approvals as of December 2001

Refrigeration Sub-Sector	Category of enterprises	Number of approved Projects	CFC Phase-out Target (ODP MT)	Approved Funding (US$)	Overall CE (US$/kg)
Domestic	Large	7	1,742	11,209,134	6.44
Commercial/other	Medium or small	33	602	7,318,068	12.16

The seven enterprises in the domestic refrigeration are large manufacturers and constitute the entire indigenous domestic refrigeration sub-sector in India. The 33 approvals in the commercial refrigeration sub-sector (and other sub-sectors) covered a total of 60 enterprises. All of the enterprises in the commercial refrigeration (and other sub-sectors) were predominantly small and medium-sized, most of them with a CFC consumption of less than 20 MT/y. Only 2 out of the 60 enterprises had a baseline CFC consumption of more than 20 MT/y. Of the total 60 enterprise covered, 44 enterprises had a baseline CFC consumption of less than 10 MT/y. The distribution of the approved investment projects based on enterprise size is tabulated below:

Table-3
India – Commercial Refrigeration (and other) Sub-sectors
Distribution of investment project approvals as of December 2001 by enterprise size

Baseline CFC Consumption range (MT/y)	Number of enterprises	Distribution (% of total CFC consumption)
0 to 5	37	33.2
5 to 10	8	12.3
10 to 20	13	47.1
Above 20	2	7.4
Total	60	100.0

Thus, 45 out of 60 (75%) of the enterprises covered, had a CFC consumption of less than 10 MT/y. This is consistent with the observations in section 3.2.2), particularly with those related to the modest levels of investments, training, technical assistance, knowledge base and awareness available to these enterprises.

The Montreal Protocol programme in India has addressed primarily the domestic refrigeration sub-sector and to some extent the commercial refrigeration sub-sector. In addition to achieving the ODS phase-out targets, it has created a degree of awareness among the industry, of the need for incorporating environmental objectives in their investment and operational decisions. The technical assistance and training inputs received through the projects have also enhanced to some extent, the capacity at the enterprise level to address technical and environmental issues. However, the source of the remaining consumption in the Refrigeration (Manufacturing) sub-sector is from predominantly small and medium-sized enterprises characterized as described in the user industry structure (section 3.2.2) by modest levels of investments, training, technical assistance, knowledge base and awareness available to these enterprises. Moreover, since the enterprises are scattered and difficult to access, the progress of the programme in this sector on the whole, has been modest.

3.3.1 Historical Phase-out Approach

Of the total of 60 enterprises covered by the investment project approvals in the commercial refrigeration sub-sector (and other sub-sectors), 40 enterprises were part of five group projects. All enterprises covered were essentially small or medium-sized with individual baseline CFC consumption levels less than 10 MT/y, most of them with less than 5 MT/y. This represents 66% of the total number of enterprises, 45.5% of the total funded baseline CFC consumption in the sub-sector and about 51.2% of the total approved funding. Thus, the group approach seems to be effective in terms of coverage and CFC phase-out, though it has not necessarily been fully effective in mitigating the infrastructural barriers, such as technology awareness, technical assistance, training, etc. due to the relatively limited amounts of resources approved for these activities, which are considered crucial in sustaining the viability of the enterprises and the CFC phase-out. A sector-wide phase-out approach therefore needs to be selected to address the remaining CFC consumption in this sector, addressing these concerns and considering that:

- That the Refrigeration (Manufacturing) Sector has made relatively modest progress in CFC phase-out
- Only the phase-out of CFCs in new products in all remaining manufacturing enterprises in this sector will primarily limit CFC use in this sector and provide the Government with the control and confidence needed to assure India's compliance with the Montreal Protocol control milestones and assist the enterprises in compliance with the present and forthcoming legislations.

3.3.2 Historical Technology Choices

Five of the seven approved projects in the domestic refrigeration sub-sector selected cyclo-pentane technology for conversion of their foam operations. All remaining approved projects selected HCFC-141b based systems. The choices have been guided primarily by the scale of operations and costs. For the refrigerant operations, enterprises of all (except one) approved projects in the sector have chosen HFC-based technology, being the only cost-effective and viable technology available.

3.3.4 Future CFC phase-out Action Plan

The Government of India plans to address the remaining CFC consumption in the Refrigeration and Air Conditioning Sector through submission of a sector-wide phase-out plans beginning 2002 as below:

- Sector Phase-out Plan for Refrigeration Manufacturing (November 2002)
- Sector Phase-out Plan for Refrigeration Servicing (November 2002)

3.4 Survey of the Refrigeration (Manufacturing) Sector

The approved non-investment project, Strategy and Action Plan for ODS Phase-out in the Foam Sector in India, was approved in July 1994. At this time, the implementation of the Montreal Protocol programme in India had just commenced. The objectives and scope of work envisaged under this project were:

- To collect information on the sector (leading to identification of users, categorization of the users, technology selection, etc.)
- To prepare an ODS phase-out strategy (covering awareness creation and information dissemination, capacity building, etc.)
- To prepare and implement an action plan for ODS phase-out (addressing management, timeframe and estimated costs of phase-out, SMEs and informal sectors, etc.)

The project was initially envisaged to be executed nationally, through the Department of Chemicals, Ministry of Petrochemicals, Government of India. However, until 1997, not much progress was made. The approved project document was not signed until this point. In the intervening period (from July 1994 until 1997) substantial progress was made in the Foam and Refrigeration (Manufacturing) Sectors through preparation, approval and implementation of several projects through the World Bank and UNDP. Thus, the original scope of this project, which presumed that a strategy would be in place before implementation of ODS phase-out activities, needed to be modified to reflect the changed scenario. The Government of India requested UNDP to propose a revised scope of activities for the project, which would enable identification of residual ODS users through direct contact, workshops and publicity, which would lead to formulation of investment projects covering the foam and refrigeration sectors and enable development of the appropriate action plan for ODS phase-out. UNDP developed the revised scope of the activities under this project in collaboration with Government of India, as below:

- Identification all upstream suppliers to the Foam Sector.
- Interaction with and information dissemination to the residual ODS users in the Foam and Refrigeration (Manufacturing) Sectors through newspaper announcements and workshops.
- Identification of all residual ODS users in the Foam and Refrigeration (Manufacturing) Sectors

UNDP/UNOPS in collaboration with MOEF, arranged for newspaper announcements for facilitating information dissemination and to locate residual ODS users in June 1998. The first identification and technical assistance workshop for residual ODS users in January 1999 which resulted in successful identification of a large section of residual ODS users in the Foam and Refrigeration (Manufacturing) sectors, fruitful interaction with them and led to the preparation of several projects. UNDP/UNOPS continued the identification work of ODS users and for maintaining sustainability and ensuring local capacity development, retained the services of a local consulting firm in agreement with MOEF. Through the UNDP international and local experts, the work of surveying and identifying remaining CFC users continued and resulted in a steady submission and approval of investment projects. The second identification and technical assistance workshop for residual ODS users, preceded by field contacts and publicity, was held during November 2000. The workshop resulted in further identification of CFC users in the Foam and Refrigeration (Manufacturing) sectors.

The surveying work of the Foam and Refrigeration (Manufacturing) sectors continued with enterprise contacts and plant visits, based on the information and knowledge base generated through the workshops and through the responses to the various publicity actions, carried out under this project. During the first half of 2002, additional assistance for the survey was provided by AIACRA (All India Air Conditioning & Refrigeration Association) and its affiliated and subsidiary associations and chapters.

The survey and identification work of residual CFC users in the foam sector was completed in April 2002 and for refrigeration (manufacturing) sector was largely completed in June 2002. Most residual CFC users are now identified and their baseline information obtained.

3.4.1 Survey Methodology

The Survey Methodology comprised of the following steps:

- Interaction with upstream suppliers (chemicals and equipment)
- Interaction with enterprises

Interaction with upstream suppliers was carried out through regular interactions, meetings and visits. Through these interactions, lists of manufacturers were obtained. Additional inputs were obtained also through the lists maintained by UNDP/UNOPS local and international experts. MOEF also carried out a publicity campaign through all major national and regional newspapers, encouraging residual ODS users to register with MOEF. In addition, information on small and medium-sized enterprises was sought from the relevant government departments and from the AIACRA. To supplement the sources of information above, two identification and technical assistance workshops were arranged as described above, through which, additional enterprises were identified. Most of the enterprises (over 80%) were physically visited through field trips and plant visits carried out by UNDP/UNOPS national consultants and AIACRA affiliates. For the purpose of obtaining baseline information on the enterprises, a questionnaire developed by UNDP was used. The figures of ODS consumption obtained through the survey, were correlated with the records of domestic ODS sales from distributors and traders and with the information provided by the upstream chemical suppliers, to the extent available.

3.4.2 Survey Results

CFC Consumption, eligibility and classification of enterprises

In the survey, a total of about 240 remaining enterprises in the Refrigeration (Manufacturing) Sector were identified, which have residual CFC consumption. The enterprises were spread out all over India, with a predictable concentration in the in the proximity of major industrial areas such as Mumbai, Delhi, Bangalore, Chennai, Chandigadh, etc. Out of these, 199 enterprises met the MLF eligibility criteria for funding, i.e. their CFC-based capacities were established prior to July 25, 1995. The indicative lists of all eligible and ineligible enterprises are provided in Annex-2. The remaining eligible CFC consumption and enterprises by sub-sector are summarized as below:

Table-4
India Refrigeration (Manufacturing) Sector – Summary of remaining unfunded CFC users/consumption

Sub-sector/Category	Number of Enterprises	CFC Consumption (MT)
Eligible enterprises		
Commercial Refrigeration (medium-sized)	6	66.92
Transport Refrigeration (medium-sized)	18	114.12
Commercial Refrigeration (small-sized with CFCs ≥ 2.5 MT/y)	58	180.32
Commercial Refrigeration (small-sized with CFCs < 2.5 MT/y)	117	173.89
TOTAL	**199**	**535.25**
Ineligible enterprises	**41**	**29.06**
GRAND TOTAL	**240**	**564.31**

The remaining 41 enterprises, with a total of CFC consumption of 29.06 MT/y were established after July 25, 1995, and are not eligible for MLF funding. The reasons for the relatively small number of non-eligible CFC users remaining in the sector are as below:

a) MOEF circulated and publicized the draft Ozone Rules in the industry around 1997. The rules included a provision prohibiting installation of new CFC-based capacity, upon coming into force.

b) The industry was in recession in 1996-98 limiting new investments.
c) Due to the awareness of the Montreal Protocol obligations, most of the new capacities established after 1995 were non-CFC-based. In addition, the Government had also extended tariff exemptions and other benefits for installing new non-ODS based technology.
d) Most enterprises with CFC-based capacities established after 1995, converted on their own to CFC-free technologies, fully or partially, knowing that they would not be eligible for funding.

Products manufactured

The surveyed enterprises in the commercial refrigeration sub-sector typically manufacture equipment such as chest freezers, display cabinets, bottle coolers, visi-coolers, reach-in refrigerators, hot/cold water dispensers, water coolers, ice-candy machines, etc, serving the users in the hospitality and food service industry. Many of these enterprises consume CFC-11 used as blowing agent for the rigid foam insulation and CFC-12 used as the refrigerant.

In the transport refrigeration sub-sector, the enterprises manufacture insulated bodies for refrigerated trucks and trailers and the refrigeration systems. These enterprises consume CFC-11 used as blowing agent for the rigid foam insulation and CFC-12/R-502 as the refrigerant.

Baseline Equipment

Based on the responses to the questionnaires, as well as the inputs received from plant visits, the baseline equipment for the foam and refrigeration operations in the enterprises can be summarized as below:

Foaming: Medium-sized enterprises mostly use locally made (or in some cases imported) foam machines. Small-sized enterprises predominantly use manual mixing of chemicals. About 80% of the enterprises in all, use PU foam in some manner; the remaining either use other insulations or are not involved in insulation.

Refrigeration: Medium-sized enterprises typically have semi-automatic charging units, vacuum pumps and leak detectors suited for CFC-12. Small-sized enterprises mostly have assorted charging kits and vacuum pumps, suited for CFC-12.

Baseline Resources

While the owners/management of the enterprises surveyed, are more or less conversant with the need to eliminate CFCs under the Montreal Protocol, most enterprises do not have the financial or technical resources to undertake and sustain conversions at their own cost. Most of the small-sized enterprises have 2-10 employees. The medium-sized enterprises employ about 10-30 persons. While the technicians have basic skills in refrigeration charging and evacuation, there is a lack of good housekeeping and related practices and lack of adequate knowledge or training on CFC-free technologies or applications. Most of the small-sized enterprises do not have well-equipped factories or workshops and lack organizational and infrastructural facilities.

Summary

The enterprises, for the purpose of this Phase-out Plan, are classified into medium-sized (with a CFC consumption typically above 5 MT/y and small-sized (with a CFC consumption typically below 5 MT/y). Among the small-sized enterprises, 117 enterprises with a CFC consumption of less than 2.5 MT/y have foaming operations, which can be considered negligible in terms of value addition to the product or in terms of sustainability. The remaining 58 enterprises with a total CFC consumption higher than 2.5 MT/y are engaged in foaming on a more regular and sustainable basis and would need assistance to facilitate their conversion and maintain their sustainability.

4. PROJECT DESCRIPTION

The Phase-out Plan for elimination of CFCs in the Refrigeration (Manufacturing) sector in India will be implemented through a combination of Investment, Technical support and Policy & management support components.

4.1 Investment Component

The investment component of the plan will focus on enabling the participant enterprises to physically eliminate CFCs from their production activities and would comprise of the following elements:

- Assessment of the technical requirements of conversion
- Determining the scope of international and local procurement
- Development of technical specifications and terms of reference for procurement
- Prequalification and short-listing of vendors
- International/local competitive bidding
- Techno-commercial evaluation of bids and vendor selection
- Procurement contracts
- Site preparation
- Customs clearance and delivery
- Installation and start-up
- Product and process trials
- Operator training
- Commissioning and phase-in of CFC-free production
- Destruction of baseline equipment

The approach for implementing the investment component in the remaining eligible and unfunded enterprises in the sector is proposed to be through a combination of individual and group sub-projects as below:

To be implemented by UNDP

- Six individual sub-projects covering 6 medium-sized enterprises in the commercial refrigeration sub-sector
- Four group sub-projects covering 58 small-sized enterprises (with significant foaming baseline) in the commercial refrigeration sub-sector
- Six group sub-projects covering 117 small-sized enterprises (without significant foaming baseline) in the commercial refrigeration sub-sector

To be implemented by UNIDO

- One group sub-project covering 18 enterprises in the transport refrigeration sub-sector.

This approach draws on previous implementation experience and has been designed based on the size, level of organization, location and customer base of enterprises concerned and also based on ease and convenience for execution and management. Given the generally small size of the remaining enterprises in the sector, with inadequate in-house technical capabilities, the need for adequate investments for plant and process changes, supported by investments on adequate technical assistance, trials and training, is critical and will involve proportionately larger inputs. It is foreseen that the durations for the sub-projects would be set in such a way as to ensure that the verifiable annual performance targets as may be required for the Phase-out Plan, would be quantifiable and achievable. CFC phase-out in ineligible enterprises will not be funded under the sector phase-out plan and is expected to take place through the control, which the Government will have through policy and regulatory actions. Any unaccounted or unidentified eligible enterprises will be identified and accommodated within the resources approved for this sector phase-out plan.

4.1.1 Plant and process investments

Foam Operations

a) New chemicals suitable for the selected alternative technology will be required. These will be available from existing chemical suppliers. No specific investments are foreseen for handling of raw chemicals. However, activities under 4.1.2 will assist enterprises for safe handling of the chemicals.

b) The use of new formulations will lead to a marginal change in mixing ratios and increased viscosity leading to reduced flowability of the chemical mixture. HCFC-141b based foam will have an increased thermal conductivity in relation to that produced with CFC-11, which is being replaced. The existing manual mixing process or low-pressure foam dispensers will not be able to handle the new formulations without adversely affecting the cell structure and thereby the thermal conductivity of the foam. Hand mixing is also not recommended from occupational health and safety standpoints. New high or medium-pressure foam dispensers as applicable, of equivalent effective capacity, which will provide a finer cell structure and help minimize the deterioration of thermal conductivity of the foam, and also minimize the occupational health and safety risks, will therefore be needed to be introduced, to replace the existing dispensers/hand-mixing process.

c) The HCFC-141b based foam will have an increased molded density with respect to the CFC-11 based foam, resulting in increased requirement of chemicals. This increase will be partially offset by the savings resulting from more efficient handling of chemicals due to the new foam dispensers.

Refrigerant Operation

a) Compressors suitable and optimized for HFC-134a/R-404a will be required. These will be available from existing suppliers.

b) The chemical stability of HFC-134a/R-404a and of the synthetic lubricants compatible with HFC-134a/R-404a is highly sensitive to moisture and impurities in the system, as compared to that with CFC-12. The evacuation/charging process for HFC-134a/R-404a and polyolester lubricant will need to ensure the required level of cleanliness and dryness in the system. To ensure this the following is proposed:

- The vacuum pumps will need to be suitable for use with HFC134a/R-404a. Retrofitting of vacuum pumps has not proven cost-effective or logistically feasible in the past, especially for enterprises of this size and considering non-availability of the required parts and services; therefore appropriate quantities of new vacuum pumps suitable for the conversion, consistent with the baseline capacities, will need to be provided.
- The existing refrigerant charging units/kits are not suitable for use with HFC-134a/R-404a and cannot be retrofitted, and will therefore be replaced with automatic or portable semi-automatic charging units suitable for HFC-134a/R-404a duty.

c) The design/sizing of the refrigeration system will need to be suitably changed, to ensure the viability of the process and to maintain product performance and reliability in manufacturing, such as:

- Upsizing the condensers and reengineering evaporators and condensers, so as to ensure the levels of cleanliness and contamination that can be tolerated with HFC-134a/R-404a (< 5 ppm)
- Lengthening of the capillaries or changing the thermostatic expansion valve models.
- Use of filter-dryers with finer pores, suitable for use with HFC-134a/R-404a.

d) The existing leak detection is unsuitable for detecting HFC-134a/R-404a leakages; therefore suitable hand-held leak detectors will need to be provided.

4.1.2 Technical assistance

Technical assistance will be required to be provided through international experts and, when available, national experts to ensure a smooth transition to the new replacement technology. The experts would need to be process specialists and their functions will include overall technical supervision of conversion projects and technical coordination between equipment/chemical suppliers, recipient enterprises and the implementing and/or executing agency. Their specific responsibilities include:

a) Technical assistance for preparing specifications of equipment to be procured in the sub-project
b) Technical equipment bid evaluation from suppliers during the competitive bidding process
c) Technical guidance to the recipient enterprise during start-up with the new equipment and process
d) Resolving technical issues with the phase-in of the new equipment and processes
e) Technical evaluation of the results of production and product quality trials jointly with the recipient enterprise
f) Technical project commissioning including final technical inspection of equipment and process for establishing completion and compliance with project objectives such as the destruction of the baseline CFC-based equipment where applicable, verification of depletion of CFC stocks, and verifying that the non-CFC production process is in operation
g) Technical evaluation of enterprise reimbursement claims on equipment, raw materials, local works and other items and certification of the same
h) Technical clearance of project completion, so that the project assets can be handed over and the project closed.
i) Technical assistance for completion and other reporting requirements.

4.1.3 Product and Process Trials

Trials will be required to validate the new/retrofitted equipment as well as the production process using the new technology, specifically to establish their performance and suitability for the conversion in accordance with specifications and project objectives. Trials will also be needed to evaluate and establish satisfactory end product properties. Trial costs will cover the cost of chemicals, raw materials, components, consumables and utilities required during site preparation and commissioning.

4.1.4 Application and Process Training

Training will be needed to acquaint the production personnel in the enterprise with the new equipment and processes. Training will also be required to address safety and industrial hygiene issues, such as flammability, ventilation, and health hazards and to institute the required industrial practices as applicable to the replacement technology.

4.2 Technical Support Component

Since the Sector Phase-out Plan will address the entire Refrigeration (Manufacturing) Sector, the industry as a whole will need to be supported through provision of a technical support component for ensuring that their phase-out actions and initiatives are not only technically sound but also sustainable, and consistent with the important priorities of the Government, which are to prevent industrial dislocation and obsolescence. The Technical Support component will assist the Refrigeration (Manufacturing) Sector as a whole, for the following:

a) Establishment of quality and performance standards for the CFC-free products and applications within the sector.
b) Interaction with the user industry for providing technology assistance for sustainability of CFC-free refrigeration applications, through technical workshops and meetings
c) Establishment of a training, certification and licensing program for refrigeration system production operators and technicians, for sustaining the CFC-free technologies.

4.3 Policy & Management Support Component

The implementation of the Phase-out Plan will need to be closely aligned and coordinated with the various policy, regulatory, fiscal, awareness and capacity-building actions the Government of India is taking and will need to take in future, in order to ensure that the implementation of the Phase-out Plan is consistent with the Government priorities, such as promotion of indigenization and decentralized management. Further, in view of the annual performance-based targets needed to be achieved under the terms of the Phase-out Plan, the implementation of the Plan will need to be closely and efficiently managed and will introduce additional coordinating, reporting and monitoring activities.

The Phase-out Plan for the Refrigeration (Manufacturing) Sector will be managed by a dedicated management team, comprising of a coordinator to be designated by the Government and supported by representatives and experts from the implementing/executing agencies and the necessary support infrastructure. The Policy & Management Support component of the Phase-out Plan will include the following activities, for the duration of the Plan:

a) Management and coordination of the Plan implementation with the various Government policy actions pertaining to the Refrigeration Sector
b) Establishment of a policy development and enforcement program, covering various legislative, regulatory, incentive, disincentive and punitive actions to enable the Government to acquire and exercise the required mandates in order to ensure compliance by the industry with the phase-out obligations.
c) Development and implementation of training, awareness and capacity-building activities for key government departments, legislators, decision-makers and other institutional stakeholders, to ensure a high-level commitment to the Plan objectives and obligations.
d) Awareness creation of the Phase-out Plan and the Government initiatives in the Sector among consumers and public, through workshops, media publicity and other information dissemination measures.
e) Preparation of annual implementation plans including determining the sequence of enterprise participation in the planned sub-projects.
f) Verification and certification of CFC phase-out in completed sub-projects within the Plan through plant visits and performance auditing.
g) Establishment and operation of a reporting system of usage of CFCs/substitutes by users
h) Reporting of implementation progress of the Plan for the annual performance-based disbursement.
i) Establishment and operation of a decentralized mechanism for monitoring and evaluation of Plan outputs, in association with provincial regulatory environmental bodies for ensuring sustainability.

5. TECHNOLOGY

The selection of the alternative technology for conversion would be governed by the following:

a) Proven and reasonably mature technology
b) Cost-effective conversion.
c) Availability of the systems at favorable pricing.
d) Critical properties that have to obtained in the end product
e) Compliance with established (local and international) standards on safety and environment.

The technology selected would also need to be easily adaptable at the (generally small-sized) recipient enterprises, which predominantly would be participating in this project. The selection of the technology would also need to be consistent with the priorities of the Government and industry and to ensure sustainability of the technology in the long-term.

5.1 Foam Operation

The presently available/emerging CFC-phase-out technologies, for rigid polyurethane insulating foams are:

CLASSIFICATION	LIQUID TECHNOLOGY	GASEOUS TECHNOLOGY
Low ODP technologies (Interim)	HCFC-141b, HCFC-141b + water	HCFCs (22, 142b, 22 + 142b/141b
Zero ODP technologies (Permanent)	Water, Pentanes (n, iso, cyclo) HFC-245fa, HFC-365mfc, HFC-365/227	HFCs (134a, 152a)

Interim Technologies

HCFC-22 (independently or in combination with HCFC-142b and more recently with HCFC-141b) based systems, due to the low boiling point of HCFC-22, cannot be supplied pre-blended and will require investments in full-fledged in-house blending facilities. HCFC-22 also has residual ODP.

HCFC-141b has a boiling point near ambient temperatures. HCFC-141b based systems are technically mature and commercially available. They also provide relatively the most acceptable insulation value and energy efficiency, and the lowest investment and operating costs vis-à-vis other options. No major changes in the auxiliary equipment/tooling in the production program, such as jig/mold redesign, are needed. However, HCFC-141b has residual ODP and is also an aggressive solvent.

Permanent Technologies

Pentane based (n-, iso-, cyclo) systems require extensive safety related provisions/investments due to their flammability. Due to safety considerations, the use of pre-blended systems is not viable and additional investments for in-house pre-mixing are required. Cyclopentane has miscibility limitations with polyols. The molded densities and insulation values are still inferior to those obtained with HCFC-141b. The advantages are their relatively lower operating costs; they are environmentally relatively safe (no ODP/GWP or health hazards) and constitute a permanent technology. Hydrocarbons are thus, the preferred conversion technology for large and organized users, where safety requirements can be complied with and investments can be economically justified. In the present scenario, since most of the enterprises are small or medium-sized, application of hydrocarbon-based systems is not considered feasible.

Gaseous HFCs have been used successfully but cannot been applied widely at the present time, due to cost and availability factors.

For water-based systems, the insulation values, density and commercial availability are unsatisfactory at present. However, these systems have acceptable processing characteristics and are expected to be mature and commercially viable in the near future, especially for applications where insulation values are not very critical. In addition, they are environmentally safe (zero ODP/GWP, no health or safety hazards) and constitute a permanent technology. Since in the current situation the rigid foam is for insulation applications, applying water-based technology is not considered feasible.

Chemical and systems suppliers and the appliance industry have extensively evaluated liquid HFC-based systems. Preliminary trials with non-optimized formulations indicate lower molded foam densities, insulation values comparable to HCFC-141b and no solvent action. On the whole, liquid HFCs are considered to be the only potential zero-ODP alternatives to hydrocarbons. HFC-245fa is expected to be commercially produced beginning the mid-2002. Another candidate, a non-flammable blend of HFC-365mfc and HFC-227, is also planned for commercial production in the second half of 2002. Provided that the commercial and availability considerations are addressed, these substances can be considered to be viable long-term substitutes.

Based on the above considerations, the enterprises will convert to CFC-free systems in future, for their rigid polyurethane foam operations. Until the commercial introduction of mature CFC-free systems, HCFC-141b based systems will need to be used as an interim technology, to maintain product standards and acceptability.

5.2 Refrigerant Operation

The alternative technologies for replacement of CFC-12 in small capacity hermetic/semi-hermetic refrigeration systems are as below:

HCFCs: HCFC-22, Blends
HFCs: HFC-134a, HFC-152a
Hydrocarbons: HC-290 (Propane), HC-600a (Isobutane), and HC290/600a (1:1mixture of both)

HCFCs are not preferred long-term substitutes, due to their residual ODP.

Hydrocarbon technologies though environmentally safe (no ODP/GWP or health hazards) and technically acceptable, require elaborate safety/monitoring provisions and investments due to their flammability and will not be suitable for cost-effective and financially sustainable transfer to small and medium-sized enterprises.

HFC-152a has higher discharge temperatures/pressures, is flammable and less stable at high temperatures and the technology for the same is not widely available.

HFC-134a technology as a replacement for CFC-12 based refrigeration systems, is universally accepted, especially in small hermetic/semi-hermetic systems. HFC-134a is a zero ODP option. The technology is commercially available. Hermetic compressors optimized for HFC-134a are commercially available. This technology is therefore the preferred conversion technology in this project. For low-temperature applications using R-502, based on similar lines as above, R-404a will be the selected replacement technology.

5.3 Technology Selection

Based on the selection parameters for the technologies for foam and refrigerant operations described earlier, the selection of the CFC replacement technologies in the remaining enterprises can be summarized as below:

Sub-sector	CFC Consumption (MT)	Technology Selected
Foam operation	393.78	HCFC-141b + partial water-based systems
Refrigerant operation	170.53	HFC-134a/R-404a

5.4 Additional Justification for HCFC technology

The implementing agency experts prior to the preparation of this proposal appraised the prospective recipient participating enterprises and had detailed discussions with the technical and managerial personnel of the enterprises, regarding the choice of technology for replacing the existing CFC-based technology, under the project. The enterprises were briefed in detail about the following:

1. An overview of the available interim (low ODP) and permanent (zero ODP) replacement technologies.
2. The techno-economic impact of each technology on the products manufactured, and the processes and practices employed by them.
3. The possible implication of each technology, in terms of its known impact on environment, health and safety, such as ozone depleting potential, global warming potential, occupational health, fire and explosion hazards.
4. It was emphasized to them that HCFC technologies are interim in nature due to their residual ODP and therefore may continue to adversely affect the environment, though at a lower scale than CFCs.
5. It was further explained that HCFCs use may become restricted under present or future international conventions and may also need to be phased out at a future date, and any investments required for their phase-out and for conversion to safer technologies, may have to be borne by them.

The enterprises indicated their preference for selection of HCFC-141b based technology, in their rigid foam operation. The specific justifications offered by them are as below:

Water-based systems were considered, but are unsuitable due to the unsatisfactory insulation values, density and other end-product properties, which will affect their competitiveness. They considered hydrocarbon-based systems unsuitable due to the following factors:

a) The fire, explosion and security hazard and compliance with local safety regulations involved in the storage and handling of hydrocarbons, in view of their flammability. In the present premises of these enterprises such compliance is not possible. At the present time, it would not be cost-effective or viable for them to relocate their manufacturing facilities to ensure such compliance.

b) Since hydrocarbons cannot be pre-mixed in polyols due to the safety hazard they present in transportation, additional investments on in-house premixing equipment will be required. Considering their low volume of production, such investments are not economically viable.

c) In view of safety considerations, additional and continuous monitoring of plant operations by statutory authorities will be needed. The plant operators will need additional retraining for safety practices. The insurance premiums will increase. This will add to the burden of recurring costs.

In view of the above, the enterprises selected HCFC-141b (+ partial water) based systems for their rigid foam operations as the interim conversion technology, which will ensure quick phase-out of most of the ODP, while maintaining products competitive and the properties at acceptable levels.

6. INCREMENTAL COSTS

6.1 Summary of incremental costs

The incremental capital and operating costs for the Phase-out Plan are calculated based on the guidance provided by the various Executive Committee Decisions and precedents and agreements reached with MLF during recently approved similar projects in this Sector. The basis and detailed calculations for the various cost elements are presented in Annex-3 and Annex-4. The total costs worked out are as below:

Incremental Capital Costs:	US$ 6,523,000
Contingencies:	US$ 594,800
Incremental Operating Costs:	US$ 1,303,963
Total:	**US$ 8,421,763**

6.2 Economies

The incremental costs of the Plan are budgeted on the basis that the sector-wide phase-out approach will result in economies through adoption of cost-effective execution strategies and also through dynamics of the market forces, while providing the Government with the flexibility and the resources to align its policy and regulatory actions with the technical actions, for ensuring a timely, systematic and sustainable phase-out. Some of the salient provisions of the economies considered for calculating the incremental costs of the sector-wide approach as compared to the individual project-to-project approach, are as below (more details are provided in Annex-3):

a) In the investment component, budgets for technical assistance, trials and training are reduced to reflect the savings in the group/sector-wide approach, based on prior agreements for similar projects.

b) Only those enterprises with significant or meaningful foaming baselines have been considered for supporting the foaming operations.

c) The proposals for replacing the baseline CFC-based equipment have been based on functionality rather than eligibility alone, resulting in savings in the overall costs of the replacement equipment, in accordance with prior agreements with MLF on similar projects.

d) To account for the impact of market forces in shaping the incremental operating costs, projected price differentials are considered only for foam chemicals and refrigerants (and not for other components).

7. COST EFFECTIVENESS

The Cost Effectiveness (ratio of the total incremental costs to the net ODP phased out per year post-project) of this project works out to US$ 15.73/kg/y. This has been calculated from the net incremental project costs of US$ 8,421,763 and the total CFCs, reflecting the net ODP value after deducting the residual ODS of HCFC-141b amounting to 28.88 MT) 535.43 MT, to be phased out upon completion. Details are provided in Annex-5. As per available guidance from Executive Committee Decisions, sector-wide phase-out plans are not subjected to a cost-effectiveness threshold.

8. FINANCING

The total requested grant funding is **US$ 8,421,763.**

9. IMPLEMENTATION

9.1 Flexibility Clause

As mentioned before, the list of enterprises as annexed is the result of a detailed survey, the accuracy of which was confirmed by MOEF and AIACRA (All India Air Conditioning and Refrigeration Association). However, in the unlikely event that some of the enterprises identified in the plan would become ineligible – for example because some would go out of business between the time of the survey and the time they would be assisted – the plan allows for the following flexibility:

(a) The tonnage corresponding to cancelled enterprises and the associated amount of fund assistance, could be applied to other refrigeration manufacturing enterprises that would be found to be eligible but that were not included in the present annex.

(b) The tonnage corresponding to cancelled enterprises and corresponding amount of funds associated to this, could be applied to any other eligible activities in the refrigeration sector, as determined by MOEF.

This is flexibility has been reflected in paragraph 5 of annex 9.

9.2 Management and execution

The overall management of the Plan will be carried out as described in Section 4.3, by Government of India with the assistance of UNDP.

The CFC phase-out activities for the 18 enterprises in the transport refrigeration sub-sector would be implemented by UNIDO. The CFC phase-out activities in all remaining eligible enterprises would be implemented by UNDP.

The Ozone Cell, Ministry of Environment & Forests, will be responsible for monitoring of the implementation of the Phase-out Plan. The Ozone Cell will be responsible for tracking the promulgation and

enforcement of policy/legislations and assist UNDP with the preparation of annual implementation plans and progress report to the Executive Committee. UNDP would conduct an annual independent audit for verifying CFC consumption levels including spot checks and random visits and supervise implementation activities.

9.3 Performance and Disbursement Schedule

Year (as of 31 Dec)	ODS phase-out target (MT)			Remaining ODS Consumption in Ref (Mfg) Sector (MT)	Disbursement (US$)		
	From approved ongoing projects	From Phase-out Plan	Total		UNIDO	UNDP	Total
2002	0	0	0	1,373	1,000,000	2,000,000	3,000,000
2003	200	0	200	1,173	524,073	2,000,000	2,524,073
2004	200	181	381	792	0	1,250,000	1,500,000
2005	200	180	380	412	0	1,250,000	1,000,000
2006	209	203	412	0	0	397,690	397,690
TOTAL	**809**	**564**	**1,373**		**1,524,073**	**6,897,690**	**8,421,763**

9.4 Funding Arrangements

Upon approval by MLF of the Phase-out Plan, the Government of India, through UNDP, requests the Executive Committee to authorize disbursement of funding in advance for 2003, the implementation plan for which, is as below:

a) Establishment of operational mechanism for management and monitoring of the Phase-out Plan.
b) Formulation of detailed terms of reference and work plans for various activities under the Technical Support and Policy & Management Support components
c) Establishment of an operational mechanism for participation in the Phase-out Plan and for obtaining phase-out commitments from enterprises.
d) Initiating CFC phase-out activities for 14 enterprises in the transport refrigeration sub-sector (UNIDO)
e) Initiating CFC phase-out activities for the 6 medium-sized enterprises in the commercial refrigeration sub-sector through individual sub-projects (UNDP)
f) Selection of the enterprises for group projects in the commercial refrigeration sub-sector (UNDP)
g) Two workshops under the Technical Support Component for technology assistance to prospective participant enterprises in the sector.
h) One workshop for public awareness and information dissemination under the Policy and Management Support component.

Since the average duration for completion of a sub-project is expected to be about 18 months, the phase-out activities initiated in 2003 will not be produce results until mid or end-2004, contributing to the reduction of consumption starting 2005. Therefore, the Government of India through UNDP, will request the disbursement of the 2004 funding not later than the last Meeting of the Executive Committee in 2003, against satisfactory reporting of activities carried out in 2003. The funds for 2005 and 2006 will be transferred to UNDP at the first meeting of the Executive Committee in these years, for the amounts listed in the table above, upon approval of the annual implementation plan and upon confirmation by UNDP, that the agreed reduction targets and relevant performance milestones of the respective preceding years have been achieved.

10. RESULTS

This project will completely eliminate the use of CFCs in the Refrigeration (Manufacturing) Sector in India.

ANNEXES

Annex-1: List of Approved Investment Projects in the Refrigeration (Manufacturing) Sector in India
Annex-2: List of remaining enterprises in the Refrigeration (Manufacturing) Sector in India
Annex-3: Incremental Capital Costs
Annex-4: Incremental Operating Costs
Annex-5: Cost-effectiveness
Annex-6: Environmental Assessment
Annex-7: Cover Sheet (UNIDO component)
Annex-8: Cover Sheet (UNDP component)
Annex-9: Draft Agreement
Annex-10: Technical Reviews

ANNEX-1
India – Refrigeration (Manufacturing) Sector: Historical Approvals

MLF Number	Agency	Sub-Sector	Title	Impact	Grant	Approval	CE	Status
Domestic Refrigeration								
IND/REF/20/INV/104	IBRD	Domestic	Godrej-GE Appliances (Foam)	568.0	2,691,570	Oct-1996	4.74	COM
IND/REF/22/INV/125	IBRD	Domestic	Maharaja International	59.80	510,000	May-1997	9.58	ONG
IND/REF/22/INV/126	IBRD	Domestic	Voltas Ltd.	354.00	2,724,378	May-1997	7.73	COM
IND/REF/22/INV/134	IBRD	Domestic	Videocon Appliances Ltd.	351.70	1,835,115	May-1997	6.82	COM
IND/REF/25/INV/183	IBRD	Domestic	BPL Refrigeration Ltd.	136.00	722,906	Jul-1998	7.76	ONG
IND/REF/27/INV/204	IBRD	Domestic	Whirlpool of India Ltd.	200.60	675,165	Mar-1999	4.84	ONG
IND/REF/30/INV/337	IBRD	Domestic	Godrej–GE Appliances (Ref)	71.7	2,050,000	Mar-2000	28.59	ONG
TOTAL (Domestic Refrigeration – 7 projects)				**1,742**	**11,209,134**		**6.44**	
Commercial Refrigeration								
IND/REF/18/INV/61	IBRD	Commercial	Meghdoot Refrigeration	18.00	164,590	Nov-1995	9.14	COM
IND/REF/18/INV/62	IBRD	Commercial	V. Krishna & Co.	14.80	147,020	Nov-1995	9.80	COM
IND/REF/18/INV/63	IBRD	Commercial	V. Krishna Engineers	17.00	202,790	Nov-1995	11.93	COM
IND/REF/18/INV/64	IBRD	Commercial	Friz-Tech P. Ltd.	12.00	132,920	Nov-1995	11.08	COM
IND/REF/19/INV/89	IBRD	Commercial	Rabi-Run Refrigeration	14.00	142,622	May-1996	10.83	COM
IND/REF/19/INV/90	IBRD	Commercial	Seepra Refrigeration	15.00	171,910	May-1996	12.12	COM
IND/REF/19/INV/91	IBRD	Commercial	Shakti Fabricators	13.50	159,230	May-1996	12.43	ONG
IND/REF/19/INV/92	IBRD	Commercial	Chandra Frig Co.	9.40	130,984	May-1996	13.98	ONG
IND/REF/19/INV/93	IBRD	Commercial	Rockwell Industries	18.00	181,004	May-1996	10.60	COM
IND/REF/19/INV/94	IBRD	Commercial	Sethia Appliances	16.00	173,384	May-1996	11.38	COM
IND/REF/20/INV/105	IBRD	Commercial	Supercold Refrigeration	11.00	133,770	Oct-1996	12.16	ONG
IND/REF/20/INV/106	IBRD	Commercial	Murali Refrigeration	9.00	126,485	Oct-1996	14.05	COM
IND/REF/22/INV/110	IBRD	Commercial	Ref. Comp. & Accessories	9.50	125,370	May-1997	13.92	ONG
IND/REF/22/INV/120	IBRD	Commercial	Standard Refrig. Appliances	18.80	170,180	May-1997	9.06	COM
IND/REF/22/INV/122	IBRD	Commercial	Sheetal Engineering	8.70	127,630	May-1997	14.64	COM
IND/REF/22/INV/123	IBRD	Commercial	Hindustan Refrig. Industries	10.10	132,320	May-1997	13.04	ONG
IND/REF/22/INV/124	IBRD	Commercial	Refrig. and Home Appliances	11.30	147,300	May-1997	12.98	ONG
IND/REF/22/INV/131	IBRD	Commercial	Polar Enterprises	10.80	138,190	May-1997	12.75	COM
IND/REF/23/INV/144	IBRD	Commercial	Aarkay Industries	19.80	135,798	Nov-1997	7.62	COM
IND/REF/23/INV/145	IBRD	Commercial	Saikrupa Industries	14.80	125,618	Nov-1997	9.20	COM
IND/REF/23/INV/152	IBRD	Commercial	Sarkar Refrigeration	12.00	117,100	Nov-1997	10.35	COM
IND/REF/23/INV/160	IBRD	Commercial	Sidwal Refrigeration	11.70	169,744	Nov-1997	14.95	COM
IND/REF/25/INV/180	IBRD	Commercial	Sandeep Refrigeration	9.90	107,684	Jul-1998	10.83	COM
IND/REF/25/INV/182	IBRD	Commercial	Prashant Refrigeration	0	0	Jul-1998	0	Canceled
IND/REF/31/INV/257	UNDP	Commercial	Fedders Lloyd Corporation	21.20	257,428	Jul-2000	12.15	COM
IND/REF/32/INV/282	UNDP	Commercial	Sandlas Air-Con Systems	23.30	228,517	Dec-2000	9.80	ONG
IND/REF/32/INV/286	UNDP	Commercial	Group - 9 Enterprises	53.50	789,425	Dec-2000	14.75	ONG
IND/REF/32/INV/290	UNIDO	Commercial	Umbrella - 3 enterprises	27.30	328,894	Dec-2000	12.04	ONG
IND/REF/34/INV/323	UNDP	Commercial	Group - 5 enterprises	22.00	323,627	Jul-2001	14.73	ONG
IND/REF/35/INV	UNDP	Commercial	Ice-Make Refrigeration	12.40	157,305	Dec-01	12.72	ONG
IND/REF/35/INV	UNDP	Commercial	Group - 9 Enterprises	56.50	726,448	Dec-01	12.85	ONG
IND/REF/35/INV	UNDP	Commercial	Konark Refrigeration	13.10	182,684	Dec-01	13.98	ONG
IND/REF/35/INV	UNDP	Commercial	Group - 14 enterprises	68.00	960,097	Dec-01	15.21	ONG
TOTAL (Commercial Refrigeration – 33 projects)				**602**	**7,318,068**		**12.16**	
GRAND TOTAL (40 projects)				**2,344**	**18,527,202**		**7.90**	

ANNEX-2
India – Refrigeration (Manufacturing) Sector: Indicative Lists of Remaining Enterprises

Table 2.1: Medium-sized Enterprises (Commercial Refrigeration)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Beeco Aircon	Meerut	CR	1 LPD (local)	2 SACU, 10VP, 3 LD
2	Cheerag Refrigeration	Mysore	CR	1 LPD	2 SACU, 2 VP, 1 LD
3	Hello Mineral Water Industries	Noida	CR	1 LPD	1 SACU, 4 VP, 2 LD
4	Hemair	Hyderabad	CR	1 LPD	1 SACU, 3 VP, 1 LD
5	Mec Air	Vadodara	CR	1 LPD	2 SACU, 3 VP, 1 LD
6	Tristar	Nasik	CR	1 LPD (local)	2 SACU, 4 VP, 2 LD
TOTAL (6 medium-sized enterprises – commercial refrigeration)				**CFC-11: 48.57 MT, CFC-12: 18.35 MT, Total: 66.92 MT**	

Table 2.2: Medium-sized Enterprises (Transport Refrigeration)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Anand Body Builders	Delhi	TR	HM	4 MCK, 3 VP, 2 LD
2	Anand Ishwar Body Builders	Delhi	TR	HM	3 MCK, 2 VP, 2 LD
3	Anil Transport	Delhi	TR	HM	2 MCK, 2 VP, 2 LD
4	Asian Perishables	Delhi	TR	HM	3 MCK, 3 VP, 2 LD
5	Bright India	Delhi	TR	HM	4 MCK, 2 VP, 2 LD
6	Evergreen Transport	Mumbai	TR	HM	2 MCK, 1 VP, 1 LD
7	Golden Temple Enterprises	Delhi	TR	HM	4 MCK, 2 VP, 2 LD
8	Harish Body Builders	Delhi	TR	HM	3 MCK 1 VP, 1 LD
9	HS Body Builders	Faridabad	TR	HM	2 MCK, 2 VP, 1 LD
10	Indo Gulf Enterprises	Gurgaon	TR	HM	3 MCK, 1 VP, 1 LD
11	JK Refrigerated Vans	Faridabad	TR	HM	3 MCK, 2 VP, 1 LD
12	Raghubir Body Builders	Delhi	TR	HM	2 MCK, 1 VP, 1 LD
13	RK Body Builders	Delhi	TR	HM	3 MCK, 1 VP, 1 LD
14	Sai Baba Refrigeration	Delhi	TR	HM	5 MCK, 4 VP, 2 LD
15	Shalu Enterprises	Delhi	TR	HM	4 MCK, 1 VP, 1 LD
16	Sheetal Perishable Cargo Carr.	Mumbai	TR	HM	1 SACU, 1 MCK, 2 VP
17	Suashish International	Delhi	TR	HM	2 MCK, 1 VP, 1 LD
18	Trans Gulf	Delhi	TR	HM	5 MCK, 3 VP, 2 LD
TOTAL (18 medium-sized enterprises– transport refrigeration)				**CFC-11: 93.78 MT, CFC-12 20.34 MT, Total: 114.12 MT**	

Table 2.3: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption > 2.5 MT/y

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Aaco Refrigeration	Amritsar	CR	HM	Assorted MCK, VP, LD
2	Air Control Systems	Lucknow	CR	HM	
3	Amber Enterprises	Rajpura	CR	HM	
4	Avon Enterprises	Delhi	CR	HM	
5	Best Refrigeration	Udaipur	CR	HM	
6	Bharat Refrigeration Mfg. Co.	Delhi	CR	HM	

Table 2.3: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption > 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
7	Birla Aircon	Delhi	CR	HM	Assorted MCK, VP, LD
8	Biswal Refrigeration Industries	Cuttack	CR	HM	
9	Bristol India	Fazilka	CR	HM	
10	Chandra Refrigeration	Hyderabad	CR	HM	
11	Chirag Refrigeration P. Ltd.	Jaipur	CR	HM	
12	Cool Age	Faridabad	CR	HM	
13	Cool Breeze	Palakkad	CR	HM	
14	Daffoo Engineering	Delhi	CR	HM	
15	Dairy Den	Gandhinagar	CR	HM	
16	DD Refrigeration	Delhi	CR	HM	
17	Delair	Gurgaon	CR	HM	
18	Freezon	Delhi	CR	HM	
19	Glacier Refrigeration	Delhi	CR	HM	
20	GN Cool Systems	Amritsar	CR	HM	
21	GS Enterprises	Delhi	CR	HM	
22	Guru Nanak Enterprises	Delhi	CR	HM	
23	ICE Enterprises	Alwar	CR	HM	
24	Indian Catering Equipment Co	Bhiwadi	CR	HM	
25	Kalyan Cooling Corporation	Kanpur	CR	HM	
26	Kamal Cool	Gurgaon	CR	HM	
27	Kanakdhara Refrigeration	Jaipur	CR	HM	
28	Khanna Engineers	Faridabad	CR	HM	
29	Khatir Refrigeration	Delhi	CR	HM	
30	Kohinoor Industries	Ludhiana	CR	HM	
31	Krishna Refrigeration	Junagarh	CR	HM	
32	Malhotra & Co	Chandigadh	CR	HM	
33	Metro Enterprises	Delhi	CR	HM	
34	Moonstar Refrigeration	Lucknow	CR	HM	
35	Paramount Industries	Delhi	CR	HM	
36	Prakash Cooling	Delhi	CR	HM	
37	Pooma Enterprises	Palakkad	CR	HM	
38	Pury's Refrigeration	Lucknow	CR	HM	
39	Relief Industries	Delhi	CR	HM	
40	Royal Refrigeration Works	Delhi	CR	HM	
41	Sagar Refrigeration	Pathankot	CR	HM	
42	Sant Refrigeration	Delhi	CR	HM	
43	Semko	Ambala	CR	HM	
44	Siddharth Refrigration	Rudrapur	CR	HM	
45	Simran Refrigeration	Faridabad	CR	HM	
46	Super Coolpoint	Agra	CR	HM	
47	Super Refrigeration Industries	Delhi	CR	HM	
48	Taj Cooling Cabinets	Agra	CR	HM	
49	Techcons Refrigeration	Mumbai	CR	HM	

Table 2.3: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption > 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
50	Thermotech	Jaipur	CR	HM	Assorted MCK, VP, LD
51	Udaya Enterprises	Udipi	CR	HM	
52	Veerm's Engineers	Nagpur	CR	HM	
53	Vijay Refrigeration	Jamnagar	CR	HM	
54	Vijay Udyog	Jaipur	CR	HM	
55	Volga Refrigeration	Kanpur	CR	HM	
56	Western Refrigeration Ind.	Palakkad	CR	HM	
57	Yamuna Telefridge	Yamunanagar	CR	HM	
58	Yog Trading Co.	Kanpur	CR	HM	
TOTAL (58 small-sized enterprises with CFCs > 2.5 MT/y				**CFC-11: 127.90 MT, CFC-12: 52.42 MT, Total: 180.32 MT**	

Table 2.4: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption < 2.5 MT/y

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Acme Refrigeration	Goa	CR	HM	Assorted MCK, VP, LD
2	Aditi Refrigeration	Delhi	CR	HM	
3	Advance Refrigeration	Delhi	CR	HM	
4	Alaska Industries	Nagpur	CR	HM	
5	Allied Refrigeration	Ghaziabad	CR	HM	
6	Amancio Refrigeration	Vadodara	CR	HM	
7	Anucool Engineers	Kolhapur	CR	HM	
8	AP Industrial Components	Nainital	CR	HM	
9	AR Corporation	Cuttack	CR	HM	
10	Arctic Aircon	Hyderabad	CR	HM	
11	Arctic Freezers	Trichur	CR	HM	
12	Asiatic Refrigeration	Delhi	CR	HM	
13	Associated Engineers	Mumbai	CR	HM	
14	Balaji Refrigeration	Hyderabad	CR	HM	
15	Bcool Refrigeration	Delhi	CR	HM	
16	Benner Enterprises	Pondicherry	CR	HM	
17	Bharat Aircon	Chennai	CR	HM	
18	Bharat Refrigeration Industries	Chennai	CR	HM	
19	Bhargava Refrigeration	Jaipur	CR	HM	
20	Bhaskar Refrigeration	Belgaum	CR	HM	
21	Bombay Refrigeration	Ahmednagar	CR	HM	
22	Canara Refrigeration	Udipi	CR	HM	
23	Carriers Refrigeration	Trivendram	CR	HM	
24	Chefaid Equipments	Delhi	CR	HM	
25	Climate Creators	Bangalore	CR	HM	
26	Comfort Refrigeration	Jaipur	CR	HM	
27	Commercial Refrigeration Ent.	Delhi	CR	HM	
28	Coolpack	Kanpur	CR	HM	

Table 2.4: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption < 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
29	Cooltech Corporation	Chandigadh	CR	HM	Assorted MCK, VP, LD
30	Cool Tech Ref. Systems	Delhi	CR	HM	
31	Cosmos Aircond. & Ref. Ind.	Cuttack	CR	HM	
32	Craisler Refrigeration	Delhi	CR	HM	
33	Crystal Refrigeration	Calcutta	CR	HM	
34	Data Refrigeration	Delhi	CR	HM	
35	DS Freezing	Kanpur	CR	HM	
36	Durga Refrigeration	Jaipur	CR	HM	
37	Elite Refrigeration	Delhi	CR	HM	
38	Eros Refrigeration	Nagpur	CR	HM	
39	Everest Engineers	Mumbai	CR	HM	
40	Everest Industries	Jalandhar	CR	HM	
41	Excel Rerigeration	Bangalore	CR	HM	
42	Expo Refrigeration	Jammu	CR	HM	
43	Freeze Cool	Nagpur	CR	HM	
44	Freezetech	Hyderabad	CR	HM	
45	Freezeking Enterprises	Bangalore	CR	HM	
46	Gemko Engineers	Ambala	CR	HM	
47	Gilly Enterprises	Aurangabad	CR	HM	
48	Gossons Air	Mohali	CR	HM	
49	GY Cooling	Kanpur	CR	HM	
50	Himalaya Cooling	Calcutta	CR	HM	
51	Imperial Refrigeration	Calcutta	CR	HM	
52	India Refrigeration	Hyderabad	CR	HM	
53	India Refrigeration Enterprises	Yamunanagar	CR	HM	
54	Indo German Refrig.	Amritsar	CR	HM	
55	Indo Tech Engineers	Saharanpur	CR	HM	
56	Industrial Refrigeration	Mumbai	CR	HM	
57	Jai Refrigeration Industries	Jammu	CR	HM	
58	Jamshed Refrigeration	Kanpur	CR	HM	
59	Jashan Refrigeration	Kanpur	CR	HM	
60	JK Industries	Kolhapur	CR	HM	
61	Jolly Refrigeration	Dehra Dun	CR	HM	
62	JVG Enterprises	Delhi	CR	HM	
63	Kadam Engineering	Kolhapur	CR	HM	
64	Kalsi Frost Engineering Co	Jalandhar	CR	HM	
65	KP Cooling Corporation	Kanpur	CR	HM	
66	Ladhar Enterprises	Ludhiana	CR	HM	
67	Lalwani Refrigeration	Sangli	CR	HM	
68	Lexus Engineering	Ludhiana	CR	HM	
69	Mittal International	Delhi	CR	HM	
70	Mohan Refrigeration	Ludhiana	CR	HM	
71	National Refrigeration	Chennai	CR	HM	

Table 2.4: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption < 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
72	Neptune Refrigeration	Chennai	CR	HM	Assorted MCK, VP, LD
73	New Coolwell Enterprises	Delhi	CR	HM	
74	Newcool India	Kanpur	CR	HM	
75	New India Refrigeration	Delhi	CR	HM	
76	New Saarkar Refrig.	Karnal	CR	HM	
77	Nikhil Enterprises	Kolhapur	CR	HM	
78	Perfect Refrigeration	Hyderabad	CR	HM	
79	Pooja Refrigeration	Jalandhar	CR	HM	
80	Prachi Enterprises	Jaipur	CR	HM	
81	Pritam Refrigeration	Nagpur	CR	HM	
82	Ranjana Frost	Chandigadh	CR	HM	
83	R. E. Airtech Industries	Calcutta	CR	HM	
84	Refair Engineering Works	Delhi	CR	HM	
85	Refrigeration Engg	Calcutta	CR	HM	
86	Refrigeration Eqpt Co	Calcutta	CR	HM	
87	Refrig. Machinery Mart	Calcutta	CR	HM	
88	Remi Instruments	Mumbai	CR	HM	
89	Renu Refrigeration	Delhi	CR	HM	
90	Sanan Refrigeration	Jalandhar	CR	HM	
91	Saturn Industries	Mohali	CR	HM	
92	Satkar Refrigeration	Ambala	CR	HM	
93	S-Cool Systems	Chennai	CR	HM	
94	Shankar Refrigeration	Amravati	CR	HM	
95	Sheetal Aircon	Delhi	CR	HM	
96	Sheetal Refrigeration Industries	Akola	CR	HM	
97	Shiva Frost	Mahadpur	CR	HM	
98	Shivalik Products	Ambala	CR	HM	
99	Shome's Refrigeration	Calcutta	CR	HM	
100	Subhash Chander & Bros.	Delhi	CR	HM	
101	Sunfrost Refrigeration	Ambala	CR	HM	
102	Supra Refrigeration	Hyderabad	CR	HM	
103	Teeyem Freezers	Trivendram	CR	HM	
104	Tempkin	Calcutta	CR	HM	
105	Trikuta Cooling	Delhi	CR	HM	
106	Uniair Enterprises	Chandigadh	CR	HM	
107	United Brothers	Delhi	CR	HM	
108	Unitemp	Ludhiana	CR	HM	
109	Upfront Engineering	Chennai	CR	HM	
110	Vanguard Refrigeration	Hyderabad	CR	HM	
111	Varsha Refrigeration	Kolhapur	CR	HM	
112	Vijay Refrigeration	Ambala	CR	HM	
113	Vishwakarma Refrig	Yamunanagar	CR	HM	
114	Vita Ice Candy	Jaipur	CR	HM	

Table 2.4: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption < 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
115	Weathermakers	Calcutta	CR	HM	Assorted MCK, VP, LD
116	You-like Refrigeration	Karnal	CR	HM	
117	3-Star Refrigeration	Ludhiana	CR	HM	
TOTAL (117 small-sized enterprises) with CFCs < 2.5 MT/y				**CFC-11: 105.99 MT, CFC-12: 67.90 MT, Total: 173.89 MT**	

Table 2.5: List of ineligible enterprises

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Abhishek Aircon Appliances	Delhi	CR	HM	Assorted MCK, VP, LD
2	Abohar Aircare	Abohar	CR	HM	
3	Aircare	Delhi	CR	HM	
4	Amigo Dispensing Solutions	Baroda	CR	HM	
5	Ascon Refrigeration	Faridabad	CR	HM	
6	BP Industries	Delhi	CR	HM	
7	Band Box Electric	Ludhiana	CR	HM	
8	Bawa Joginder Singh & Co	Chandigarh	CR	HM	
9	Bhandari Engg & Electricals	Bhatinda	CR	HM	
10	Bliss Engineers	Jalandhar	CR	HM	
11	Climatic Equipments	Delhi	CR	HM	
12	Cool Connection	Delhi	CR	HM	
13	Cool Makers	Tennur	CR	HM	
14	Cool-N-Cool	Faridabad	CR	HM	
15	Cool Palace	Delhi	CR	HM	
16	Cryoscientific Instruments	Chennai	CR	HM	
17	Fauji Refrigeration	Chandigarh	CR	HM	
18	Fridge India	Faridabad	CR	HM	
19	Gulshan Engineers	Delhi	CR	HM	
20	Hemkunt Electricals	Delhi	CR	HM	
21	Jogi Refrigeration	Chandigarh	CR	HM	
22	Khera Instruments	Delhi	CR	HM	
23	Marito Appliances	Mehsana	CR	HM	
24	Marplex Appliances	Ankleshwar	CR	HM	
25	Naarang Scientific Works	Delhi	CR	HM	
26	Noble Refrigeration	Delhi	CR	HM	
27	Osho Home Appliances	Delhi	CR	HM	
28	Paras Enterprises	Parwanoo	CR	HM	
29	Parkaire Engg Co	Delhi	CR	HM	
30	Rakesh Industries	Delhi	CR	HM	
31	Rattan Refrigeration	Delhi	CR	HM	
32	Refco & Wassamat Appliances	Delhi	CR	HM	
33	Saraf Cooling Co	Kanpur	CR	HM	
34	SK Refrigeration Co	Delhi	CR	HM	

Table 2.5: List of ineligible enterprises (Cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
35	Solar Engineering Co.	Bangalore	CR	HM	Assorted MCK, VP, LD
36	Surendra Fabricators	Delhi	CR	HM	
37	Surendra Refrigeration Works	Khanna	CR	HM	
38	Swastik Industries	Delhi	CR	HM	
39	Triveni Refrig & Elect. Ent.	Allahabad	CR	HM	
40	United Refrigeration Works	Kanpur	CR	HM	
41	Unity Aircon Systems	Delhi	CR	HM	
TOTAL (41 ineligible enterprises)				**CFC-11: 17.54 MT, CFC-12: 11.52 MT, Total: 29.06 MT**	

Table 2.6: Summary

Sub-sector	Indicative Number of Enterprises	CFC Consumption (MT/y)		
		CFC-11	CFC-12	Total
Commercial Refrigeration (medium-sized)	6	48.57	18.35	66.92
Transport Refrigeration (medium-sized)	18	93.78	20.34	114.12
Commercial Refrigeration (small-sized with CFCs ≥ 2.5 MT/y)	58	127.90	52.42	180.32
Commercial Refrigeration (small-sized with CFCs < 2.5 MT/y)	117	105.99	67.90	173.89
Ineligible enterprises	41	17.54	11.52	29.06
GRAND TOTAL	**240**	**393.78**	**170.53**	**564.31**

KEYS FOR TABLE:

DR: Domestic Refrigeration
CR: Commercial Refrigeration
TR: Transport Refrigeration
IR: Industrial Refrigeration
CS: Cold storage

HM: Hand-mixing
LPD: Low-pressure foam dispenser
HPD: High-pressure foam dispenser

MCK: Manual charging kits
SACU: Semi-automatic charging units
ACU: Automatic charging units
VP: Vacuum pumps
LD: Leak detectors

ANNEX-3
INCREMENTAL CAPITAL COSTS

A. Investment Component

The following table summarizes the basis and considerations for calculating the incremental capital costs, for the remaining unfunded eligible participant enterprises in the Phase-out Plan:

Medium-sized enterprises (Commercial Refrigeration)

No	Item/Description	Unit	Qty	Cost (US$)
Foam Operation				
1	High-pressure foam dispenser	Nos	1	80,000
2	Trials for establishing the technology, equipment and process	Lot	1	5,000
3	Technical assistance	Lot	1	5,000
4	Training	Lot	1	2,500
Sub-total (Foam operation)				**92,500**
Refrigerant Operation				
1	Automatic charging units	Nos	1	15,000
2	Vacuum pumps	Nos	2	6,000
3	Hand-held leak detectors	Nos	2	2,000
4	Trials and prototype testing	Lot	1	5,000
5	Technical Assistance	Lot	1	5,000
6	Training	Lot	1	2,500
Sub-total (Refrigerant operation)				**35,500**
Total (for each enterprise)				**128,000**
Grand Total (for 6 enterprises)				**768,000**

Medium-sized enterprises (Transport Refrigeration)

No	Item/Description	Unit	Qty	Cost (US$)
Foam Operation				
1	Medium-pressure foam dispenser (60 lit/min)	Nos	1	30,000*
2	Trials for establishing the technology, equipment and process	Lot	1	5,000
3	Technical assistance	Lot	1	5,000
4	Training	Lot	1	2,500
Sub-total (Foam operation)				**42,500**
Refrigerant Operation				
1	Portable charging units	Nos	2	5,000
2	Vacuum pumps	Nos	2	6,000
3	Hand-held leak detectors	Nos	2	2,000
4	Trials and prototype testing	Lot	1	5,000
5	Technical Assistance	Lot	1	5,000
6	Training	Lot	1	2,500
Sub-total (Refrigerant operation)				**25,500**
Total (for each enterprise)				**68,000**
Grand Total (for 18 enterprises)				**1,224,000**

* Reflects 33% enterprise contribution to account for hand-mixing baseline

Small-sized enterprises (Commercial Refrigeration) with significant foaming baseline considered

No	Item/Description	Unit	Qty	Cost (US$)
Foam Operation				
1	Medium-pressure foam dispenser (40 lit/min)	Nos	1	20,000*
2	Trials for establishing the technology, equipment and process	Lot	1	2,500
3	Technical assistance	Lot	1	2,500
4	Training	Lot	1	1,000
Sub-total (Foam operation)				**26,000**
Refrigerant Operation				
1	Portable charging units	Nos	2	5,000
2	Vacuum pumps	Nos	2	6,000
3	Hand-held leak detectors	Nos	2	2,000
4	Trials and prototype testing	Lot	1	2,500
5	Technical Assistance	Lot	1	2,500
6	Training	Lot	1	1,000
Sub-total (Refrigerant operation)				**18,000**
Total (for each enterprise)				**44,000**
Grand Total (for 58 enterprises with significant foaming baseline)				**2,552,000**

* Reflects 33% enterprise contribution to account for hand-mixing baseline

Small-sized enterprises (Commercial Refrigeration) without significant foaming baseline

No	Item/Description	Unit	Qty	Cost (US$)
Foam Operation				**0***
Refrigerant Operation				
1	Portable charging units	Nos	1	2,500
2	Vacuum pumps	Nos	1	3,000
3	Hand-held leak detectors	Nos	1	1,000
4	Trials and prototype testing	Lot	1	2,500
5	Technical Assistance	Lot	1	2,500
6	Training	Lot	1	500
Sub-total (Refrigerant operation)				**12,000**
Total (for each enterprise)				**12,000**
Grand Total (for 117 enterprises without significant foaming baseline)				**1,404,000**

* See note 1 at the end of Annex-2

The total costs for the investment component are summarized as below:

Enterprise Category/Sub-sector	Cost (US$)
Medium-sized enterprises (commercial refrigeration)	768,000
Medium-sized enterprises (transport refrigeration)	1,224,000
Small-sized enterprises with significant foaming baseline	2,552,000
Small-sized enterprises without significant foaming baseline	1,404,000
Sub-total	**5,948,000**
Contingencies (10%)	**594,800**
Total (Investment Component)	**6,542,800**

B. Technical Support Component

Activity	Cost (US$)
Establishment of product and quality standards for various CFC-free refrigeration products and applications (Technical consultancy for 50 man-days @ US$ 500 per man-day)	25,000
User industry interactions for technology assistance for applications through technical workshops and meetings (10 workshops at US$ 10,000/workshop)	100,000
Training, certification and licensing program for refrigeration system manufacturing operators and technicians to be carried out through the industry associations (Legal and technical consultancy for 100 man-days @ US$ 500 per man-day)	50,000
Total	**175,000**

C. Policy & Management Support Component

Activity	Cost (US$)
Management and monitoring (1,000 man-days @US$ 100/man-day)	100,000
Policy development & decentralized enforcement program (500man-days @ US$ 100 per man-day	50,000
Training and capacity-building activities for government stakeholders and decision makers (10 workshops @ US$ 10,000/workshop)	100,000
Public awareness creation and information dissemination activities (5 workshops @ US$ 10,000 per workshop, plus information dissemination	75,000
Verification and certification (500 man-days @ US$ 150/man-day)	75,000
Total	**400,000**

D. Summary

Activity	Cost (US$)
Investment Component (including 10% contingencies)	6,542,800
Technical Support Component	175,000
Policy & Management Support Component	400,000
GRAND TOTAL	**7,117,800**

Notes:

1. For small-sized enterprises consuming CFCs equal or more than 2.5 MT/y, the baseline is considered significant and sustainable enough for supporting foaming operations. Out of a total about 175 small enterprises, there are 58 enterprises with a CFC consumption of equal or more than 2.5 MT/y. Foaming equipment has been proposed for these 58 enterprises only. For the remaining 117 enterprises, only the refrigeration operation is proposed to be supported.

2. The determination of the quantity, budget and type of replacement equipment, is based on previous agreements and precedents for similar projects and guidance provided by relevant Executive Committee decisions.

ANNEX-4
INCREMENTAL OPERATING COSTS

A. Basis and considerations

1. **Incremental operating costs are not claimed for the refrigeration operation in enterprises in the transport refrigeration sub-sector in accordance with the relevant MLF rules.** Only the incremental operating costs on account of their foaming operations are considered.
2. **Incremental operating costs claimed pertain only to the cost differentials between foam chemicals and refrigerants, as it is foreseen that these differentials would exist throughout the duration of the project due to indigenous availability.**
3. **Incremental operating costs are not claimed on account of cost differentials for other components, such as compressors, condensers, evaporators, capillaries or expansion devices, etc., as it is foreseen that these cost differentials may not apply throughout the duration of the project.**
4. The increased costs on account of molded foam density increases in rigid foam with HCFC-141b based systems with respect to CFC-11 based systems as calculated as recommended by OORG and adopted by Executive Committee Decision 31/35. In order to apply the density increases, the distribution of products manufactured by relative CFC consumption, is assumed to be equal among the five product classifications, namely, display cabinets, chest freezers, visi-coolers, vending machines and walk-in-coolers.
5. The net savings on account of more efficient handling of chemicals due to the introduction of a new high-pressure or medium-pressure foam dispensers are calculated at 5%.
6. The calculation of incremental operating costs is based on the following assumptions and chemical costs:

   Rigid foam
   - Cost of baseline CFC-based chemical system: US$ 2.50/kg (Baseline ratio - 100:43:143)
   - Cost of HCFC-141b based chemical system: US$ 2.67/kg (New ratio - 100:26:145)

   Refrigeration
   - Cost differential for refrigerant: US$ 3.00/kg

7. All amounts rounded off to the nearest US$ 1.00
8. The calculations exclude all taxes/duties and growth.
9. All other considerations not specifically clarified above, are based on recent agreements with MLF.

2. Calculations

Foam Operation

Item	Unit	Before Conversion (US$)			After Conversion (US$)			Net Incremental Cost (US$/yr)
		Qty	Rate	Amount	Qty	Rate	Amount	
Foam Chemicals	Kg	2,508,267	2.50	6,270,668	2,633,680	2.67	7,031,926	761,258
Subtotal				6,270,668			7,031,926	761,258
Less savings due to more efficient processing of chemicals (5%)								(351,596)
Incremental operating costs/year for foam operation								**409,662**
Incremental operating costs for foam operation (NPV for 2 years @10% annual discounting)								**712,812**

Refrigerant Operation

Item	Unit	Qty.	Price Differential between pre- and post conversion (US$/unit)	Modifying Factor (if applicable)	Net Incremental Cost (US$/yr)
Refrigerant	Kg	138,670	3.00	0.90	339,742
Incremental operating costs/year for refrigeration operation					**339,742**
Incremental operating costs for ref. operation (NPV for 2 years @10% annual discounting)					**591,151**

3. Summary Of Incremental Operating Costs

The incremental operating costs for the various categories of enterprises/sub-sectors are tabulated below:

Enterprise Category/Sub-sector	Baseline CFCs (MT/y)	Baseline CFCs eligible for IOCs (MT/y)	IOCs (US$)
Medium-sized enterprises (commercial refrigeration)	66.92	66.92	170,245
Medium-sized enterprises (transport refrigeration)	114.12	93.78	177,673
Small-sized enterprises (commercial refrigeration, $\geq$ 2.5 MT/y)	180.32	180.32	465,782
Small-sized enterprises (commercial refrigeration, < 2.5 MT/y)	173.89	173.89	490,263
Ineligible enterprises	29.06	0	0
TOTAL	**564.31**	**514.91**	**1,303,963**

ANNEX-5
COST-EFFECTIVENESS

A. ODP Impact of the Project

SUBSTANCE	ODP	CONSUMPTION (KG)	NET ODP KG
CFC-11	1.00	393,780	393,780
Substitute: HCFC-141b	0.11	262,520	28,877
CFC-12	1.00	170,530	170,530
Substitute: HFC-134a	0.00	153,477	0
Remaining ODP Consumption in the sector			**28,877**

B. Cost-effectiveness Calculation

PARAMETER/COST HEAD	UNIT	TOTAL
Total Project Costs		
A. Incremental Capital Costs	US$	7,117,800
B. Contingencies (10% of A)	US$	Included
C. Incremental Operating Costs	US$	1,303,963
D. Total Project Costs (A + B + C)	US$	8,421,763
Adjustments to Project Costs		
E. Adjustment for non-Article-5 ownership	US$	0
F. Adjustment for export to non-Article-5	US$	0
G. Adjustment for technological upgrade	US$	0
Net Project Costs		
H. Net Project costs (D – [E + F + G])	US$	8,421,763
ODS Phase-out		
I. Total ODS phase-out	Kg	564,310
J. Net ODP phase-out	ODP Kg	535,433
Cost-effectiveness		
K. Cost-effectiveness (H/J)	US$/kg/y	15.73
Eligible MLF Funding	**US$**	**8,421,763**

ANNEX-6
ENVIRONMENTAL ASSESSMENT

HCFC-141b has an ODP of 0.11 and GWP of 630, which are considered acceptable for rigid polyurethane foam application. HCFC-141b is considered non-flammable as a liquid and moderately flammable as a gas (7.6% to 17.7% in air by volume), and is considered safe in applications where the exposure level is less than 500 ppm on a 8-hour time weighted average basis, which is marginally lower than the existing technology. The smog potential of HCFC-141b is about ten times that of CFC-11, although with an emission rate of about 3% during production, this is not an issue. No changes in the current occupational safety practices are envisaged.

HFC-134a has zero ODP and GWP of 1,300. For this application, this is considered acceptable. HFC-134a is non-flammable, and has been extensively tested for toxicity, and is considered safe in applications where the exposure level is less than 1000 ppm on a 8-hour time weighted average basis, which is the same as that for CFC-12, the existing technology. Therefore no changes in the current occupational safety practices are envisaged in this project.

This project thus uses environmentally safe and acceptable technology

The enterprises participating in this project have obtained the necessary statutory environmental clearances for their present operations. Additional clearances if any, for implementing this project, will be obtained as and when required from the relevant competent authorities.

ANNEX-7
Cover Sheet – UNIDO Component

COUNTRY	INDIA		**IMPLEMENTING AGENCY**	UNIDO
PROJECT TITLE	Plan for elimination of CFCs in the transport refrigeration sub-sector in India.			
PROJECT IN CURRENT BUSINESS PLAN			Yes	
SECTOR			Refrigeration (Manufacturing)	
SUBSECTOR			Transport Refrigeration	
ODS USE IN SECTOR	Baseline (Average of 1995-97)		2,770	MT ODP (All sub-sectors)
	Current (2000)		2,297	MT ODP (All sub-sectors)
ODS USE IN ENTERPRISE	Current (2000)		114.12	MT ODP
PROJECT IMPACT			107.24	MT ODP
PROJECT DURATION			2 years	
PROJECT COSTS	Incremental Capital Costs	US$	1,224,000	
	Contingencies	US$	122,400	
	Incremental Operating Costs	US$	177,673	
	Total Project Costs	US$	1,524,073	
LOCAL OWNERSHIP			100%	
EXPORT COMPONENT			0%	
REQUESTED GRANT		US$	**1,524,073**	
COST EFFECTIVENESS		US$/kg/y	N/A	
IMPLEMENTING AGENCY SUPPORT COSTS		US$	TBD	
TOTAL COST OF PROJECT TO MULTILATERAL FUND		US$	TBD	
STATUS OF COUNTERPART FUNDING			N/A	
PROJECT MONITORING MILESTONES			Included	
NATIONAL COORDINATING BODY			Ministry of Environment & Forests	

PROJECT SUMMARY

This project will phase out 93.78 MT of CFC-11 and 20.34 MT of CFC-12 consumption annually, in the production of transport refrigeration equipment at 18 enterprises, by converting foam operations to HCFC-141b as the blowing agent (as the interim technology, with later conversion to ODS-free technology) and to HFC-134a/R-404a as the refrigerant. This conversion constitutes the complete phase-out of CFCs in this sub-sector in India. The enterprises use manual mixing of polyurethane chemicals and CFC-12-based refrigeration charging, evacuation and leak detection equipment in the baseline, which will be replaced/retrofitted. The project will include incremental capital costs for the 18 enterprises, covering (partial) costs of medium-pressure foam dispensers (US$ 540,000), refrigerant charging units (US$ 90,000), vacuum pumps (US$ 108,000), leak detectors (US$ 36,000), re-design, testing, trials (US$ 90,000), technical assistance (US$ 90,000) and training (US$ 45,000). The eligible incremental operating costs amount to US$ 177,673.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules and its obligations under the Phase-out Plan for eliminating CFCs in the Refrigeration (Manufacturing) Sector.

PREPARED BY	UNDP (in consultation with MOEF and UNIDO)	**DATE**	August 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

ANNEX-8
Cover Sheet – UNDP Component

COUNTRY	INDIA		**IMPLEMENTING AGENCY**	UNDP
PROJECT TITLE	Plan for elimination of CFCs in the Refrigeration (Manufacturing) Sector in India (except transport refrigeration)			
PROJECT IN CURRENT BUSINESS PLAN			Yes	
SECTOR			Refrigeration (Manufacturing)	
SUBSECTOR			All (except Transport Refrigeration)	
ODS USE IN SECTOR	Baseline (Average of 1995-97)		2,770	MT ODP
	Current (2000)		2,297	MT ODP
	From remaining enterprises		450.19	MT ODP (except Trans. Ref.)
PROJECT IMPACT			428.19	MT ODP
PROJECT DURATION			4 years	
PROJECT COSTS	Incremental Capital Costs	US$	5,299,000	
	Contingencies	US$	472,400	
	Incremental Operating Costs	US$	1,126,290	
	Total Project Costs	US$	6,897,690	
LOCAL OWNERSHIP			100%	
EXPORT COMPONENT			0%	
REQUESTED GRANT		US$	**6,897,690**	
COST EFFECTIVENESS		US$/kg/y	N/A	
IMPLEMENTING AGENCY SUPPORT COSTS		US$	TBD	
TOTAL COST OF PROJECT TO MULTILATERAL FUND		US$	TBD	
STATUS OF COUNTERPART FUNDING			N/A	
PROJECT MONITORING MILESTONES			Included	
NATIONAL COORDINATING BODY			Ministry of Environment & Forests	

PROJECT SUMMARY

This project will eliminate all the remaining eligible CFC consumption in the Refrigeration (Manufacturing) Sector in India (except Transport Refrigeration) upon completion. The Phase-out Plan will be implemented through four annual implementation programmes and together with the implementation of the approved ongoing projects, will result in the complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India in four years. The Phase-out Plan will cover the technology conversions in the remaining eligible enterprises in the Refrigeration (Manufacturing) Sector and ensure timely, sustainable and cost-effective phase-out through a combination of investment, technical support and policy/management support components. The Refrigeration (Servicing) sector is being addressed through a separate phase-out plan being submitted to the 38th EC Meeting. The total eligible incremental costs and the requested grant for the Phase-out Plan for the Refrigeration (Manufacturing) Sector (except Transport Refrigeration) are US$ 6,897,690.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules.

PREPARED BY	Nandan Chirmulay, UNDP Expert	**DATE**	July 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

ANNEX-9
Draft Agreement

1. The Executive Committee approves in principle a total of US$ 8,421,763 in funding for the phased reduction and complete phase-out in of CFCs used in the Refrigeration (Manufacturing) Sector in India. This is the total funding that would be available to India from the Multilateral Fund for the complete elimination of CFC use in the Refrigeration (Manufacturing) Sector in India, by 31 December 2006. The agreed level of funding would be disbursed in installments as indicated in Table-1 and on the basis of the understanding set out in this agreement. By this agreement, India commits that it will eliminate its total CFC consumption in the Refrigeration (Manufacturing) Sector in accordance with the phase-out target and CFC consumption limits as indicated in Table-1 below:

Table-1
Disbursement Schedule and Control Targets for CFC Consumption and Phase-out in the Refrigeration (Manufacturing) Sector in India

Parameter		2002	2003	2004	2005	2006	2007	Total
Annual CFC Consumption limit in the Refrigeration (Mfg) Sector (ODP MT)		1,373	1,373	1,173	792	412	0	N/A
Annual CFC phase-out target in the Refrigeration (Mfg) Sector (ODP MT)		0	200	381	380	412	0	1,373
Annual funding instalment (US$)	UNIDO	1,000,000	524,073	0	0	0	0	1,524,073
	UNDP	2,000,000	2,000,000	1,250,000	1,250,000	397,690	0	6,897,690
	Total	**3,000,000**	**2,524,073**	**1,500,000**	**1,000,000**	**397,690**	**0**	**8,421,763**
Agency support costs (US$)	UNIDO						0	
	UNDP						0	
	Total						**0**	
Total cost to Multilateral Fund (US$)							0	

2. The phase-out of CFCs achieved in the Refrigeration (Manufacturing) Sector in excess of the specified target for a given year will contribute to achievement of the phase-out targets in subsequent years.

3. The Executive Committee also agrees in principle that the funds for the implementation of the annual programme for any given year will be provided at the last meeting of the Executive Committee in the preceding year, in accordance with the disbursement schedule in Table-1, for the exact amount listed for that year and on the basis of the implementation programme for the year, subject to the performance requirements contained in this agreement. The Executive Committee will strive to ensure that funds are provided at its second meeting in the preceding year. The funding installments for 2004, 2005 and 2006 will be released subject to:

a) The confirmation that all agreed phase-out targets and consumption limits for the previous year have been achieved;

b) The verification that the activities planned for the previous year, were undertaken in accordance with the annual implementation programme.

4. The Government of India agrees to ensure accurate monitoring of the phase-out. The Government of India will provide regular reports, as required by its obligations under the Montreal Protocol and this Agreement. The consumption figures provided under this agreement will be consistent with India's reports to the Ozone Secretariat under Article 7 of the Montreal Protocol. The Government of India also agrees to allow independent verification audits as provided for in this agreement, and in addition, external evaluation as may be directed by the Executive Committee, to verify that annual CFC consumption levels correspond to those agreed and that the implementation of the Refrigeration (Manufacturing) Sector Phase-out Plan proceeds as scheduled and agreed in annual implementation programmes.

5. The Executive Committee agrees to provide India with flexibility in using the agreed funds to meet the consumption limits indicated in Table-1. The Executive Committee has the understanding that during implementation, as long as it is consistent with this Agreement, the funds provided to India pursuant to this Agreement may be used in the manner that India considers will achieve the smoothest possible CFC phase-out, consistent with operational procedures as agreed between India and UNDP in the Refrigeration (Manufacturing) Sector Phase-out Plan as revised and as indicated in the annual implementation programmes. In addition, in the unlikely event that some enterprises would become ineligible for funding – for example because they would go out of business between the time of approval and the time they would be assisted – and if no further eligible manufacturing enterprises can be identified for assistance, the tonnage corresponding to these cancelled enterprises and their corresponding level of funds, could be applied to any other eligible activities in the refrigeration sector, as determined by MOEF. In the Executive Committee's acknowledgement of the flexibility available to India in achieving a complete CFC phase-out in the Refrigeration Sector, it is understood that India is committing to provide the necessary level of resources as may be required for the implementation of the plan and for achieving the consumption limits indicated in Table-1 above.

6. The Government of India agrees that the funds being agreed in principle by the Executive Committee at its 37th Meeting for the complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector are the total funding that will be available to India to enable its full compliance with the reduction and phase-out as agreed with the Executive Committee, and that no additional Multilateral Fund resources will be forthcoming for any related activities in the Refrigeration (Manufacturing) Sector. It is also understood that aside from the agency fees referred to in paragraph 8 below, the Government of India, the Multilateral Fund, and its Implementing Agencies, and bilateral donors will neither request nor provide further Multilateral Fund related funding for the accomplishment of the total phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India.

7. The Government of India agrees that if the Executive Committee meets its obligations under this Agreement, but India does not meet the reduction requirements outlined in Table-1 and other requirements outlined in this Agreement, the Implementing Agency and the Multilateral Fund will withhold subsequent tranches of funding outlined in Table-1, until such time as the required reduction has been met. It is clearly understood that the fulfillment of this Agreement depends on the satisfactory performance by both the Government of India and the Executive Committee of their obligations. In addition, India understands that with respect to all calendar year targets beginning with 2004, the Multilateral Fund will reduce the subsequent tranches and therefore the total funding for Annex-A Group-I substances in the amount of US$ _____ per ODP MT of reductions in consumption not achieved in any year, unless the Executive Committee decides otherwise.

8. UNDP is the Implementing Agency for the implementation of this Phase-out Plan, which will be completed by the end of 2006. A fee of a total of ___ % of the value of the investment activities and ___ % of the value of the policy and management support activities has been agreed in accordance with provisions of this Agreement as indicated in Table-1. As the main implementing agency, UNDP would be responsible for the following:

a) Ensuring performance and financial verification in accordance with specific UNDP procedures and requirements as specified in the Refrigeration (Manufacturing) Sector Phase-out Plan;

b) Reporting on the implementation of the annual implementation programmes to be included as part of each annual programme starting with the submission for the 2003 annual implementation programme prepared in 2002;

c) Providing verification to the Executive Committee that the control targets listed Table-1 and the associated activities have been met;

d) Ensuring that technical reviews undertaken by UNDP are undertaken by appropriate independent technical experts;

e) Assisting India in preparation of annual implementation programmes, which will incorporate achievements in previous annual programmes;

f) Carrying out required supervision missions;

g) Ensuring the presence of an operating mechanism to enable effective, transparent implementation of the programme, and accurate data reporting;

h) Verifying to the Executive Committee that CFC consumption phase-out in the Refrigeration (Manufacturing) Sector has been completed based on the schedules listed in Table-1;

i) Ensuring that disbursements are made to India based on agreed performance targets in the project and provisions in this Agreement;

j) Providing assistance for policy, management and technical support for implementation of the Sector Phase-out Plan, as and when required.

9. The Government of India also commits through this Agreement, to permanently sustain the reductions indicated in Table-1.

F. No. 5-1-2001
Government of India
Ministry of Environment and Forests
Ozone Cell

Core IV B, 2nd Floor
India Habitat Centre
Lodhi Road
New Delhi – 110003
Ph. : 4642176 / Fax : 4642175
Dated : 24th August, 2002

OFFICE MEMORANDUM

Sub: Endorsement of Projects for submission to the 38th Meeting of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol.

The undersigned is directed to enclose herewith government note of transmittal for elimination of CFC-11 and CFC-12 in the Refrigeration (manufacturing) Sector in India (excluding the MAC Sector) to the 38th Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol.

(Dr. S. Satapathy)
Joint Director

Mrs. Suely Machado Carvalho
Principal Technical Adviser & Chief
UNDP/BDP/ESDG/MPU
Room FF-9116, 304 East 45th Street
New York, NY 10017, USA
Tel: (212) 906-6687
Fax: (212) 906-6947

Copy to : Dr. Tamás Gróf
Deputy Director
Montreal Protocol Branch
UNIDO
Wagrammerstrasse 5
A-1220 Wien, Austria
Tel.: +43-1-260264714
Fax.: +43-1-213464714

ANNEX-8
Cover Sheet - UNDP Component

COUNTRY	INDIA	**IMPLEMENTING AGENCY**	UNDP
PROJECT TITLE	Plan for elimination of CFCs in the Refrigeration (Manufacturing) Sector in India (except transport refrigeration)		
PROJECT IN CURRENT BUSINESS PLAN			Yes
SECTOR			Refrigeration (Manufacturing)
SUBSECTOR			All (except Transport Refrigeration)
ODS USE IN SECTOR	Baseline (Average of 1995-97)		2,770 MT ODP
	Current (2000)		2,297 MT ODP
	From remaining enterprises		450.19 MT ODP (except Trans. Ref.)
PROJECT IMPACT			428.19 MT ODP
PROJECT DURATION			4 years
PROJECT COSTS	Incremental Capital Costs	US$	5,299,000
	Contingencies	US$	472,400
	Incremental Operating Costs	US$	1,126,290
	Total Project Costs	US$	6,897,690
LOCAL OWNERSHIP			100%
EXPORT COMPONENT			0%
REQUESTED GRANT		US$	6,897,690
COST EFFECTIVENESS		US$/kg/y	N/A
IMPLEMENTING AGENCY SUPPORT COSTS		US$	TBD
TOTAL COST OF PROJECT TO MULTILATERAL FUND		US$	TBD
STATUS OF COUNTERPART FUNDING			N/A
PROJECT MONITORING MILESTONES			Included
NATIONAL COORDINATING BODY			Ministry of Environment & Forests

PROJECT SUMMARY

This project will eliminate all the remaining eligible CFC consumption in the Refrigeration (Manufacturing) Sector in India (except Transport Refrigeration) upon completion. The Phase-out Plan will be implemented through four annual implementation programmes and together with the implementation of the approved ongoing projects, will result in the complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India in four years. The Phase-out Plan will cover the technology conversions in the remaining eligible enterprises in the Refrigeration (Manufacturing) Sector and ensure timely, sustainable and cost-effective phase-out through a combination of investment, technical support and policy/management support components. The Refrigeration (servicing) sector is being addressed through a separate phase-out plan being submitted to the 38th ExCom Meeting. The total eligible incremental costs and the requested grant for the Phase-out Plan for the Refrigeration (Manufacturing) Sector (except Transport Refrigeration) are US$ 6,897,690.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules.

PREPARED BY	Nandan Chirmulay, UNDP Expert	**DATE**	July 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

ANNEX-7

Cover Sheet – UNIDO Component

COUNTRY	INDIA	**IMPLEMENTING AGENCY**	UNIDO
PROJECT TITLE	Plan for elimination of CFCs in the transport refrigeration sub-sector in India.		
PROJECT IN CURRENT BUSINESS PLAN			Yes
SECTOR			Refrigeration (Manufacturing)
SUBSECTOR			Transport Refrigeration
ODS USE IN SECTOR	Baseline (Average of 1995-97)		2,770 MT ODP (All sub-sectors)
	Current (2000)		2,297 MT ODP (All sub-sectors)
ODS USE IN ENTERPRISE	Current (2000)		114.12 MT ODP
PROJECT IMPACT			107.24 MT ODP
PROJECT DURATION			2 years
PROJECT COSTS	Incremental Capital Costs	US$	1,224,000
	Contingencies	US$	122,400
	Incremental Operating Costs	US$	177,673
	Total Project Costs	US$	1,524,073
LOCAL OWNERSHIP			100%
EXPORT COMPONENT			0%
REQUESTED GRANT		US$	**1,524,073**
COST EFFECTIVENESS		US$/kg/y	N/A
IMPLEMENTING AGENCY SUPPORT COSTS		US$	TBD
TOTAL COST OF PROJECT TO MULTILATERAL FUND		US$	TBD
STATUS OF COUNTERPART FUNDING			N/A
PROJECT MONITORING MILESTONES			Included
NATIONAL COORDINATING BODY			Ministry of Environment & Forests

PROJECT SUMMARY

This project will phase out 93.78 MT of CFC-11 and 20.34 MT of CFC-12 consumption annually, in the production of transport refrigeration equipment at 18 enterprises, by converting foam operations to HCFC-141b as the blowing agent (as the interim technology, with later conversion to ODS-free technology) and to HFC-134a/R-404a as the refrigerant. This conversion constitutes the complete phase-out of CFCs in this sub-sector in India. The enterprises use manual mixing of polyurethane chemicals and CFC-12-based refrigeration charging, evacuation and leak detection equipment in the baseline, which will be replaced/retrofitted. The project will include incremental capital costs for the 18 enterprises, covering (partial) costs of medium-pressure foam dispensers (US$ 540,000), refrigerant charging units (US$ 90,000), vacuum pumps (US$ 108,000), leak detectors (US$ 36,000), re-design, testing, trials (US$ 90,000), technical assistance (US$ 90,000) and training (US$ 45,000). The eligible incremental operating costs amount to US$ 177,673.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules and its obligations under the Phase-out Plan for eliminating CFCs in the Refrigeration (Manufacturing) Sector.

PREPARED BY	UNDP (in consultation with MOEF and UNIDO)	**DATE**	August 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

c. UNIDO

Subject: RE: URGENT: IND-Refrigeration Manuf
Date: Tue, 27 Aug 2002 13:38:37 +0200
From: T.Grof@unido.org (Tamas GROF)
To: jacques.van.engel@undp.org
CC: ozone@del3.vsnl.net.in, S.Yalcindag@unido.org (Seniz YALCINDAG)

Dear Jacques,

Thanks for the Project Document. In line with our telephone discussion we agree to its submission to the Secretariat. In case of any assistance required, please contact us.

Kind regards,

Tamás

Country: **INDIA**
Firm: **Various**
Type: **Refrigeration (Manufacturing) Sector Plan**
Date: **August 2002**

RTU-UN/Pav-LK-20233-dl

Scope
The plan under review covers the conversion in India of the remaining CFC consumption in the manufacturing of all domestic, commercial and transport refrigeration units (excluding the servicing sector).

1. Project Objectives and Institutional Framework
No comments regarding this description. The legislation is adequately described.

2. Description of the Refrigeration Sector
The description of the background and the structure of the refrigerator sector are clear. 3.2.2 "User industry" gives a good overview. The ODP tonnes (and CE values) given in the tables 1-3 are clear. It is useful information to learn that the net refrigeration consumption for 2001 is 1373 ODP tonnes (excluding servicing), of which 809 tonnes are already addressed in approved projects. This leads to the conclusion (from the figures given) that a "net" consumption of 535 ODP tonnes still needs to be addressed via projects (or a sectoral plan for manufacturing). Table 2 gives an adequate description of the historic project information, where the commercial sector had a funding level of US$12.16/ODP kg.

The description of the historical approach (and technology choices) in phasing out as given in sections 3.3.1 and 3.3.2 does not raise questions (where is section 3.3.3?).

Chapter 3.4, sections 3.4.1, survey methodology, and 3.4.2, survey results, do not raise comments. Table 4 gives a brief description of the companies concerned, which is supported by sections on "products manufactured", "baseline equipment", baseline resources" etc. It would have been interesting if a description would have been given of the number of units made per year by representative companies together with the refrigerant charge applied, in this way making it possible to check operating costs for the refrigerant consumed (is all the refrigerant reported consumed in the manufacturing process and is it necessary?) *(additional information provided gives insight in the production and refrigerant use for some representative companies).*

3. Project Description
The plant and process investments material given here is identical to the material given in separate projects before. However, a brief explanation could be given why vacuum pumps cannot be retrofitted (age?) and why existing refrigerant charging kits are not suitable for HFCs. Under "refrigerant operation" part c it is mentioned "upsizing the condensers and reengineering evaporators and condensers, so as to ensure the levels of cleanliness....". The first is engineering for product performance, the second has to do with the manufacturing process, and this needs to be corrected.

The technical assistance is the important issue. One can assist companies via national consultants and experts, but it should be emphasised that one needs to make provisions that the companies do not keep using CFCs (if they are cheap and available); in fact the small companies are comparable to small servicing companies where the same issue plays an important role. This implies destruction of old equipment, national monitoring, and some kind of certification of the manufacturing people and the products. This is explicitly mentioned under "technical support component" point c. The important issue is the question "how can training and certification guarantee that the non-CFC operations become "sustainable". This is pertinent and is also addressed in section 4.2.

No comments to the management component description. This management could indeed be part of the system that guarantees that operations are CFC free, and one should attribute to this management component a clear reporting requirement on all kind of phenomena.

4. Technology

The summary of the selection of the alternative technology for conversion is brief and adequate. The proposal gives a short overview of the refrigerant candidates for domestic/commercial refrigerators, i.e. HCF-134a, HFC-152a, propane, isobutane and mixtures. In fact, only, HFC-134a (R-404A) and isobutane are globally valid options for new equipment; it is acceptable if the proposal mentions that flammables are not suited for SME operations. The choice for HFC-134a (R-404A) is acceptable.

5. Environmental impact

The refrigerant HFC-134a (R-404A) proposed has no ODP and acceptable other environmental characteristics.

6. Project costs

The following to the project costs:
Incremental investment and operating costs etc. amount to US$8.4 million, with a CE of 15.73/kg ODP. If this is compared to the cost effectiveness of historical approvals for medium or small commercial firms, being about US$12 (see earlier table in the proposal), one can observe that the CE in this proposal is 15% higher (mainly due to costs for foaming equipment).

No comments to Annex 1 and Annex 2.

Costs given per company for medium sized enterprises (refrigerant operation) are acceptable. The same applies to the small sized operations. Costs for technical support are acceptable (should it be US$500 per day?); the same applies to the policy component (should it be US$150 per day?).

The calculation of operational costs on the basis of the chemical only is acceptable. The Table nr 3 giving the summary is in order. No comments to the cost effectiveness calculation.

7. Implementation time frame (disbursement schedule)

No comments.

8. Recommendation

The conversion project **is supported** where it concerns the entire project concept and the various elements.
It would be useful in addition,

- To give some more information on number of units produced in certain companies and the charges applied, than just for a representative number;
- To describe why new vacuum pumps and charging machines need to be installed at all companies; and
- To correct for inconsistencies in the description of the re-engineering for HFC-134a.

Eindhoven, 02 08 21
Kuijpers, LJM

---------- Original Message ----------
Date: Wed, 21 Aug 2002 09:19:54 -0400
To: Lambert Kuijpers <lambermp@wxs.nl>
From: Nandan Chirmulay <nandan@erols.com>
Subject: Re: 38th EC: India - Refrigeration (Mfg) Sector Phase-out Plan
Cc: Jacques Van Engel <jacques.van.engel@undp.org>

Dear Lambert:

Thank you for the review. My comments are as below:

a) Individual enterprise production levels:

There is a significant variation in the ranges, sizes, models, capacities, etc. of products manufactured by different enterprises - and this makes it an enormously difficult task to arrive at anything, which could be called "representative". A similar exercise done for the Indonesia Refrigeration (Mfg) Sector Plan submitted and approved at the 37th EC Meeting did not prove very fruitful in enhancing the understanding of the consumption patterns. Further, this is a Sector Phase-out Plan with a provision to address the individual enterprise consumption in a flexible manner, provided the overall Plan commitments are met. Therefore, individual enterprise-level calculations may not have a bearing on the incremental costs finally agreed upon or needed. Moreover, the overall IOC calculations provided in Annex-4 can be used to estimate the overall production level in the Sector and at the enterprise level as well (by dividing it over the number of eligible enterprises and obtaining a kind of "per enterprise average").

b) Your other two points relating to the vacuum pump retrofit and changes in the refrigeration system design are now addressed in the final version of the document.

If you find the above explanations acceptable, please have a signed version of the review faxed to Jacques/UNDP at your earliest convenience.

Best regards
Nandan

TECHNICAL REVIEW.

1.Country:

India.

2.Project Title:

Plan for phase-out of CFCs in the refrigeration (manufacturing) sector in **India.**

3.(Sub)Sector:

Refrigeration.

This review covers only the foam part.

4.CP-Relationship:

India ratified the Vienna Convention in March 1991, and the Montreal Protocol in June 1992. A detailed country programme was prepared in 1993. It aimed to phase-out all ODS in accordance with its national industrial development strategy, and the Montreal control schedule.

The Ministry of Environment and Forest (MOEF) is leading the efforts in the phaseout of CFCs in close cooperation with the consuming and supplying industry. The MOEF has set up an Ozone Cell as the national unit to manage and coordinate India's country programme for ODS phase-out.

5.Technology:

The government of India wants to achieve a complete phase-out of CFCs in the refrigeration manufacturing sector within four years, and proposes therefore, together with UNDP and UNIDO a phase-out project.

This project is based upon development and implementation of measures in the field of investments, technical support and management procedures.

The reviewer fully agrees with the proposed project text. Some additional suggestions are:

-under 4.1 or 4.2, it could be added that measures must be foreseento update the industry on further developments concerning the use of new zero ODS technologies. This could eg be done by publications from

UNDP or UNIDO, or via the raw material suppliers. In this way, smaller enterprises will be able to learn when technically and economically acceptable solutions are available.

-under 4.3, a new legislation could be added which forbids imports of CFCs, or so called "recycled" CFCs.

6.Environmental Impact:

HCFC 141b has an ODP and a GWP of 0.1 (vs 1.0 for CFC 11). The smog potential is about ten times the one of CFC 11. The emission legislation of India must be consulted, and the workplace concentration must be monitored and kept below the legal value.

7.Project Costs:

Both ICC and IOC can be accepted as presented. It should be checked whether all mentioned companies are 100% Indian.

8.Implementation:

Can be accepted as presented.

9.Recommendation:

It is recommended to accept the project.

Prepared by Dr. Hubert Creyf, UNDP Foam Sector Reviewer.

Date:082602

GOVERNMENT NOTE OF TRANSMITTAL OF INVESTMENT PROJECTS TO THE EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

PROJECT OF THE GOVERNMENT OF INDIA

The Government of India requests UNDP and UNIDO to submit the Sectoral Phaseout Plan for CFCs in the Refrigeration (manufacturing) Sector in India (excluding the MAC Sector) Sector in India to the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol for consideration at its 38th Meeting. (project copy is enclosed)

Section I: ODS Consumption Data

1. The ODS consumption figure of the project has been validated by the National Ozone Unit (NOU).

2. The consumption data have been retained in the records of the NOU for reference and/or future verification.

3. The Government has been advised by the NOU that the agreement to the project indicates a commitment to ensure that the validated phase-out figure was realized and yielded a sustained reduction from the 2000 consumption of 2898 (CFC-11) ODS metric tonnes and 690.33 (CFC-12) MT for the RAC sector.

Table 1: Project Submitted to the 38th Meeting of the Executive Committee

No.	Name of Recipient Enterprise	Sector/Sub-Sector	ODS phaseout (ODP-MT)	Grant Requested (US$)	Implementing Agency
1.	Sectoral Phaseout Plan for CFCs in the Refrigeration (manufacturing) Sector in India (excluding the MAC Sector)	Refrigeration Sector (excluding Mobile Air-Conditioning)	428.19 MT 107.24 MT	6,897,690 1,524,073	UNDP UNIDO

Section II: Other Relevant Actions Arising from Decision 33/2

4. It is understood that, in accordance with the relevant guidelines, the funding received for a project would be partly or fully returned to the Multilateral Fund in cases where technology was changed during implementation of the project without informing the Fund Secretariat and without approval by the Executive Committee;

5. The National Ozone Unit undertakes to monitor closely, in cooperation with customs authorities and the environmental protection authorities, the importation and use of CFC and to combine this monitoring with occasional unscheduled visits to importers and recipient manufacturing companies to check invoices and storage areas for unauthorized use of CFC.

6. The National Ozone Unit will cooperate with the relevant implementing agencies to conduct safety inspections where applicable and keep reports on incidences of fires resulting from conversion projects.

Section III : Projects Requiring the Use of HCFCs for Conversion *(To be included where applicable)*

7. In line with Decision 27/13 of the Executive Committee and in recognition of Article 2 F of the Montreal Protocol, the Government

(a) has reviewed the specific situations involved with the project(s) (insert names of enterprises) as well as its HCFC commitments under Article 2F; and

(b) has nonetheless determined that, at the present time, the projects needed to use HCFCs for an interim period with the understanding that no funding would be available for the future conversion from HCFCs for the company/companies involved.

Name: Usha Chandrasekhar
Designation: Director (Ozone Cell)
Telephone: 91-11-4642176
Fax: 91-11-4642175/4643318
E-mail: ozone@del3.vsnl.net.in

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