



欢迎! Welcome!

COPA 试点报告会议：中国汽车养护行业的制冷剂回收

**COPA Session for Pilot Report: Refrigerant Recycling in China's
Automotive Maintenance Industry**

22nd Oct. 2024, moderator: Theresa Bruns, Malin Emmerich (GIZ)

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COPA 试点报告会议：中国汽车养护行业的制冷剂回收

- ✓ COPA 与中国汽车技术研究中心（简称 CATARC）、Heat 和 Harson Group 合作，在中国广州开展了一个试点项目。
- ✓ COPA 试点的目标是估计汽车冷却系统可能减少的 HFC 排放。

AGENDA / 议程

0	Agenda & Introduction	Theresa Bruns (GIZ Proklima)	议程和介绍
1	COPA Welcome	Malin Emmerich (GIZ Proklima)	COPA 欢迎
2	Research Study & Pilot work	Ms. Wangjia, CATARC	研究 研究和试点工作
3	Demonstration Partner introduction: Harson Group	Mr. Zhang Xiaojun, Harson Group	示范合作伙伴介绍: Harson Group
4	Methodology & Baseline calculation	Mr. Manuel Prieto Garcia, Heat GmbH	方法和基线计算
5	Conclusions, lessons learned	Ms. Wangjia, CATARC	结论、经验教训
6	Discussion & Questions	All	讨论和问题
7	Wrap-up; publication & next steps	Malin Emmerich (GIZ Proklima)	包起来;发布和下一步

欢迎致辞 / WELCOME REMARKS

- 欢迎您代表气候和臭氧保护联盟秘书处参加今天的会议。很高兴您今天能加入。今天的演讲非常精彩，原因有三：
- 首先，汽车行业在制冷剂减排方面的潜力尚未开发。通过正确的设备、培训和流程可以避免的排放是相当大的。
- 其次，汽车行业的制冷剂管理在未来将变得更加重要。电动汽车是摆脱化石燃料过渡的一部分。然而，由于电池的原因，它们需要比传统汽车更大的冷却系统。这意味着它们将携带更多的制冷剂。因此，避免汽车制冷系统排放物将是一项持续的重要贡献，是阻止持续气候变化所必需的。
- 第三;有效管理制冷剂应在制冷剂的整个生命周期内进行。制冷剂是宝贵的资产，对健康、生产力和运输都有所帮助。从长远来看，世界不能不尽可能有效地使用它。
- 这就是为什么我很高兴今天邀请到 CATARC 和 Harson 的专家在这里分享他们在中国的经验 and 知识。作为世界上最大的制冷剂生产国、消费国和出口国，中国在制冷剂回收和再利用方面面临着重大挑战。汽车维修行业的缓解潜力是有希望的，但流程尚未优化。开发、实施和验证标准化制冷剂回收流程对于提高整个地区和行业的资源效率至关重要。
- 凭借研究期间收集的试点数据，以及 Manuel from Heat 将引入的基线方法，我们现在拥有了即用型工具，可以推动汽车行业冷却行业向可持续制冷剂管理的转变。
- 这就是你进来的地方，亲爱的 COPA 会员和朋友们。使用今天介绍的试点研究中的工具和知识！！我希望您发现今天的会议和出版物和我一样有用。

中国汽车维修行业制冷剂回收示范项目——研究与试点工作

王佳 高级研究员

中国汽车技术研究中心有限公司

Demonstration Report on Refrigerant Recycling in China's Automotive Maintenance Industry - Part 1: Research Study & Pilot work

Wang Jia, Senior Researcher

China Automotive Technology And Research Center Co., Ltd.

中国汽车技术研究中心有限公司

China Automotive Technology and Research Center Co., Ltd.



- 中国汽车技术研究中心有限公司 (CATARC) 是中国国务院国资委直属中央企业。
- 为控制汽车空调温室气体减排, CATARC 一直在开展车用空调制冷剂减排及替代方案研究, 参与了多项相关政策政研及专项研究, 在制冷剂减排及替代方面积累了丰富的经验。

- China Automotive Technology and Research Center Co., Ltd. (CATARC) is a central enterprise directly under the State-owned Assets Supervision and Administration Commission (SASAC) of the State Council of China.
- To control greenhouse gas emissions from automotive air conditioning, CATARC has conducted research on refrigerant reduction and substitution, participating in policy studies and projects, and gaining extensive experience in the field.

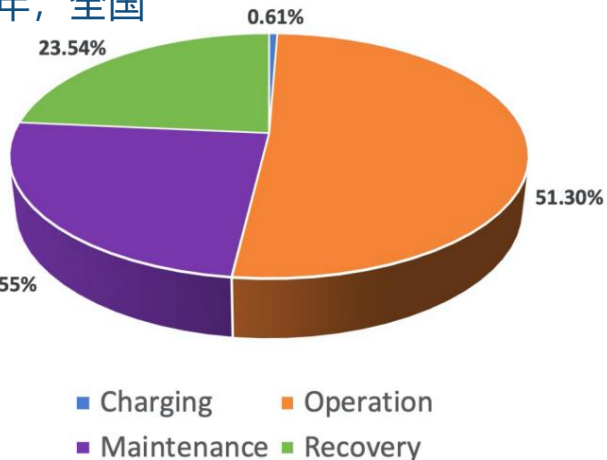
中国汽车维修行业介绍

1. 概况

中国汽车维修行业规模庞大且差异化明显。根据交通运输部的数据，截至2022年，全国汽车维修企业数量已达38.6万家。

2. 制冷剂回收问题

- (1) 维修人员缺乏专业技术培训
- (2) 不合规的维护实践
- (3) 回收设备回收利用不足
- (4) 企业管理水平低



根据中国汽车技术研究中心的一项调查，燃油车维修的直接排放量占其整个生命周期总排放量的24.55%。

1. Overview

The Chinese automotive maintenance industry is vast and highly differentiated. According to the Ministry of Transport, as of 2022, there were 386,000 automotive maintenance enterprises nationwide.

2. Issues in Refrigerant Recovery

- Lack of professional technical training for maintenance personnel
- Non-compliant maintenance practices
- Underutilization of recovery equipment
- Low management standards in enterprises

According to a survey by the China Automotive Technology and Research Center Co., Ltd., the direct emissions from the maintenance of fuel vehicles account for 24.55% of their total lifecycle emissions.

项目概述及时间表

1. 概述

在中国某地区汽车维修企业开展空调制冷剂回收示范，增加设施设备以及开展标准化回收培训。通过示范前后的数据对比，总结示范经验并探索汽车维修行业减少制冷剂排放的路径。

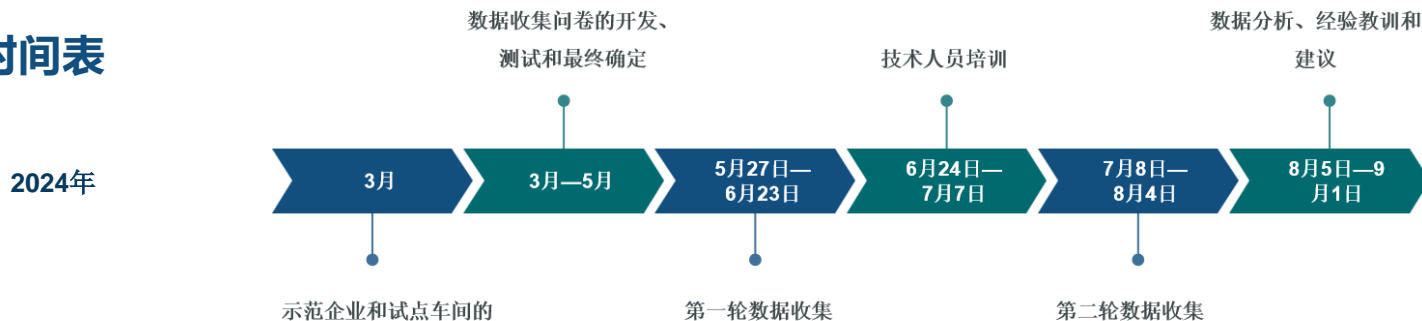
Overview and Time schedule of Pilot Project

1. Overview

A demonstration project on air conditioning refrigerant recovery was conducted in an automotive maintenance enterprises in a specific region in China. This involves enhancing facilities and equipment, as well as providing standardized recovery training. By comparing data before and after the demonstration, the project aims to summarize the experience and explore pathways to reduce refrigerant emissions in the automotive maintenance industry.

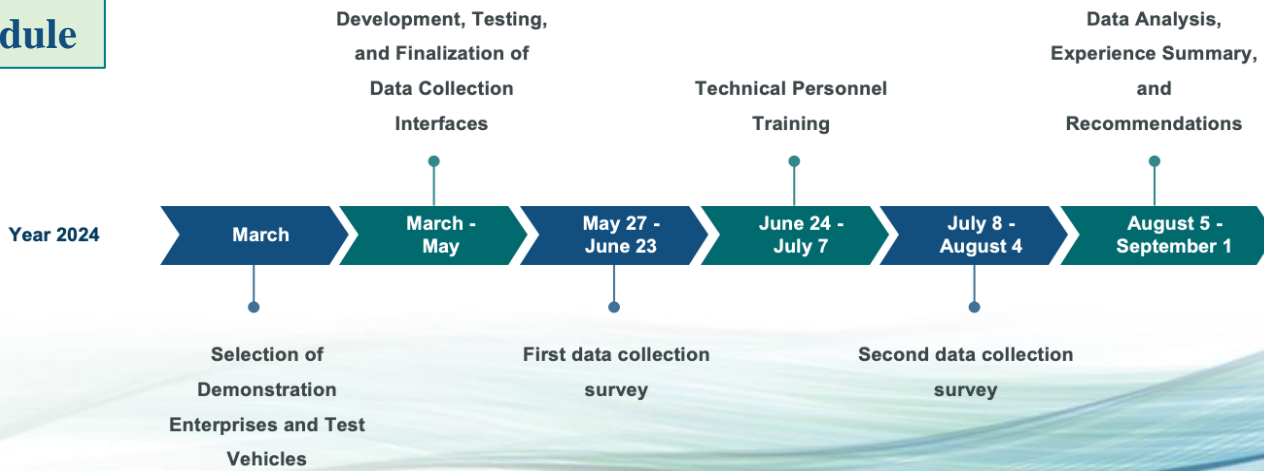
项目概述及时间表

2. 时间表



Overview and Time schedule of Pilot Project

2. Time schedule



选择华胜作为试点企业

Harson was selected as the pilot enterprise for the project

主要因素:

- 业务实力和品牌影响力
- 门店覆盖面广，专业团队
- 技术和标准化优势
- 良好的合作关系



华胜示范店

Harson Demonstration Store

Key Factors:

- Business strength and brand influence
- Extensive store network and professional team
- Technical and standardization advantages
- Strong collaborative relationships

华胜将单独展示其详细情况

Harson will present its details separately.

试点方法

Pilot Method

1. 数据调查表

- 经过多次调整确定最终数据调查表

Data Survey Form: The final data survey form was determined after multiple adjustments.

汽车维修制冷剂回收数据采集表项目说明

序号	车辆序号
收集日期	制冷剂收集的日期
车型	车辆类型, 例如: SUV, 轿车, MPV
车龄	车辆使用年数
品牌	车辆品牌, 例如: 比亚迪, 宝马, 大众等
车牌号	车辆牌照
进店维修空调的原因	车辆进入维修店的原因
上一次制冷剂加注时间	上次车辆充注制冷剂的时间
制冷剂初始充注量 (克)	车辆出厂时充注的制冷剂量
制冷剂型号	空调系统使用的制冷剂类型
制冷剂回收时长 (分钟)	制冷剂回收过程中使用的时间
回收过程中存在的问题	在制冷剂回收过程中出现的问题
回收总量 (克)	维修后需要处理或回收的制冷剂总量
回收制冷剂状况	请注明回收的制冷剂的污染程度
回收制冷剂处理方式	制冷剂回收以后的处理方式
新充注制冷剂类型	再次充注到空调器中的制冷剂, 包括如新制冷剂或再生的制冷剂
如果同时补充了额外的制冷剂, 请填写补充制冷剂的重量 (克)	此处说明是否将新制冷剂加到回收制冷剂中, 以完成车辆空调系统的完全充注。
顾客满意度 (10分)	让顾客对您所提供的服务打分, 从1到10, 10分为最满意
备注	数据收集过程中的任何事项
操作人员	操作人员姓名

汽车维修制冷剂回收数据采集表

序号	回收日期	车型	车龄	品牌	车牌号
进店维修空调的原因	上一次制冷剂回收时间	制冷剂初始充注量(克)	制冷剂型号	制冷剂回收时长(分钟)	
选项(A)			选项(C)		
A-空调制冷问题			A-R12 B-R134a		
B-整车常规保养			C-R134a D-R744		
C-其他原因			E-R290 F-HFO-1234yf		
回收过程中存在的问题	回收总量 (克)	回收制冷剂状况	回收制冷剂处理方式	新充注制冷剂类型	
		选项(E)	选项(G)	选项(I)	
		A-纯净 B-中污染 C-污染	A-交还正规制冷剂回收处理机构 B-再利用处理设备处理 C-存储 D-直接排放 E-其他途径	A-新制冷剂 B-再利用制冷剂	
如果同时补充了额外的制冷剂, 请填写补充制冷剂的重量 (克)	顾客满意度 (10分)	备注	操作人员		

注意: 在电脑数据录入时, 含有选项的题目请使用下拉选项选择。

2. 数据收集情况

- 两次共收集37组数据

Data Collection

A total of 37 data sets were collected over two rounds.

日期	车辆基本信息				维修师傅空调维修数据										操作人员				
	车辆品牌	车型	车龄	车牌号	进店维修空调原因	上一次制冷剂回收时间	制冷剂初始充注量(克)	制冷剂型号	制冷剂回收时长(分钟)	回收过程中存在的问题	回收总量(克)	回收制冷剂状况	回收制冷剂处理方式	新充注制冷剂类型	如果同时补充了额外的制冷剂, 请填写补充制冷剂的重量(克)	顾客满意度(10分)	备注	操作人员	审核人
2024-3-28	轿车	4	宝马	粤B-12345	空调制冷问题	2024-01-15	500	R134a	15分钟	液	430	污	交还正规机构处理	新制冷剂	0	9		张三	李四
2024-3-30	轿车	10	福特福克斯	赣A-67890	整车常规保养	2024-02-20	700	R134a	16分钟	液	520	污	交还正规机构处理	新制冷剂	0	10		王五	赵六
2024-4-3	轿车	6	梅赛德斯奔驰	沪C-11111	空调制冷问题	2024-03-10	630	R134a	10分钟	液	470	污	交还正规机构处理	新制冷剂	0	8		陈七	孙八
2024-6-5	轿车	11	宝马	粤B-22222	空调制冷问题	2024-05-01	680	R134a	10分钟	液	510	污	交还正规机构处理	新制冷剂	0	9		周九	吴十
2024-6-5	MPV	8	别克	苏E-33333	空调制冷问题	2024-04-15	1000	R134a	10分钟	液	800	污	交还正规机构处理	新制冷剂	0	8		徐十一	冯十二
2024-6-6	轿车	10	奥迪	苏E-44444	空调制冷问题	2024-05-20	570	R134a	10分钟	液	400	污	交还正规机构处理	新制冷剂	0	9		冯十三	陈十四
2024-8-17	轿车	5	梅赛德斯奔驰	沪C-55555	空调制冷问题	2024-07-01	390	R134a	10分钟	液	300	污	交还正规机构处理	新制冷剂	0	10		孙十五	周十六
2024-8-17	轿车	12	奥迪	苏E-66666	空调制冷问题	2024-06-10	580	R134a	10分钟	液	470	污	交还正规机构处理	新制冷剂	0	7		周十七	冯十八
2024-8-19	运动型多用途汽车	12	梅赛德斯奔驰	沪C-77777	空调制冷问题	2024-07-20	1200	R134a	10分钟	液	860	污	交还正规机构处理	新制冷剂	0	8		周十九	冯二十
2024-8-15	轿车	7	宝马	粤B-88888	空调制冷问题	2024-08-01	850	R134a	15分钟	液	600	污	交还正规机构处理	新制冷剂	0	20		周二十一	冯二十二
2024-8-16	轿车	4	丰田	粤B-99999	空调制冷问题	2024-07-15	480	R134a	15分钟	液	0	污	交还正规机构处理	新制冷剂	0	9		周二十三	冯二十四
2024-8-21	轿车	10	梅赛德斯奔驰	沪C-00000	空调制冷问题	2024-08-10	680	R134a	10分钟	液	500	污	交还正规机构处理	新制冷剂	0	9		周二十五	冯二十六
2024-8-22	轿车	5	宝马	粤B-11111	空调制冷问题	2024-08-05	600	R134a	10分钟	液	500	污	交还正规机构处理	新制冷剂	0	9		周二十七	冯二十八

采集数据

Example of collected data

意外天气事件对试点的挑战

不可预测的自然挑战——极端天气和洪水

- 广州在4月份经历了严重的暴雨，导致大范围的洪水，影响了该地区的正常活动，包括进入商店进行维修的车辆数量减少。
- 为了弥补洪水的影响，试点团队提出了以下措施：
 - (1) 延长数据收集期
 - (2) 多渠道数据收集
 - (3) 与历史数据的综合比较

幸运的是，示范店面与洪水前类似时期的比较显示，汽车进店次数没有明显偏差。鉴于春季暴雨经常不同程度地影响广州，决定不采取进一步的补偿措施，而是使用实际收集的数据来反映该试点项目的情况。

Unpredictable Natural Challenges - Extreme Weather and Flooding

- Guangzhou experienced severe rainfall in April, leading to widespread flooding, which impacted normal activities in the area, including a decrease in the number of vehicles visiting the shops for maintenance.
- To mitigate the effects of the flooding, the pilot team proposed the following measures:
 - (1) Extending the data collection period
 - (2) Collecting data through multiple channels
 - (3) Comprehensive comparison with historical data

Fortunately, a comparison of the demonstration store's data with a similar period before the flooding showed no significant deviation in the number of vehicles visiting the store. Given that heavy spring rains frequently affect Guangzhou to varying degrees, it was decided not to implement further compensatory measures and to use the actual collected data to reflect the situation of the pilot project.

培训

- 1. 培训活动：** 5名工作人员参加了培训，共10次，每次2小时。
- 2. 培训规范：** 中国汽车技术研究中心和华胜公司的技术人员共同为培训课程制定了《汽车维修企业制冷剂回收规范》。



培训现场
Training On-site



制冷剂回收机
Refrigerant Recovery Machine

Training

- 1. Training Activities:**
Five staff members participated in the training, with a total of 10 sessions, each lasting 2 hours.
- 2. Training Standards:**
Technical personnel from the China Automotive Technology and Research Center Co., Ltd. and Harson jointly developed the *Refrigerant Recovery Standards for Automotive Maintenance Enterprises* for the training program.

问题? Questions?



感谢您的关注! Thank you for your attention!



HARSON

空调制冷剂回收介绍

Air Conditioner Refrigerant Recycling

张小菊
天津区域总经理
华胜集团

Zhang Xiaoju
General Manager of Tianjin Region
Harson Group

2024年10月

华胜集团：供应链驱动的数字化中高端汽修整体解决方案服务商

Harson Group: a supply chain-driven digital middle and high-end auto repair overall solution service provide



华胜现是一家拥有汽修、汽配、软件数据服务三大业务板块的全国性汽修服务集团，为中国中高端汽车车主、汽修服务门店提供领先的数字化汽修整体解决方案，是国内第一家真正实现汽修汽配一体化、并持续性盈利的企业。



豪华车专修连锁
全国260+门店



中端新能源车专修连锁
全国30+门店



正品汽配服务商
6个中心仓 100+门店



主机厂、电池等授权业务
全国200+授权项目

服务210万+车主，门店最多、覆盖最广、客户最多

50+国际品牌战略合作

自主研发、一云三端

Harson have auto service, auto parts, supply chain, software data service, three business sectors of the national auto service group, provide leading, digital auto parts overall solution for China's high-end car owners, automobile service stores. It is the first domestic real auto parts integration, and sustainable profitable company.

数据统计截止2024年9月

Harson Group: a supply chain-driven digital middle and high-end auto repair overall solution service provider

Harson is a have auto service, auto parts, supply chain, software data service three business sectors of the national auto service group, provide leading, digital auto parts overall solution for China's high-end car owners, automobile service stores, it is the first domestic real auto parts integration, and sustainable profitable company.



Luxury car specialist chain
260 + stores nationwide



Mid-end new energy vehicle specialized chain
30 + stores nationwide



OEMS, battery and other authorized business
200 + stores nationwide



Authentic auto parts service providers
6 central warehouse with 40 + stores



One-cloud, three-end data and software services
200 + auto repair store verification

Serving more than 2 million car owners, with the most stores, the widest coverage, the most customers

50 + International brand strategic cooperation

Independent research and development, one cloud three end

Data statistics up to February 2024



- **华胜2018年成立空调专业科室至今，已服务70万+空调专业需求客户；**

- Harson Air Conditioning Specialized Department was established in 2018 and has served over 700,000 customers since then.

- **华胜连锁门店100%配备专业空调制冷剂加注回收工具，并完全按照国家标准和企**

- Harson repair chain stores are 100% equipped with professional Air Conditioning Refrigerant Filling&Recycling equipment and are fully implemented following national standards and corporate standards.

- **华胜年回收空调制冷剂12万kg，净化提纯再利用4万kg,最大限度保护了环境；**

- Harson recycles 120,000 kg of air-conditioning refrigerants annually, purifies and reuses 40,000 kg, protecting the environment to the greatest extent.

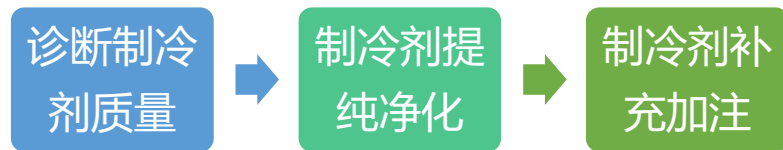
- **2020年起；华胜布局新能源车空调修理业务，并高标准执行新能源车空调制冷剂的回收、加注业务。**

- Since 2020, Harson has started to develop a new energy vehicle air-conditioning repair business and implement the recycling and filling business of new energy vehicle air-conditioning refrigerants with high standards.

制冷剂回收过程

Refrigerant Recycling Process

汽车空调系统中，制冷剂是确保制冷效果的关键元素。随着车辆使用年限的增加，制冷剂品质下降成为影响制冷效果的主要因素。华胜制冷剂更换主流程：



参考标准：

《汽车空调制冷剂回收、净化、加注设备》 JT/T 783-2010

《汽车空调制冷剂回收、净化、加注工艺规范》 JT/T 774-2010

Reference Standards:

《Vehicles' Air Conditioning Refrigerant Recovery, Purification, and Refilling Equipment》 JT/T 783-2010

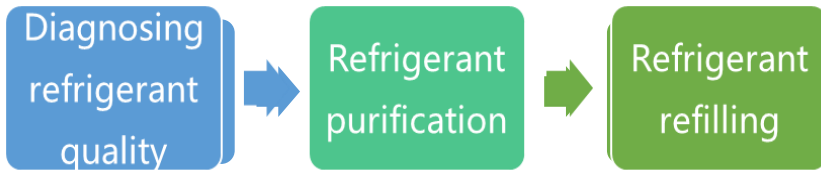
《Standard Procedure for Vehicle Air conditioning Refrigerant Recycling, Purification, and Refilling》 JT/T 774-2010

制冷剂回收过程

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Reference Standards:

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《Standard Procedure for Vehicle Air conditioning Refrigerant Recycling, Purification, and Refilling》 JT/T 774-2010

The refrigerant is a key element in ensuring cooling performance in a car's air conditioning system. As the vehicle's years of use increase, the decline in refrigerant quality becomes a major factor affecting cooling efficiency.

制冷剂纯度检测和回收工作的专业工具与设备

Professional Tools and Equipment for Refrigerant Purity Testing and Recycling



空调管路免
拆清洗机

Air conditioning pipeline non-
disassembly cleaning machine



冷媒鉴别仪

Refrigerant Identifier



冷冻油检测棒

Refrigeration Oil Test Stick



冷媒检漏仪

Refrigerant Leak Detector

专业的设备，为我们提供了强大的技术支持，确保每一位车主都能得到最优质的服务。

Professional equipment provides us with strong technical support, ensuring that every car owner receives the highest quality service.

标准化流程与专业培训：为车主打造无忧服务体验

Standardized procedures and professional training: Creating a worry-free service experience for car owners.



“科学诊断、循环清洗、精准添加、恢复工况”的标准流程，无论是在制冷剂回收还是充注过程中，维修人员都确保操作的科学与合理性，为车主提供更加放心、满意的服务！

车辆熄火，关闭空调



将设备连接车辆
高低压管，打开
电源开关



按压操作面板上的
自动按键



选择自动清洗加注
菜单 (3)



选择自动清洗15分
钟（可根据冷冻油
的检测情况进行选
择）



根据车辆要求写入
冷媒和冷冻油的加
注量



按下Enter确认开
关



全部流程自动完
成后，设备复位



1. 检测出风口温度，与净化前效果作对比。
2. 排出的冷冻油与加入冷冻油做效果对比

标准化流程与专业培训：为车主打造无忧服务体验

Standardized procedures and professional training: Creating a worry-free service experience for car owners.

The standard process of "scientific diagnosis, circulation cleaning, precise filling, and restoration of operating conditions" ensures that, whether in refrigerant recovery or refilling, technicians maintain scientific and reasonable operations, providing car owners with more reliable and satisfactory service!

Turn off the vehicle and the air conditioning.



Connect the equipment to the vehicle's high and low-pressure lines, then turn on the power switch.



Press the "Auto" button on the control panel.



Select the "Automatic Cleaning and Refilling" Menu (3).



Select "Automatic Cleaning for 15 Minutes" (this can be adjusted based on the condition of the refrigerant oil).



Input the required amount of refrigerant and refrigerant oil based on the vehicle specifications.



Press the Enter key to confirm.



After the entire process is completed automatically, reset the equipment.



1. Compare Air Outlet Temperature Before and After Purification
2. Compare Discharged Refrigeration Oil with Newly Added Refrigeration Oil

华胜助力《中国汽车空调维保标准》制定，积极参与国际示范项目

Huasheng contributes to the development of the "China Automotive Air Conditioning Maintenance Standard" and actively participates in international demonstration projects.

中国汽车技术研究中心(简称“中汽研”)启动了《中国汽车空调维保标准》的制定工作。在此过程中，华胜积极参与，以标准化、规范化的服务流水线，为制冷剂回收及循环利用技术规范提供支持。



China Automotive Technology and Research Center (CATARC) has initiated the development of the "China Automotive Air Conditioning Maintenance Standard." During this process, Harson has actively participated, supporting the formulation of standards and regulations for refrigerant recovery and recycling technology through its standardized and regulated service workflows.

汽车空调制冷剂规范回收不仅是提升服务质量的关键，更是我们作为汽车维修企业应尽的责任和义务。未来，华胜将继续致力于推动汽车维修行业的绿色发展，为共创美好未来贡献力量！

The standardized recycling of automotive air conditioning refrigerants is not only a key to improving service quality but also the responsibility and obligation of an automotive repair company. In the future, Harson will continue to drive the green development of the automotive repair industry, contributing to a better future for all!



数字化汽修整体解决方案服务商
Digital autorepair integrated solution servicer

让客户车辆维修服务选择不再难
让天下没有难开的修理厂
在汽车维修服务行业塑造新的商业文明

THANKS!

"Making it Easier for Customers to Choose Vehicle Repair Services"

"Making Repair Shops Easy to Operate for All"

"Shaping a New Business Culture in the Automotive Repair Service Industry"



Questions

?



Thank you for your attention!



中国汽车维修行业制冷剂回收示范项目 - 方法和结果

Manuel Prieto Garcia - HEAT 环境顾问

Demonstration Project on Refrigerant Recycling in China's
Automotive Maintenance Industry – Methodology and Results

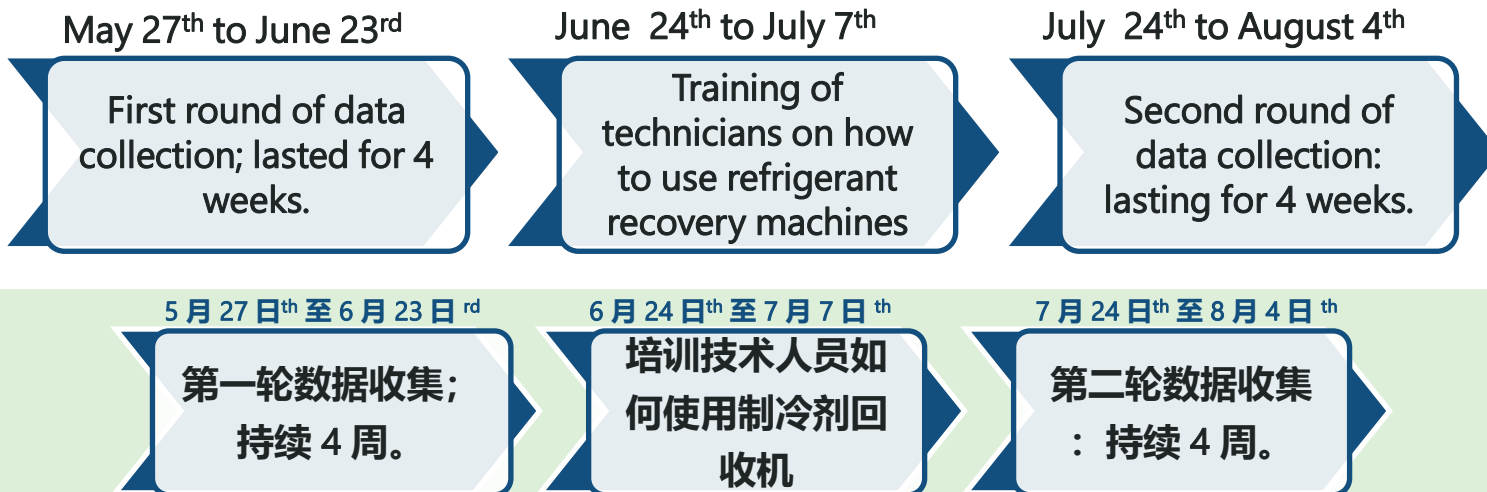
Manuel Prieto Garcia – Environmental Consultant HEAT

TIMELINE – DATA COLLECTION CAMPAIGNS

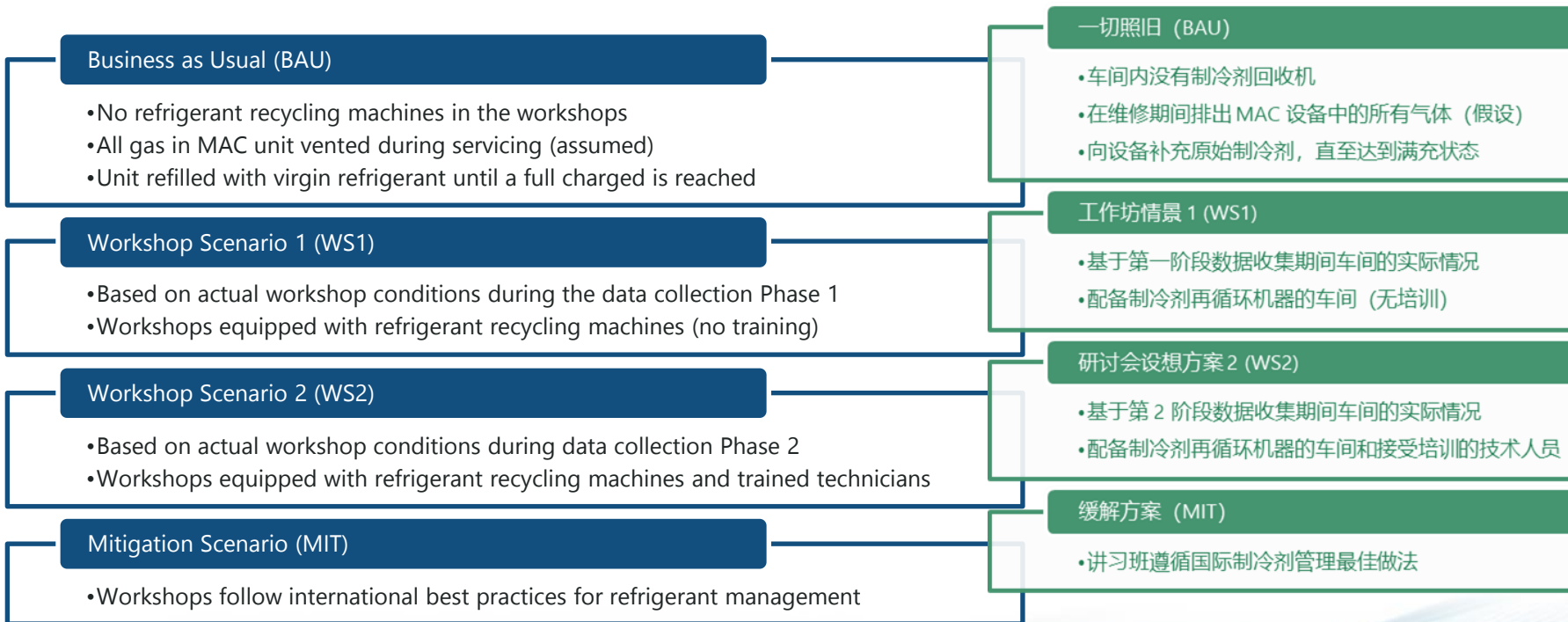
1. Selection of demonstration enterprise and pilot workshop in March 2024.
2. Develop, test and finalize Template for data collection during March-May 2024.

时间表--数据收集活动

1. 2024 年 3 月遴选示范企业并举办试点研讨会。
2. 2024 年 3 月至 5 月期间，开发、测试并最终确定数据收集模板。



EMISSION SCENARIOS / 排放情景



TEMPORAL AND SPATIAL BOUNDARIES OF THE BASELINE AND EMISSIONS

Workshop

Scenarios:

- BAU, WS1 & WS2

Spatial Boundary:

- Workshop (where the data collection took place)

Temporal Boundary:

- 4-weeks & 1 year

Guangzhou

Scenarios:

- BAU, WS 1 & 2* MIT

Spatial Boundary:

- All Servicing workshops and road (usage)

Temporal Boundary:

- 1 year

基准和排放的时间和空间界限

工作坊

情景:

- BAU, WS1 & WS2

空间边界:

- 研讨会 (数据收集地点)

时间界限:

- 4周和1年

广州

情景:

- BAU, WS 1 & 2* MIT

空间边界:

- 所有维修车间和道路 (使用)

时间界限:

- 1年

VARIABLES CALCULATED FOR THE BASELINE AND EMISSIONS OF THE WORKSHOP

为基线和研讨会排放计算的变量

N°	Variables	Name	Units	Special Boundaries	Temporal Boundaries	Sources
1	R_{rcyl}	Refrigerant recycled	kg	Workshop	4 weeks	Data collection campaigns
2	R_{vent}	Refrigerant vented	kg	Workshop	4 weeks	Data collection campaigns
3	VR	Virgin refrigerant needed for servicing	kg	Workshop	4 weeks	Data collection campaigns
4	Em	Refrigerant emissions	CO ₂ eq	Workshop	4 weeks	Data collection campaigns
5	BL _{BAU}	Baseline emissions	CO ₂ eq	Workshop	4 weeks	Estimation based on data
6	AvEm	Total avoided emissions	CO ₂ eq	Workshop	4 weeks	Estimation based on data
7	PR _{rcov}	Potential refrigerant for recovery	Kg	Workshop	4 weeks	Theoretical variable for MIT scenario
N°	变量	名称	单位	特殊边界	时间界限	资料来源

为基线和研讨会排放计算的变量

VARIABLES CALCULATED FOR THE BASELINE AND EMISSIONS OF THE WORKSHOP

N°	变量	名称	单位	特殊边界	时间界限	资料来源
1	R _{rcyl}	回收的制冷剂	公斤	工作坊	4 周	数据收集活动
2	R _{vent}	制冷剂排放	公斤	工作坊	4 周	数据收集活动
3	虚拟现实	维修所需的原始制冷剂	公斤	工作坊	4 周	数据收集活动
4	Em	制冷剂排放	CO eq ₂	工作坊	4 周	数据收集活动
5	BL _{BAU}	基准排放量	CO eq ₂	工作坊	4 周	基于数据的估算
6	AvEm	避免的排放总量	CO eq ₂	工作坊	4 周	基于数据的估算
7	公关 _{rcov}	可能回收的制冷剂	公斤	工作坊	4 周	麻省理工学院方案的理论变量
N°	Variables	Name	Units	Special Boundaries	Temporal Boundaries	Sources

RESULTS FOR THE WORKSHOP

研讨会的成果

Variable	BAU Scenario (Baseline)	Workshop Scenario 1	Workshop Scenario 2
Number of days	88	28	28
Number of weeks	12,57	4,00	4,00
Number cars surveyed	59	13	24
Cars surveyed per day	0,67	0,46	0,86
Standardized results			
Refrigerant recycled (R_{rcyl})	0 kg	9,3 kg	8,5 kg
Virgin refrigerant (VR)	13,1 kg	3,8 kg	4,6 kg
Refrigerant emissions (Em) or Potential refrigerant for recovery (PR_{rcov})*	9,5 kg	0,5 kg	0,7 kg
Refrigerant emissions (Em)	14.481 kgCO ₂ eq (BL)	776,3 kgCO ₂ eq	1051,2 kgCO ₂ eq
Total avoided emissions (AvEm)	-	13.705 kgCO ₂ eq	13.430 kgCO ₂ eq
可变	BAU 情景 (基线)	讲习班情景 1	讲习班情景 2

研讨会的成果

RESULTS FOR THE WORKSHOP

可变	BAU 情景 (基线)	讲习班情景 1	讲习班情景 2
天数	88	28	28
周数	12,57	4,00	4,00
接受调查的汽车数量	59	13	24
每天调查的汽车	0,67	0,46	0,86
标准化结果			
回收的制冷剂 (R) _{rcyl}	0 千克	9.3 千克	8.5 千克
初榨制冷剂 (VR)	13.1 千克	3.8 千克	4.6 千克
制冷剂排放量 (Em) 或潜在制冷剂回收量 (PR _{rcov}) [*]	9.5 千克	0.5 千克	0.7 千克
制冷剂排放量 (Em)	14.481 千克二氧化碳 ₂ 当量 (BL)	776.3 千克二氧化碳 当量 ₂	1051.2 千克二氧化碳 当量 ₂
避免的排放总量 (AvEm)	-	13.705 千克二氧化碳 当量 ₂	13.430 千克二氧化碳 当量 ₂
Variable	BAU Scenario (Baseline)	Workshop Scenario 1	Workshop Scenario 2

RESULTS FOR THE CITY OF GUANGZHOU

广州市的搜索结果

Variable	BAU Scenario (Baseline)	Workshop Scenarios 1 & 2 (average)	Mitigation Scenario (MIT)
Refrigerant recycled (R_{rcyl})	0 kg	236.268 kg	252.255 kg*
Refrigerant emission in the workshops Em_w	252.255 kg	15.988 kg	0 kg
Refrigerant emission on the road Em_{road}	92.360 kg	92.360 kg	92.360 kg
Refrigerant emissions (Em_{mac}) or Virgin refrigerant (VR)**	344.615 kg (BL)	108.348 kg	92.360 kg
Refrigerant emissions (Em_{mac})	527.261 tCO ₂ eq (BL)	165.772 tCO ₂ eq	141.311 tCO ₂ eq
Total avoided emissions ($AvEm_{mac}$)	-	361.489 tCO ₂ eq	385.950 tCO ₂ eq
可变	BAU 情景 (基线)	研讨会方案 1 和 2 (平均值)	缓解方案 (MIT)

广州市的搜索结果

RESULTS FOR THE CITY OF GUANGZHOU

可变	BAU 情景 (基线)	研讨会方案 1 和 2 (平均值)	缓解方案 (MIT)
回收的制冷剂 (R) _{rcyl}	0 千克	236.268 千克	252.255 千克*
车间的制冷剂排放 Em_w	252.255 千克	15.988 千克	0 千克
道路上的制冷剂排放 Em_{road}	92.360 千克	92.360 千克	92.360 千克
制冷剂排放量 (Em_{mac}) 或原生制冷剂 (VR) **	344.615 千克 (BL)	108.348 千克	92.360 千克
制冷剂排放量 (Em) _{mac}	527.261 tCO ₂ eq (BL)	165.772 tCO eq ₂	141.311 tCO eq ₂
避免的排放总量 ($AvEm$) _{mac}	-	361.489 tCO eq ₂	385.950 tCO eq ₂
Variable	BAU Scenario (Baseline)	Workshop Scenarios 1 & 2 (average)	Mitigation Scenario (MIT)

CONCLUSIONS FORM THE RESULTS

- The emissions are slightly lower in WS1 than in the WS2 when the technicians had received proper training.
- A possible explanation for the venting of refrigerant is that the refrigerant was too polluted to be recycled.
- The most critical point for reducing refrigerant emissions of passenger cars in China is by addressing the refrigerant servicing practices in the workshops.
- If all workshops in the metropolitan area of Guangzhou reach the high rates of refrigerant recycling seen during the data collection campaigns, the reduction will be very (**significant around 94% reduction of emissions**).

结果结论

- 在技术人员接受过适当培训的情况下，WS1 的排放量略低于 WS2。
- 对制冷剂排放的一个可能解释是，在这三个案例中，制冷剂污染太严重，无法回收利用。
- 要减少中国乘用车的制冷剂排放，最关键的一点是解决维修车间的制冷剂维修问题。
- 如果广州大都市区的所有车间都能达到数据收集活动中看到的高制冷剂回收率，减排量将非常可观，约为 94%。

Questions?

有问题吗?



Thank you for your attention!

感谢您的关注!

中国汽车维修行业制冷剂回收示范项目——结论与经验教训

王佳 高级研究员

中国汽车技术研究中心有限公司

Demonstration Report on Refrigerant Recycling in China's Automotive Maintenance Industry - Part 2: Conclusions, lessons learned

Wang Jia, Senior Researcher

China Automotive Technology And Research Center Co., Ltd.

经验教训

挑战1：维修人员缺乏专业技术培训

示范前	示范后
一些技术人员不熟悉制冷剂回收的技术和操作过程，导致回收过程中出现了许多问题和安全隐患	操作失误减少，效率提高

——人员技术能力：标准化操作的坚实基础

挑战2：不合规的维护实践

示范前	示范后
存在操作不规范、流程混乱等问题	在回收过程中严格遵守操作说明，确保回收工作的有序进行、效率和质量

——标准化流程：制冷剂回收效率的关键

Experiences and lessons learned (1+2)

Before vs after training measures (demonstration)

Challenge 1: Lack of professional technical training for maintenance personnel

- Technical Skills of Personnel: A Solid Foundation for Standardized Operations

Challenge 2: Non-compliant maintenance practices

- Standardized Procedures: The Key to Efficient Refrigerant Recovery

经验教训

挑战1：维修人员缺乏专业技术培训

示范前	示范后
Before Demonstration	After Demonstration
Some technicians were unfamiliar with the technology and operation process of refrigerant recovery, leading to numerous issues and safety hazards during the recovery process.	Operational errors decreased, and efficiency improved.

挑战2：不合规的维护实践

示范前	示范后
Before Demonstration	After Demonstration
Non-standard operations and disorganized procedures.	During the recovery process, strict adherence to the operating instructions was maintained to ensure orderly operations, efficiency, and quality.

Experiences and lessons learned (1+2)

Before vs after training measures (demonstration)

Challenge 1: Lack of professional technical training for maintenance personnel

- Technical Skills of Personnel: A Solid Foundation for Standardized Operations

Challenge 2: Non-compliant maintenance practices

- Standardized Procedures: The Key to Efficient Refrigerant Recovery

经验教训

挑战3：回收设备回收利用不足

示范前	示范后
Before Demonstration	After Demonstration
Without recovery equipment, refrigerants are generally not recovered.	Refrigerants are directly reused and recharged into the original vehicle through the equipment.

挑战4：企业管理水平低

示范前	示范后
Before Demonstration	After Demonstration
Insufficient staff training, poor equipment maintenance, and non-standard operating procedures.	Refrigerant recovery operations have become more standardized and efficient, not only improving recovery efficiency and quality but also reducing costs and increasing customer satisfaction.

Experiences and lessons learned (3+4)

Before vs after training measures (demonstration)

Challenge 3: Insufficient utilization of recovery equipment for recycling

- Advanced Equipment: Ensuring Efficiency and Safety in Refrigerant Recovery

Challenge 4: Low level of enterprise management

- Company Management System: Providing Stable Support for Refrigerant Recovery Operations Recovery

下一步计划

1. 加强专业培训和技能提升

培训内容应涵盖制冷剂的特性、回收技术、操作程序和环境法规，以确保维护人员能够熟练掌握制冷剂回收的相关知识和技能。

2. 促进标准化操作程序

在汽车维修行业制定和推广制冷剂回收的标准化操作程序。这些流程应详细说明从制冷剂回收、储存、净化到加油的每个步骤

3. 提高回收设备的配置和利用率

一是建议政府出台相关政策，要求汽车维修企业配备符合标准的制冷剂回收设备；二是政府可以提供一定的财政补贴或税收优惠，以减轻企业购买和使用回收设备的成本负担。

Next Steps:

1. Strengthen professional training and skill enhancement

The training content should cover the properties of refrigerants, recovery technology, operating procedures, and environmental regulations to ensure that maintenance personnel acquire the necessary knowledge and skills for proficient refrigerant recovery.

2. Promote standardized operating procedures

Standardized operating procedures for refrigerant recovery should be developed and promoted in the automotive maintenance industry. These procedures should detail each step, from refrigerant recovery, storage, and purification to refilling.

3. Improve the allocation and utilization rate of recycling equipment

Firstly, it is recommended that the government introduce relevant policies requiring automotive maintenance enterprises to be equipped with standard-compliant refrigerant recovery equipment. Secondly, the government could provide financial subsidies or tax incentives to reduce the cost burden on enterprises for purchasing and using recovery equipment.

下一步计划

4.完善企业管理和监管体系

企业应建立健全内部管理制度，包括制定详细的制冷剂回收操作规程，加强员工责任分工和 workflow 管理，提高服务质量。

5.车间技术人员的培训和认证

中国汽车技术研究中心和华胜集团将进一步开发与汽车空调制冷剂回收相关的专业课程和认证证书，同时也适用于报废汽车回收行业。

6.新试点项目

建议未来启动第二个试点项目，选择东南亚国家企业开展示范，并与广州试点进行比较。

Next Steps:

4.Improve enterprise management and regulatory system

Enterprises should establish comprehensive internal management systems, including developing detailed operating procedures for refrigerant recovery, strengthening employee responsibility and workflow management, and improving service quality.

5.Training and certification for workshop technicians

CATARC and Harson Group will further develop specialized training courses and certification programs related to automotive air conditioning refrigerant recovery, which will also be applicable to the end-of-life vehicle recycling industry.

6.New pilot projects

It is recommended to initiate a second pilot project in the future, selecting enterprises in Southeast Asian countries for demonstration and comparing the outcomes with those of the Guangzhou pilot.

下一步-标准规范制定

Next step - Standard specification development

1.标准制定的依据和主要内容

1.Basis and main content for standard formulation.

章节	内容
制冷剂回收和处理设备	制冷剂回收所需设备的类型、性能要求、维护和校准的详细说明。
人员要求	明确参与制冷剂回收工作的人员所需的专业培训、知识和技能。
制冷剂回收操作流程和规范	详细描述制冷剂回收操作过程，包括操作前准备、检测和识别、回收、储存和记录、净化等环节。
安全注意事项和应急措施	列出操作过程中应遵循的安全注意事项以及可能的应急响应措施。
监管	已就建立管理制度、操作程序、设备检查和维护、员工培训等方面提出监管要求。

下一步-标准规范制定

Next step - Standard specification development

1.标准制定的依据和主要内容

1.Basis and main content for standard formulation.

章节	内容
Section	Content
Refrigerant Recovery and Processing Equipment	Detailed explanation of the types, performance requirements, maintenance, and calibration of the equipment needed for refrigerant recovery.
Personnel Requirements	Specifies the professional training, knowledge, and skills required for personnel involved in refrigerant recovery work.
Refrigerant Recovery Operation Procedures and Standards	Detailed description of the refrigerant recovery process, including preparation, detection and identification, recovery, storage and recording, and purification stages.
Safety Precautions and Emergency Measures	Lists safety precautions to be followed during operations and possible emergency response measures.
Supervision	Regulatory requirements have been proposed regarding the establishment of management systems, operating procedures, equipment inspection and maintenance, and employee training.

下一步-标准规范制定

2.新标准规范的预期优势和标准化转化过程

- 新的标准规范具有显著的科学质量，基于制冷剂的物理和化学性质等制定详细全面的操作程序，提高回收操作专业性，奠定可持续发展基础。
- 新标准显示出进步性，引入高精度识别装置和高效回收机，提高回收准确性和效率，强调设备维护和校准，确保稳定性和准确性。
- 通过加强培训和教育、建立有效的监督机制、建立激励和惩罚机制推动标准化转化。

Next step - Standard specification development

2.The expected advantages of this new standard specification.

- The new standards and regulations demonstrate significant scientific quality, establishing detailed and comprehensive operating procedures based on the physical and chemical properties of refrigerants. These measures enhance the professionalism of recovery operations and lay a foundation for sustainable development.
- The new standards show progress by introducing high-precision identification devices and efficient recovery machines, improving recovery accuracy and efficiency. They emphasize equipment maintenance and calibration to ensure stability and precision.
- By strengthening training and education, establishing effective supervision mechanisms, and implementing incentive and penalty systems, the transition to standardization is further promoted.

总结

中国在制冷剂回收和再利用方面面临着重大挑战。

汽车维修行业是制冷剂使用和回收的关键领域，但该行业的回收条件目前并不理想。本次示范有效证明：开发、实施和验证标准化的制冷剂回收工艺对于改善环境和提高资源利用效率至关重要。

Summary

China faces significant challenges in refrigerant recovery and reuse. The automotive maintenance industry is a critical sector for refrigerant usage and recovery, yet current recovery conditions are not ideal. This demonstration effectively proves that developing, implementing, and validating standardized refrigerant recovery processes is essential for improving the environment and enhancing resource utilization efficiency.

Questions?



Thank you for your attention!

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ANY QUESTIONS?

有问题吗?

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**下一届 COPA 会议：
基线方法和情景计算**

欧洲中部时间 11 月 7 日 10: 00, Manuel Prieto Garcia – HEAT 环境顾问

**Next COPA Session:
Baseline methodology and Scenario Calculations**

November 7th, 10:00 CET, Manuel Prieto Garcia – Environmental Consultant HEAT

COPA MATERIALS ONLINE: WWW.COPALLIANCE.ORG

- Today's session is recorded and will be uploaded on the COPA's website, together with the report publication as a pdf-file.
- Already there are other cool and informative materials available on the COPA website.
- [Webinar Sessions](#) (video recording)
- **Guidelines** – e.g. on ODS/HFC banks Inventory
- **Virtual Study Tour on Reclamation & Destruction Technology** (live-session-series)
- **COPA studies and Reports**



COPA 在线资料: www.copalliance.org

- ✓ 今天的会议将被记录下来，并将与 pdf 文件形式的报告一起上传到 COPA 网站。
- ✓ COPA 网站上已经提供了其他很酷且信息丰富的材料。
- ✓ 网络研讨会（视频录制）
- ✓ 准则 – 例如，ODS/HFC 库存
- ✓ 关于回收和破坏技术的虚拟学习之旅（现场会议系列）
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感谢您的参与

THANK YOU FOR YOUR PARTICIPATION