PILOT CONTROL TECHNOLOGY ASSESSMENT OF CHEMICAL REPROCESSING AND RECLAIMING FACILITIES

WALK-THROUGH SURVEY REPORT

OF

SOLVENT RESOURCE RECOVERY, INC.
WEST CARROLLTON, OHIO

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Report Written By:
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National Institute for Occupational Safety and Health
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16. Abstract (Limit: 200 words)

Solvent Resource Recovery, Inc., produces clean solvents from both chlorinated and non-chlorinated waste solvents collected from suppliers within a 300 mile radius. The chlorinated products include methylene chloride, 1,1,1-trichloroethane, trichloro ethane, and tetrachloroethene. The non-chlorinated products are blends from acetone to the higher boiling naphthas which vary depending on the supplier. Waste solvents are received from such industries as electronics, automotive, food, pharmaceutical, and pringing. As much as 85 percent of the clean product is returned to the suppliers. The remaining 15 percent is sold to other customers, used for blending or no-site use in processing steam boilers.

The solvent recovery operations at SRR are modern and apparently well controlled. This is a clean and efficiently run plant. This company exhibited a conscientious attitude toward safety and a growing concern for worker health. Conspicously lacking, however, were industrial hygiene monitoring data to confirm the effectiveness of control technologies being used.

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PURPOSE OF SURVEY:	To conduct an investigative survey of the solvent recycling operations.
EMPLOYER REPRESENTATIVES CONTACTED:	Robert L. Kohnen, P. E.; Vice President
EMPLOYEE REPRESENTATIVES CONTACTED:	None
STANDARD INDUSTRIAL CLASSIFICATION:	4953 - Refuse Systems
ANALYTICAL WORK PERFORMED BY:	Non-Applicable

INTRODUCTION

There are between 35 and 60 million tons of hazardous wastes generated annually, of which about 15 million are generated by the industries in the Chemical and Allied Products Sector (SIC 28). Many of these wastes contain toxic substances which may also be carcinogenic, mutagenic, and teratogenic. Some of the companies in SIC 28 treat, store, and dispose of the wastes that they generate. However, others may transport their wastes to companies who specialize in the treatment, storage, and disposal of these wastes. This group of companies are classified as "Refuse Systems" with an SIC of 4953. It is estimated that about 18,000 workers are directly involved in the transportation, treatment, storage, and disposal of hazardous wastes from SIC 28, and a total of 80,000 may be directly involved in such operations for all wastes classified as hazardous.

The Resource Conservation and Recovery Act (PL 94-580) of 1976 (RCRA) was enacted in order to provide technical and financial assistance for the development of management plans and facilities for the recovery of energy and other resources from discarded materials, for the safe disposal of discarded materials, and to regulate the management of hazardous waste. Under Subtitle C of RCRA, the Environmental Protection Agency was required to promulgate regulations on identification and listing of hazardous wastes and regulations effecting the generators, transporters, and owners/operators of facilities for the treatment, storage, and disposal of hazardous wastes. These regulations appeared in the Federal Register on May 8, 1980. Regulations affecting the listing of hazardous wastes were amended later. The amendments appeared in the Federal Register November 12, 1980.

Reuse or reclamation of materials which had been previously discarded is now encouraged by rising raw material and processing costs, energy considerations and RCRA legislation restricting disposal of wastes. Many of these materials are hazardous in themselves or may be contaminated with toxic substances. The objective of this pilot study is to determine the needs of industries engaged

in reprocessing pertaining to control technology. The information generated may form the basis of future detailed studies.

This investigative survey was conducted as part of a NIOSH Pilot Control Technology Assessment (CTA) of Chemical Reprocessing and Reclaiming Facilities.

AUTHORITY

Two of the main policy objectives of the 1970 Occupational Safety and Health Act (PL 91-596) are to:

- Encourage employers and employees in their efforts to reduce the number of occupational safety and health hazards at their places of employment, and to stimulate employers and employees to institute new and to perfect existing programs for providing safe and healthful working conditions.

- Provide for research in the field of occupational safety and health with a view to developing innovative methods, techniques, and approaches for dealing with occupational safety and health.

Under Section 20 of the Act, The Secretary of Health and Human Services is authorized to conduct special research, experiments, and demonstrations relating to occupational safety and health as are necessary to explore new problems including those created by new technology.

Paragraph (d) requires the dissemination of the information obtained to employers and employees.

The National Institute for Occupational Safety and Health was established to perform the functions of the Secretary of Health and Human Services described in Sections 2 and 20 of the Act. The manner in which investigations of places of employment are conducted by NIOSH and its representatives is outlined in the Code of Federal Regulations (Title 42, Part 85a).

PLANT DESCRIPTION

Solvent Resource Recovery (SRR) is situated on 1.5 acres of an 11 acre plot on the west side of Infirmary Road in a rural area near West Carrollton, Ohio. The layout of this plant is represented in Figure 1. SRR produces clean solvents from both chlorinated and non-chlorinated waste solvents collected from suppliers within a 300 mile radius. The chlorinated products include methylene chloride, 1,1,1-trichloroethane, trichloroethene, and tetrachloroethene. The non-chlorinated products are blends from acetone to the higher boiling naphthas which vary depending on the supplier. Waste solvents are received from such industries as electronics, automotive, food, pharmaceutical, and printing. As much as 85 percent of the clean product is returned to the suppliers. The remaining 15 percent is sold to other customers, used for blending or on-site use in process steam boilers.

Constructed in 1979, this plant uses distillation to process up to 12,000 gallons per day of used solvents. Initial separations equipment were a pot still and a thin-film evaporator. In 1981, an additional thin-film evaporator was installed. A fractionating column has been purchased and is anticipated to be in operation by March 1982.[1] Storage capacity for this facility is 100,000 gallons for incoming waste and 80,000 gallons for product. Diked areas are provided for this storage.

Waste solvent is received into bulk storage at the plant by tanker truck. Barreled waste is seldom received at the plant, and when so, is first vacuum-pumped into an SRR tanker before being introduced into bulk storage. SRR owns a 7,000 gallon stainless steel compartmentalized tanker. The three compartments hold 2,500, 2,000, and 2,500 gallons and are used for segregation of non-compatible solvents. This tanker is equipped with a vacuum pump for loading and is filled from drums 80 percent of the time at the purchase site. All product solvent is shipped from the plant by tanker.

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[1] This unit is now on-line, reportedly doubling the firms recycling capacity, Chemical Engineering, V 89, N7, p. 30 (Apr. 5, 1982).

SRR employed 18 workers at the time of this survey. First shift production required nine workers and second shift three. The remaining six employees were divided among administration (2), sales (3), and the laboratory (1).

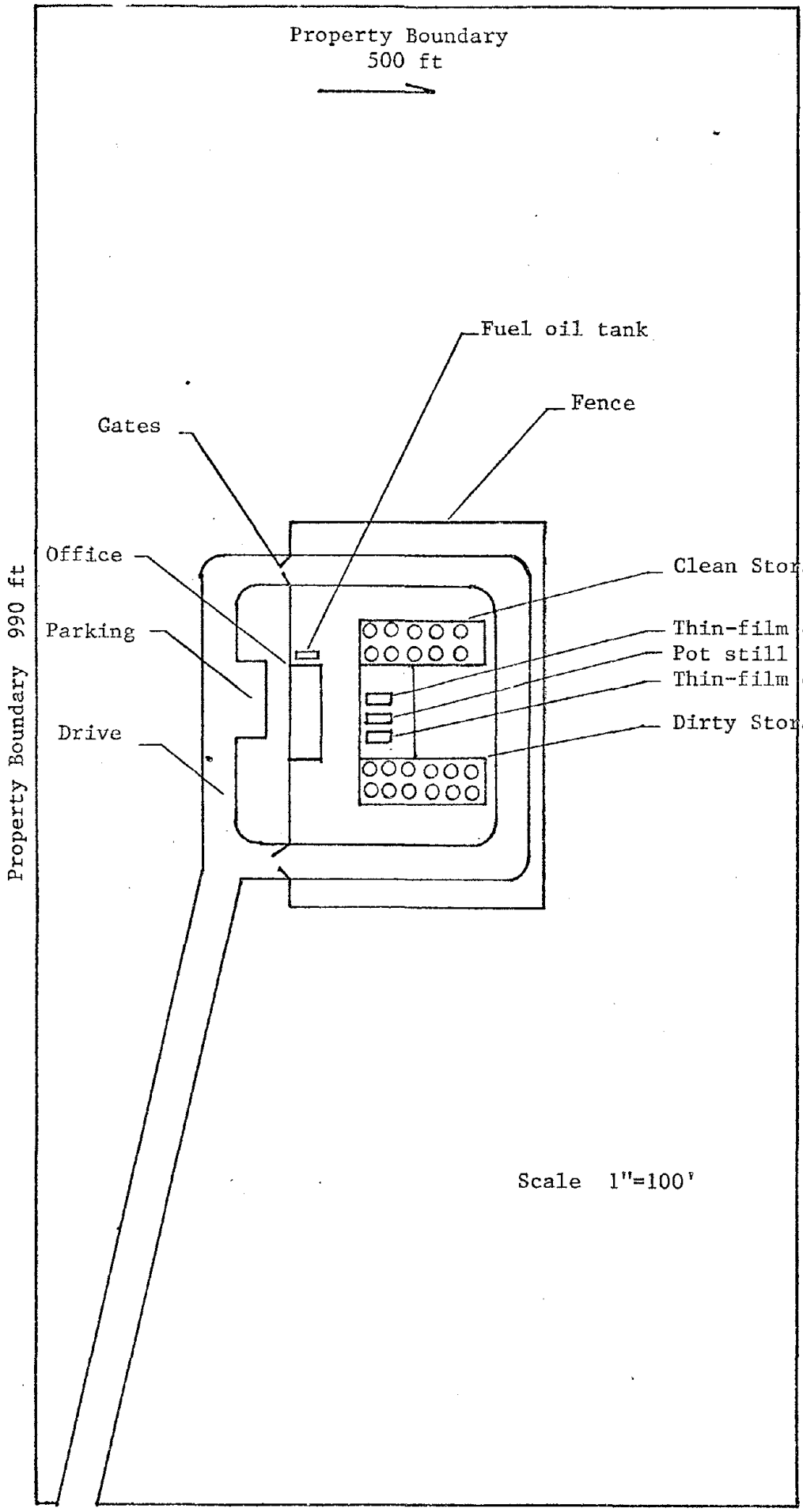

Figure I. Facility drawing

PROCESS DESCRIPTION

POT STILL (Figure 2)

The waste solvent from a run tank is charged to the pot still which is operated at approximately 25-inches of mercury vacuum. Heat is provided by steam plates in the bottom of the still. The distillation proceeds with the clean vapor exiting overhead to a heat exchanger. The condensate (clean solvent) goes to a reservoir from which it is pumped to storage. After the distillation is complete, a viscous sludge is pumped from the bottom of the still to a storage tank.

THIN-FILM EVAPORATION (Figure 3)

Waste solvent from a run tank is charged to a steam-jacketed, Luwa thin-film evaporator, operating at up to 28 inches of mercury vacuum. The internal rotor blades spread the liquid over the entire heated wall. As the liquids spiral down the wall, the volatile components are rapidly evaporated. These vapors pass through the vapor outlet then through a cyclone and a demister, which remove entrained aerosol by centrifugal action and impingement. The clean vapor now passes through a heat exchanger. The condensed clean solvent goes to a reservoir from which it is pumped to storage. The non-volatile components of the liquid waste solvent are discharged from the bottom of the evaporator. These are recycled to the run tank until the evaporator bottoms reach the proper viscosity. At this time, the sludge is pumped to a storage tank.

The above description is of the older of the two thin-films in operation at SRR. The newer one, also a Luwa, operates similarly except that there is no cyclone in the system. Instead, an internal axial separator is used before the demister.

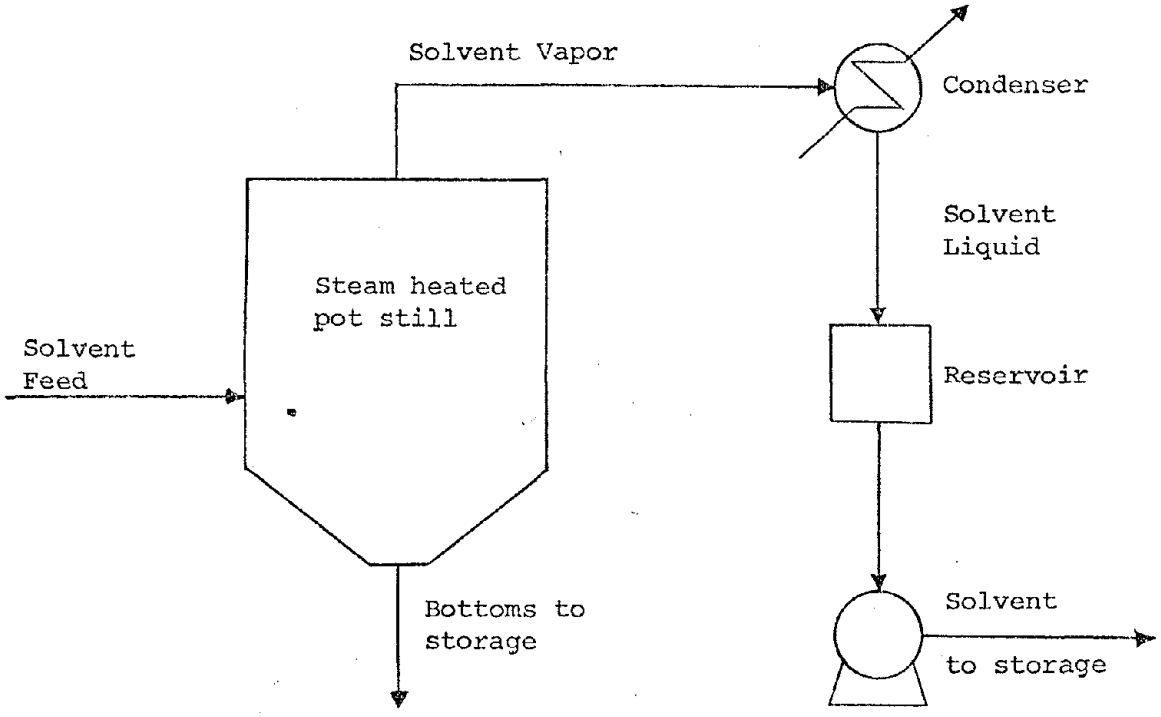

Figure 2. Pot still process.

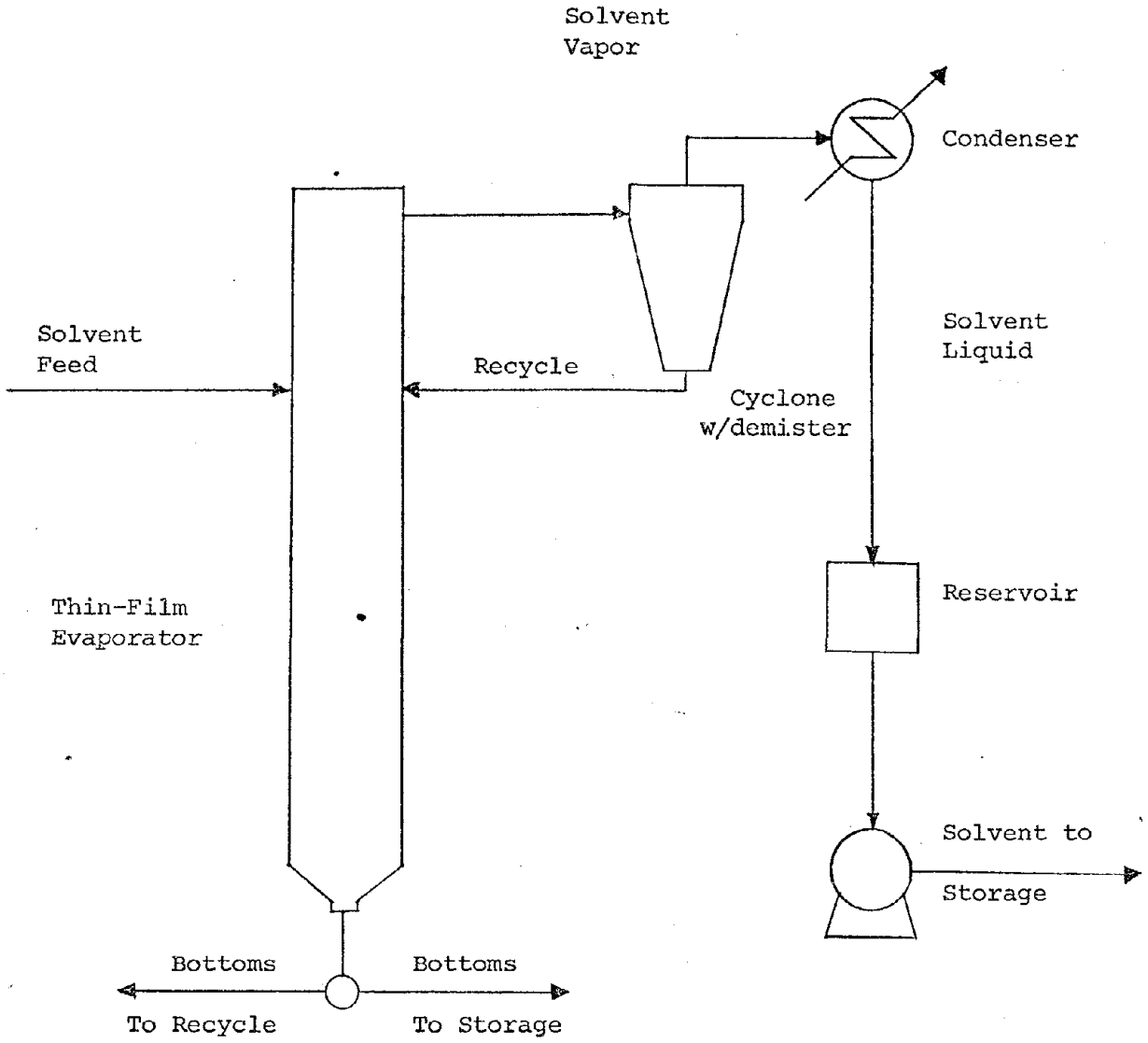

Figure 3. Thin-film evaporation process.

DISPOSAL OF PROCESS WASTE

Process residues, or still bottoms, are sold as a supplemental fuel. These are co-fired with coal in a cement kiln run by General Portland, Inc. located in Paulding, Ohio. The contents of the sludge must be less than 3 percent chlorine and less than 200 parts per million each of lead and zinc. For quality and physical property enhancement, refined solvent may be blended with these residues.

DESCRIPTION OF PROGRAMS

INDUSTRIAL HYGIENE

There was no industrial hygiene program at SRR. No industrial hygiene samples had ever been collected.

MEDICAL

The plant had no formal medical program at the time of this visit. However, a physician was on call full-time in Dayton, Ohio. A contingency plan for emergency medical care had been presented to Kettering Hospital in Dayton (5 miles) and the West Carrollton Life Squad was available (2.5 miles). A program is currently being set up to provide for pre-employment physicals for all employees. There are personnel trained in first aid on each shift. The plant manager has completed cardiopulmonary resusitation courses, while the second shift operator has completed emergency medical technician training.

SAFETY

This plant does have a formal safety program. Mr. Bob Kohnen is designated as the coordinator and he is assisted by the Plant Manager. They have a safety manual covering the operations at this plant including descriptions of safety precautions (protective equipment, vessel entry, etc.) and procedures to be followed in an emergency. Monthly safety seminars are held.

HOUSEKEEPING

Housekeeping at this plant was good. However, a solvent odor did pervade the area.

DESCRIPTION OF CONTROLS

ENGINEERING CONTROLS

Hard piping of the entire processing system from dirty material storage through clean material storage and outdoor operation were the primary engineering control methods. Maintaining integrity of seals, gaskets, valves, and fittings is the major obstacle to ensuring exposure control. A vapor suppression system was used for loading and unloading both dirty and clean material in storage areas. This system is designed to recycle head space vapor from the tanker or the storage tank during these operations instead of venting to the atmosphere.

PROTECTIVE EQUIPMENT

The following protective equipment is provided for worker use: uniforms, safety glasses and shoes, hard hats, gloves, and respirators for both particulates (cleaning boilers), and solvent vapors (when necessary). Respirator fit testing has not been conducted. Respirator cartridges are generally changed after two or three uses. Self-contained breathing apparatuses are available for use during emergencies. These are inspected monthly.

Protective equipment use for certain tasks (e.g., distillation equipment maintenance and vessel entry) is detailed in the plant safety manual. Respirators were not worn by the truck drivers while coupling and uncoupling tankers or while pumping from barrels into the tanker.

CONCLUSIONS AND RECOMMENDATIONS

Solvent recovery is a burgeoning industry of small businesses. It is growing in proportion to the profitability of using recycled product in place of virgin stock.

The solvent recovery operations at SRR are modern and apparently well controlled. This is a clean and efficiently run plant. This company exhibited a conscientious attitude toward safety and a growing concern for worker health. Conspicuously lacking, however, were industrial hygiene monitoring data to confirm the effectiveness of control technologies being used.

Based upon the observations made during this survey and the conclusions drawn, it is recommended that:

1. Baseline data be collected concerning exposure to volatile organic hydrocarbons, especially the chlorinated species, for those employees handling both dirty and clean solvent materials, to be used as present indicators of control effectiveness and for comparison with future data to show continued exposure control;

2. Solvent Resource Recovery be considered a candidate site should the solvent recovery industry be selected for future study as a result of this pilot CTA.