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**Advisory Unit for Agricultural Corporations
Ministry of Agriculture
Government of Sudan**

and

**World Bank
Washington
USA**

**FINAL REPORT
RECYCLING OF PESTICIDE CONTAINERS**

March 1989

**Hunting Technical Services Limited
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The Director
The Advisory Unit for Agricultural Corporations
Ministry of Agriculture
Khartoum
Sudan

12th May 1989

Dear Sir

Study on Recycling of Pesticide Containers

We have pleasure in enclosing herewith our report on this study in four copies. A further copy is being sent direct to the World Bank in Washington, for Dr A Kiss.

In carrying out this study we found it necessary to touch upon areas that are not strictly within the terms of the study, notably in the areas of storage of pesticide and disposal of outdated or banned product. Comments in these areas are superficial only as they impinge on the main topic and should be read in that light although we trust they will be of help.

We trust this report will provide a practical answer to the sensitive problems involved.

Yours faithfully

M C B Williams
Regional Manager

13023

consultants in natural resource development

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1.1 Background

The Agricultural Rehabilitation Programme (ARP) financed by World Bank and Government

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1. INTRODUCTION

1.1 Background

The Agricultural Rehabilitation Programme (III) financed by World Bank and Government of Sudan includes a programme to develop the concept of integrated pest management in irrigated cotton. This programme covers a wide range of related activities, including improvement in pesticide application technology, storage, handling and disposal of pesticide and containers. Concern has been expressed by the World Bank and other donor agencies regarding the procedures and precautions taken to make sure that drums used for pesticides present no hazard when disposed of, frequently through the open market for public use.

Hunting Technical Services were approached by GIFAP, on behalf of the World Bank, for provision of consultant advice on this subject, it being felt by GIFAP that an independent organisation, rather than the agricultural chemicals industry, was more appropriate to undertake a study of this nature.

1.2 Mobilisation

Hunting responded in January to Washington, suggesting the study be undertaken from March 6 over a two to three week period. This was agreed late February, subject to final approval by the co-ordinating Sudanese body, the Advisory Unit for Agricultural Corporations, to whom full details of the Hunting offer and the Terms of Reference proposed by the Bank were sent.

A positive response was received from Khartoum on March 6th and the consultant proceeded there on March 13th. Unfortunately delay in preparation of a formal contract, in obtaining travel permits and in hire of transport within the limit of budget stipulated by AUAC/RPMU meant that the consultant could not travel to the field until March 17. Delay was also caused by collapse of arrangements made through AUAC to hire a vehicle in Wad Medani. Details of the Terms of Reference are given in Appendix A and the consultants itinerary in Appendix B.

1.3 Terms of Reference

The terms suggested by Washington were discussed in Khartoum after the consultant's arrival. The terms agreed differed only slightly from the Bank's. The phrase "excess pesticide" was clarified to mean the excess or residue left in drums after the aircraft loading operation. It does not concern excess stocks carried over from one season to another, nor pesticide banned, expired, sub-standard or from which registration has been withdrawn.

An extra clause was agreed regarding the inventory and condition of containers of expired insecticide held by the Corporations.

1.4 Approach to the Study

The study was approached as a follow up to review, update and attempt to resolve certain hazards to public health and safety which were identified during the Monitoring of Agricultural Inputs study of 1985/86 (Ref. 1). That report criticised the then procedures for disposal of containers and waste (expired or banned) pesticide. It made specific recommendations on these problems which included:

"The Consultants consider that the Corporations should take full responsibility for cleansing of pesticide containers in the future, and recommend that a statutory commitment to this effect be enacted by Government as soon as possible".

The present study reviews the situation against that in 1986, reports on the improvements implemented since then, and recommends further action. The time available for field studies due to administrative delays and transportation problems meant that only a few visits could be made to Group stores to verify that official regulations, described by Crop Protection Departments senior staff, were in fact being carried out.

2. THE PRESENT SITUATION

2.1 The Distribution System

2.1.1 On the Gezera scheme pesticides imported under the annual tender are delivered to the central store Gorashi siding, Hassa Heisa and forwarded early in the season to the 14 Group stores on the scheme according to the groups cropping programmes. During the spray season airstrips are supplied direct from Group stores, normally on a daily basis. Block stores no longer hold pesticides (since 1986/87). After spraying all empty drums are returned by the airspray contractor as soon as possible to the Group store. This is an important improvement. There are 107 Blocks on the Gezira, many of which have their own store and airstrip and in the past these also acted as "container depots". By reducing the number of depots to 14 the risk of spillage and subsequent health or contamination hazards is greatly reduced, and control of disposition of the empty drums is much improved. Responsibility for disposal of drums is firmly that of the Group entomologist under overall direction of the crop protection manager delegated by a Corporation Managing Director. No empties can be disposed locally. The Gezira main store at Gorashi was inspected. No empty-after-use drums were found. About 30 empty product drums were held. These were for repacking. Some 20 Endosulfan drums, carry over into 1988 and since found damaged, were noted by the store keeper as due for repacking. The Centre Group Barakat store held about 650 empties. 150 had already been supplied to chemical companies. Empties examined contained very small quantities of residues. About 10 part-drums of different insecticides were also held, being excess after spray operations. Protective clothing, some equipment, and water is available at Centre group.

2.1.2 On Rahad scheme the distribution system is simpler, due to its smaller scale. The main difference is that all pesticides are distributed from the central store, Fau, direct to 18 Block airstrips two or three days before use. Transport is contractor responsibility. After spraying all empties and excess insecticide drums must be returned to the central store against certificate by the Block supervisor. Thus a simple Central store - Airstrip - Central store system is in force. Empty drums are held at central store.

Part drums of the same chemical are bulked by central store and reissued for application as soon as possible. There may be some carry over to the next year.

Protective clothing, equipment and water is available.

2.1.3 At New Halfa scheme stores are under the control of the Procurement Dept. and distribution is from five Group Stores and the Central store against order from the Protection Dept. for delivery to the spray contractor immediately prior to spraying. Amounts sent out to Group stores from Central for the last spray of a season are calculated to ensure minimal stock is held at Group store the following year. After application, and against certificate by the Field Technician, the contractor returns the empty drums and any excess or unopened drums to the Group Store. Where, occasionally, several part-drums of an insecticide accumulate at one Group Store these are decanted into one drum and used. At the end of the season part-drums, if any, are returned to the central store together with any odd drums and drums of insecticides which it has been decided not to re-tender for the next season. These excess insecticides will be held over and used up on one selected block early the next year. While protective clothing is available a manual pump is not. Empty drums are held at the 5 Group stores and central store prior to disposal. Disposal is under control of the Procurement Dept. (ref. Appendix C).

2.1.4 Blue Nile scheme receive all pesticide into the central store at Sennar. Only one regional store, at Sinja, is now used as an additional depot although it is planned to open one more at Shashaina. The scheme serves an extensive area and their commendable decision to concentrate pesticide storage means that distribution to airstrips (numbering 18) poses transportation problems for both airspray contractor and Corporation, who must assist with this. Also the full quantity for a spray round from any one airstrip must be delivered. This means that the airstrip will act as an open store for one to three or four days. During this period the spray contractor staff

take responsibility and must account for all pesticide. After application empty drums and any excess are returned to the central store, or to Sinja.

2.1.5 On Suki scheme insecticide is received at Wad Tuktuk central store. Suki have for years been the scheme most susceptible to late delivery. They frequently have to hold very substantial carry over stock at Wad Tuktuk. This is distributed appropriately in September to 3 group-stores at Mahalla, Salma and Wad Onza. On arrival the new year stocks are held at central store and delivered against need direct to airstrips and Wad Onza, which is far from the centre. In this way insecticide stock at the three group stores is minimal at the end of the season, while the main carry over remains at centre. This was confirmed by visits to the centre, and Mahalla and Salma group stores where 14 and 9 drums only were to be seen. It was agreed by the Head of Crop Protection that it would present no problem to cease using Mahalla and Salma for pesticide stores as they are only 12 to 15km from Wad Taktak. That would reduce pesticide storage to two sites.

As with Blue Nile airstrips may act as temporary depots. Only 4 airstrips are now in use for 35,000 feddan cotton.

Empty drums are returned to all four stores for disposal locally (para 2.3.5).

2.1.6 Carry Over

It appears appropriate to note that late delivery of pesticide, particularly in 1988/89, has meant that schemes are carrying abnormally large carry over stocks. This was particularly noted at Rahad, Blue Nile and to a lesser extent at Suki. This extra carry over presents a storage problem, to say nothing of possible degradation. The more important question is what the effect of late delivery would have been had 1988/89 been a serious year for pest infestation. Fortunately it was not.

Average number spray rounds	1985/86	1988/89
Gezira	8.43	5.35
Rahad	6.0	6.0?
New Halfa	4.22	3.5
Blue Nile	?	5.3
Suki	?	4.5
White Nile	4.7	?

2.2 Airstrip Operations

The procedures and efficiency of airstrip operations are important as this determines the amount and concentration of pesticide left in the empty drums returned to the store. In the past the "losses" in drums and spillage at airstrips (discharge after spraying/split hoses etc) has been estimated at 2.5 to 5% of drums contents. In 1985/87 (Ref. 1) it was noted that returned empty drums frequently contained considerably more than 5l pesticide. Action taken since then to reduce losses has been directed toward physical emptying of containers at the airstrips (all schemes) and in reducing the half or quarter-used drums to a minimum. Management have accepted this still is inadequate for both safety and financial reasons. In November 1988 closed filling systems (which eliminate physical contact with chemicals by loaders) were supplied for demonstration and testing by three chemical companies (Ciba - Geigy, Sandoz, Shell Chemicals) under supervision of the S.G.B. Applications Consultant. Results have been positive and the 1989/90 Spraying Contracts Tender **will include** the stipulation that all Spray Contractors must use an approved closed filling system on all schemes. This system must include a mechanical drum rinsing facility whereby water is jetted into the drum (Emulsifiable concentrates only) under pressure to rinse it, and then sucked out via the standard probe direct to the aircraft. The rinsed empty drums will thus contain very little pesticide, heavily diluted, when returned to store.

Past experience has shown Contractors may pay lip service only to obligations. It was therefore suggested the Corporation consider purchasing the required closed systems equipment (3 or 4 units per spray contractor) and deduct costs when making payment for work performed. Ownership, maintenance and obligation to use is of course the Contractors.

ULV Oil-based pesticides cannot be rinsed with water.

2.3 Disposal of Drums

2.3.1 General

The 1985/86 insecticide tender called for supply of 1,576,920 Imp. gallons pesticide for cotton or wheat. This is equivalent to 35,040 drum units of 45 l.G. (Ref 1, Vol 1 APP B.). That season posed serious pest control problems (8.4 sprays average on Gezira) and stocks carried over to 1986/87 were probably lower than brought forward from the previous year. The Gezira alone had 22,200 drums units for disposal after 1985/86 season. It is reasonable therefore to assume a maximum of 35,000 drums from all irrigated schemes could require disposing in a season.

In 1988/89 SGB. will have around 14,000 empty drums having applied about 5.35 sprays on average.

In 1985 an empty drum was valued at L.S. 10 to 20. In 1989 the price ranges from L.S. 75 (Suki), L.S. 100 (Rahad) and L.S. 120 (S.G.B. latest contract) through L.S. 170-200 in Wad Medani market up to over L.S. 200 in Khartoum. Thus the value to S.G.B. would be not less than 1.68 million Sudanese pounds in 1988-89 season. (2.66 million in 1985/86).

It is against this scale of quantities and values that the question of disposal has to be assessed. Table 2.1 summarises the position in January 1989.

Table 2.1

Stock and Value of Pesticide Drums 1988-1989 Totals in stock prior to Disposals Jan-March 1989

Corporation	No Drums	Price Per Drum (Range L.S.)		Total Value ¹ Million LS	
Gezira	14,000	120	160	1.68	2.24
Rahad	3,000	110	-	0.33	-
New Halfa	8,000 ²	130	-	1.04	-
Blue Nile	2,000	100	140	0.2	0.28
Suki	750	75	-	0.056	-
Total	27,750			3.306	3.946

Note: 1. Two Ranges of value per drum
2. 3 years stock. 1988/89 season 1,800 drums

In the past disposal of drums by Corporations was either

- i. Direct from Group or Block stores as ex-store sales.
- ii. Sold in bulk to an individual merchant who collected and disposed (guaranteeing non-domestic use).
- iii. Offered to purchasers on a tender basis which could include some small lots.

Under ii and iii the drums were sold on condition the purchaser fired them and did not process them for domestic use. This cannot be enforced. (Ref Para 1.4).

2.3.2 Gezira

Since 1987 i and iii have been stopped by S.G.B. in response to considerations of public health safety and pollution hazards. It is stated by S.G.B. that drums are now disposed of in three ways:-

- i. To the Ministry of Irrigation for use in flow regulation on the Abu Eshreen canals.
- ii. To Shell Chemical formulation plant for packing Endosulphan, Birlane, Alamos D, Danitol S (at L.S. 155 per drum).
- iii. To Chemical companies, agricultural contractors to the Group units and some other organisations for fuels and lubricants. (L.S. 140-165).

In 1988/89 the number of drums for disposal will be relatively low but it has been estimated that a stock balance of 4-6000 may remain. The S.G.B. Crop Protection Department faces the problem of how to cope with this. It also means some L.S. 600,000 to 900,000 is tied up (varying price and quantity).

2.3.3 New Halfa

New Halfa had just been advised verbally that, under terms laid down by World Bank, empty drums may not be sold by Tender or released on to the general market. They had anticipated sale to the Shell formulation plant but Shell have already filled their requirements. New Halfa have approx 8000 drums to dispose of valued at L.S. 1.04 million, accumulated over 3 or 4 years (last season approx 1800). The stores Procurement Department are at a loss what to do. At present they see no alternative to reverting to the practise of 10 years ago of cutting top and bottom off the drum, opening the side and flattening it, then heaping drums over a trench, dousing them with kerosene and firing the whole. The sides can then be used for sheet-metal walls round open stores or open-sided roofed stores.

2.3.4 Rahad

At Rahad there should be over 3000 drums for disposal this year, worth L.S. 330,000 on the market. Since 1986/87 season Rahad have ceased to release drums for tender or through the open market. Disposal is now:

- i. As long-drop latrine liners (pit latrines)
- ii. To Ministry of Irrigation for flow regulators.
- iii. For fuel containers, to the corporation or contractors, after cleansing with diesel.

It must be anticipated that they will encounter problems in disposing of their stock. There is also a public demand for drums and pressure that empties be released. It has been contended that since the tenants pay for the contents the empties are rightfully theirs.

2.3.5 Suki

Suki estimated 750 empty drums from 1988/89 for disposal. The bulk of these have already been auctioned or supplied for fuel containers to various organisations, from both central and three group stores. Central now holds about 320, some 2 or 3 seasons old., One of the two group stores inspected had none, the other about 35, having sold 180; price reported about L.S. 75. The Corporation fuel depot holds about 100 old drums for fuel transportation. Drums have been or will be disposed for:

- i. Fuel (P.P.D. Min. of Irrigation, Agri. contractors, the Corporation).
- ii. Corporation workshop.
- iii. Recycling, after firing, for charcoal stoves and other purposes.
- iv. Direct sale from store to individuals claiming need for fuel or non-domestic use.
- v. Auction from Group or Central store.

2.3.6 Blue Nile

Blue Nile estimated about 2000 drums per season for disposal. Recent auction prices were L.S. 100 each. Those sold to private buyers as fuel drums were at L.S. 140 in small lots. From 1988/89 season about 600 empties remain held in a locked store at the central depot. Some thefts have occurred in the past. Drums have gone to:

- i. Auction to highest bidder with guarantee of firing.
- ii. Regional Government of south Sudan (L.S. 140).
- iii. Local Government Organisations for fuel containers.
- iv. Special private buyers (normally for fuel) in small lots.

The two Corporations still operating the auction system (as approved by G.O.S.) accept that the guarantees of burning or firing cannot be assured. All senior staff consulted agree that present systems of drum disposal are not fully satisfactory with regard to public and environmental contamination hazards. They all are interested in improved ways of disposal but stated these needed to be practical and economic.

2.4. Repacking and Disposal of Insecticide

2.4.1 Repacking - Excess Pesticide

All schemes encounter the problem of repacking excess insecticide returned from airstrips or decanting from several part-drums into one. The potential hazard at the stores has been reduced over the past three years on all schemes by:

- Instructions to drain empty drums at the airstrips by upending into mixing tanks.
- By supplying to and from Group or Central stores only and eliminating pesticides from Block stores, or most Group stores on small schemes. (Suki were the exception but agreed that 2 of 3 Groups should be supplied from the central store).

Decanting is thus carried out at fewer places, and can now be supervised by a senior storeman or technician. Airstrip operations had ceased in January so no actual repacking was viewed by the consultant. The following comment is therefore based on interviews with storemen, from which Table 2.2 is derived.

Table 2.2

Equipment and Facilities for Repacking Pesticides

Item	Gezira		Rahad Centre	New Halfa Centre ³	Blue Nile Centre	Suki Centre M'la	
	1 ¹	2 ²					
Water	+	+	+	+	+	+	-
Rotary Pump	-	-	+	+	-	+	-
Funnel	-	-	+	+	+	-	-
Overalls	-	+	-	+	+	-	-
Gloves	-	+	+	+	+	-	-
Boots	-	+	+	+	-	-	-
Goggles	-	+	-	-	-	-	-
Mask ⁴	-	+	+	+	+	-	-

Notes:

1. Gorashi Main store. Stated they bring pump and protective clothing in from North-West Group store if they ever need to repack.

2. Barakat. Centre Group Store
 3. Central Store. No water at Temporary store.
 4. Masks in general use are white Triple M filter type. Where respirators are available there are unlikely to be replacement cartridges.
- + = Available at Store
 - = Not available, or broken pump

There is substantial improvement since 1985/86, however repacking facilities still leave much to be desired. All senior staff are fully conscious of the importance of improving safety standards both at stores and airstrips. Action already taken includes:

- Enforcing of Article 34 of the Spray contract re provision and use of protective clothing.
- Provision of two vehicles, through Ciba Geigy, for Ministry of Health staff to check airstrips and carry out Lovibond cholinesterase tests on Gezira.
- Ministry of Health to carry out pre, during, late season Lovibond tests on all crop protection technical, stores, and airstrips staff on Gezira.
- Pressure on commercial organisations to provide after sale service in the area of safe application. This includes provision of antidotes and introduction (1989?) of the new Shell tropical material for protective overalls.

As can be seen from Table 2.2 protective clothing notably overalls and goggles, is still lacking. This is particularly serious in view of lack of rotary pumps suitable for use with agricultural pesticides. It is, however, essential that protective clothing be practical under high temperatures and that training be given in its proper use. Hands need to be washed clean before putting on gloves. Overalls to be washed daily.

2.4.2 Disposal of out dated/banned Pesticide

This question is not strictly within the study brief, however, the disposal of excess residues is pertinent and hence the present situation was investigated.

Only two ways of disposal are currently available in Sudan. The first is deep burial of entire drums in a desert area. This method has been used in the past and, providing there is no possibility of movement into watercourses or deep groundwater, can be considered safe and with the low environmental contamination hazard (except perhaps for DDT and other residual chlorinated hydrocarbons). However, burial is in principle undesirable since the pesticide is not seen to be destroyed.

The second available means is incineration. This is at present being carried out by Shell Chemicals, Sudan who have a mobile incinerator stationed at their formulation plant at Wad Medani. They are currently operating under contract to the Plant Protection Department. In 1987/88 they incinerated 93 tons; the 1988/89 contract is for 40 tons, including about 13 left over from 1988. Pesticides being handed this year include DDT 25, Zolone, Ekaton 15 ULV, malathion, Torbidan, HelioTox. The bulk is from Kordofan Province, with some from the northern Nile areas of Dongola and Merowe.

The Shell operation was visited to assess suitability for future destruction of collected residues or effluent from cleaning drums. The site is about 4km, direct, east of the Blue Nile across the bridge on the main Port Sudan road. It is elevated and about 1.5km from the Ciba airstrip, 2km from the nearest village further to the east. The site was selected by the Wad Medani Health Dept. in conjunction with Shell. Operation is only when there is a north, cool wind and from 5.30am to

midday. A Health Dept. man must be present. Water, soap and an emergency shower is available. Protective clothing, but without mask or goggles is worn. The minimum number of staff necessary were there and they knew their routine.

In only one area did the operation fall below standard. In accordance with the approved Government procedure, the empty but unwashed drums (135 counted on site + 16 x 25l) will be sold to a licensed, approved dealer. He undertakes to burn off the drums prior to recycling them into items NOT for domestic use. The burning is done over ignited old truck tyres, so that temperature is likely to be quite low. The suggestion was made to the Shell manager that they should undertake washing the drums in solvent at their factory.

The ratio of diesel to pesticide is almost constant at about 1:1, so cost of incineration is quite high. Shell undertake to survey stocks of outdated pesticide, repack where necessary and transport to site within their contract price. Only liquids are accepted. The price varies according to pesticide and distance for transportation. One problem may arise. Shell find the present operation is unprofitable and are considering disposing of the incinerator. Thus all future incineration proposals may be in jeopardy.

Their capacity is 3 to 4 ton per day, depending on the viscosity.

The potential value of the Shell incinerator for future residue disposal is discussed in Chapter 3. Shell are negotiating with the Gezira board over incineration of their present stock of outdated pesticide but funding this remains a problem for S.G.B. Rahad and Blue Nile also proposed the use of the Shell incinerator, so far without making progress due to lack of finance.

2.5 Stocks of Outdated pesticides

the inventory of pesticides that need to be destroyed is given in Table 2.3, based on data provided by the corporations.

In 1986 the Central Store of S.G.B. contained enormous stocks of old DDT formulations. This has been entirely disposed of. The site is now bare ground (albeit discoloured by leakage over some 10-15 years). The useable DDT was supplied to Public Health Departments as suggested in 1986, for mosquito and sand fly control. The unusable drums (solidified or split emulsion) plus other insecticides was reported to be buried, perhaps some 750 drums or half their 1986 stocks. Substantial stocks of insecticides and also herbicide are still to be found at the Group stores. Those held by S.G.B. at Centre Group store Barakat included considerable numbers of split or corroded containers. Old rice herbicide (85 drums - Stam F34) written off when the scheme ceased to grow rice is an important item.

All schemes were advised to incinerate, or bury with slaked lime far out in the desert as soon as possible. The site should be elevated impossible to flood, far from any watercourse or groundwater and must be completely fenced.

Table 2.3

Stocks Held of Out-dated or Banned Pesticides
Packing as drums (approx 45 gal. contents) Data March 1989

Product	SGB ¹	Rahad	New Halfa	Blue Nile	Suki ¹	Total
Insecticide						
DDT	100	- 54	132	20	306	
HELIOTOX	20	- 108	-	-	128	
TORBIDAN	30	305 (9yr)	10	77	22	444
FOLIMAT	-	30 (4yr)	-	-	-	30
THIMUL/DIMETHOATE	2	-	-	-	-	2
CYBOLT	1 x 20l	-	-	-	-	(1)
MICKANTOP	19	12 (4yr)	-	-	-	31
SUMICIDIN	53	1	-	-	-	54
DURSBAN	20	3 (9yr)	-	-	4	27
BIRLANE	4	35	-	-	5	44
EKALUX	-	9 (8yr)	-	1	25	35
CURACRON	2	51 (5yr)	-	-	-	53
DECIS 25 EC	-	6 (7yr)	-	-	-	6
NURELLE	3	-	-	-	-	3
DECIS ULV	-	7	-	-	-	7
ALAMOS	2	1	-	-	-	3
FASTAC-BIRLANE	2	-	-	-	-	2
ENDOSULPHAN	10	2 (9yr)	-	-	5	17
AZODRIN	10	2 (10yr)	5	-	-	17
ANTHIO	20	-	9	-	80	109
BIDRIN 24	-	-	16	-	-	16
BIDRIN/DDT	-	-	35	-	-	35
CITROLANE	-	-	15	-	-	15
ENDRIN	-	-	1	-	-	1
FENITROTHION	-	-	3	-	-	3
ENDOPHOS	-	18 (5yr)	1	-	-	19
HOSTATHION	-	-	18	-	-	18
PHOSVEL	-	-	40	-	-	40
ROGOR	10	53 (5yr)	38	46	5	152
TORAK	-	-	3	-	-	3
RIPCORD/BIDRIN	-	4	-	-	-	4
TEMIK	0.5 ton?	6 ton	-	-	-	(6.5t)
Total	307	539	356	256	166	1624
Herbicides						
				None		
COTODON	2	-	?	-	18 x 25kg	
KURTAL	7 x 50kg	-	?	-	-	
STAM 2 others	85	-	?	-	-	
GRAMMOXE	-	1703 x 5l	-	-	-	
D.E.F.	-	1550 x 20l	-	-	-	
TOK 25	?	70	-	-	70	
RONSTAR	?	25	-	-	40 x 20l	
TREFLAN	?	-	-	-	-	35

Note: 1. Stock returns incomplete and estimates made.

3. IMPROVED DRUM RECYCLING

3.1 The Basic Criteria

The international association of agricultural chemicals manufacturers, GIFAP, based in Brussels state the following regarding disposal of pesticide containers (Ref 3).

"All Empty Containers Must be Safely Dealt with:

Metal Cans and drums - Wash out, puncture and bury (Do not puncture aerosol cans)

Plastic - Wash out, puncture, burn or bury.

Cardboard Packaging-Burn.

Burning must take place away from dwellings and from crops.

Do not stand in the smoke of such fire and keep children away.

Pesticide containers must not be rinsed or washed in streams, rivers or ponds. The water used for washing must be tipped into a hole in the ground away from dwellings, wells, waterways and crops.

If containers cannot be disposed of immediately, rinse them and store securely to prevent theft or misuse, and away from children and animals.

Do not use pesticide containers for food or drinking water for humans or animals because adequate cleansing is very difficult to achieve. It is everyone's responsibility to discourage this practice."

Obviously in the ideal world this advice would not be controversial. In the Sudan, and most developing countries, the intrinsic usefulness of empty pesticide containers means that recommendations that they be destroyed would be ignored. This is confirmed by the high prices they command. A semi-skilled worker (car driver, Khartoum) earns LS 550-700 per month; a drum may be one week wages.

It is thus accepted that containers should be re-used. It is accepted by all that drums must be cleansed before re-use and recycling to industry, commerce or the general public. It has been recommended that the responsibility for cleansing must be with the Vendor, thus with the agricultural corporations, and that the mode of cleansing should eliminate health hazard to the purchaser, and of contamination of the environment. The consultant gained the impression that senior crop protection management now accept this as their Scheme responsibility, underlining a changed attitude since 1985/86.

3.2 Disposal of Drums - Options available

3.2.1 Unwashed Drums

Drums which have simply been drained and dried out in the sun could be disposed of safely, where the user guarantee is secure, in the following ways:

- i. To Shell Chemical formulation plant at Wad Medani
- ii. To large commercial organisations and agricultural contractors where the drums will without fail be used for fuels.
- iii. To the Ministries of Irrigation or Health for use as noted in chapter 2.3
- iv. After cutting open, flattening and firing **under Scheme control** they may be used for walls of open, roofed stores or similar purposes. They should not be released for recycling into cooking stoves and domestic utensils, suitcases or any domestic use.

3.2.2 Cleansed drums

There appear four options for treatment and recycling drums which will or could pass to the general public. These are

- Rinsing during closed system loading operations at the airstrip.
- Drum Reconditioning at a specialised plant.
- Solvent cleansing at Scheme stores.
- Pressurised water cleansing at Scheme stores.

These options will be discussed below and indications of foreign exchange costs will be given.

3.3 Airstrip Operations, the Closed Loading system

As noted in chapter 2.2 three closed systems have been tested and recommendations have been made separately (Ref. 2). The benefits of improved airstrip safety, economy due to elimination of losses and better measurement, and reduced environmental contamination (through zero spillage) are of major importance. Rinsing of water-miscible formulation containers with water during the operation is the other benefit; one which becomes a vital factor contributing to cleansing of drums prior to recycling.

Appendix D gives diagrammatically the systems offered by CIBA-GEIGY Shell, and Sandoz. It should be noted that although only the Ciba-Geigy diagram includes a washing probe the other models also have these fitted, or can simply be modified.

The 1989/90 tender for Airspraying includes an article making use of closed loading systems mandatory. When this is properly implemented the problem of drum cleaning will be resolved, to a great extent, for E.C. formulation containers. There will remain the problem of ULV oil formulation containers. If these are stored separately they could be disposed of safely as fuel containers to responsible government organisations or within the corporations.

The first option therefore is for corporations to take no action other than to adopt the closed system and to separate unrinsed oil from rinsed E.C. containers.

This course of action involves no extra expense and is thus attractive but falls short of requirements, since traces of pesticide will remain in the rinsed drums.

SPECIAL NOTE

In view of the importance of introduction of closed systems in 1989 the following comments are made.

- i. S.G.B. must decide which of the three systems is to be selected in accordance with the Coutts report (Ref 2) and quotations should be requested urgently.
- ii. The selected supplier(s) should be informed as soon as possible so that he can import the required parts, assuming local manufacture, or whole units.
- iii. A decision on how units will be supplied to the Spray contractors is needed - through corporations and the debiting of costs, or as the responsibility of the spray contractors to purchase direct from the supplier.
- iv. Foreign exchange for imported items must be allocated, and donor loan finance arranged if this is required for corporations to buy units.

Urgent decisions are needed since only five months remain before contractors should be in Sudan, fully operational.

3.4 Drum Re-conditioning

A number of developing countries in which, for reason of cost or availability, new drums are in short supply have established drum re-conditioning factories. The feasibility of establishing such a factory for Sudan requires consideration.

If one was constructed then all empty pesticide drums would be acquired, unwashed and ex-store, by the factory management and transported direct to the plant. The question arises as to whether such a plant would be economically viable. The following includes some of the baseline questions determining viability.

- Are new drums manufactured in Sudan, and in sufficient quantities to meet the demand?
- Would Sudan benefit in terms of foreign exchange from drum reconditioning, which would be mainly a "local currency" cost?
- Is the supply of used drums of all sorts sufficient for an economically viable reconditioning plant?
- Is there a market for reconditioned drums sufficient to absorb the number produced?
- What adverse effect would follow upon drying up of the supply of ordinary secondhand drums to the small private users?

A brief preliminary study indicates that the prospects for a reconditioning plant are reasonable.

A drum manufacturing plant is in operation at Port Sudan, operated by Shell Sudan, with a capacity of 250,000 drums per year. Unless Shell find this uneconomic and are prepared to close it down in favour of utilising reconditioned drums, (or to convert their new drum line to a reconditioning line), there would be competition between the two and probably neither would be profitable. However Aviation gasoline must be supplied in new drums.

It is understood that Shell have problems in obtaining sufficient foreign exchange to purchase imported items needed to keep their factory running at the designed capacity.

The capital investment cost of a reconditioning plant is stated to be of the order of US\$ 150,000, which is not high. The resale cost after reconditioning should be less than half the cost of a new drum, currently about L.S. 240. Reconditioning may be possible up to eight times depending on conditions, permitting substantial saving of foreign exchange through recycling. Thus a reconditioning plant appears attractive from a national point of view.

Experienced specialist advice is that a small plant processing 25 drums per hour or 860 per week can be economically viable when demand is high and resale price is good. This is a production capacity of not less than 45,000 per year. It appears likely that this number of used drums would be available for reconditioning if the large number of circulating drums could be tapped.

As noted before the total number of used pesticide drums ranges from 40,000 to 20,000 per year, with the average at the lower end of the range. The number of pesticide drums depends on the severity of pest infestation and hence the number of spray rounds in any year.

It has not been possible to assess accurately the availability of empty fuel and lubricant drums but Shell's plant has a capacity of 250,000 new drums per year, and it is reasonable to believe about 100,000 could be pulled back for reconditioning by introducing a system of cash deposit on new drums which would not be paid when an empty one is exchanged.

The market for reconditioned drums is essentially into the petroleum industry for diesel or petrol.

There is a considerable demand for drums by government (including the army) and by transporters and agricultural contractors in the private sector but all of these would prefer to draw on the standard secondhand market (Ref chapter 2.3) where prices range at present from L.S. 110 to 160. Discussion with the petroleum industry indicates that the annual requirement for reconditioned drums would be of the order of 100,000. Shell Sudan have already done a preliminary feasibility study. Results are confidential but they indicate a reconditioning plant to be of interest.

An adverse effect of diversion of all pesticide drums (except the requirement for fuel on a scheme) from the market would be that genuine small users for fuel would not be able to obtain their requirements. This would be a serious hardship particularly if clean drums could be provided for other uses at a lower price than after reconditioning.

Technically a drum reconditioning production line may be summarised as comprising:-

- | | | |
|-----|---|--------------------------------------|
| 1. | Input | |
| 2. | Pre-wash | Caustic soda or diesel |
| 3. | Chaining | Scouring, loosening heavy deposits |
| 4. | Modular Washing | High standard cleansing |
| 5. | Chimber | Reform, reseal top and bottom chimbs |
| 6. | De-denter | Reshapes body of drum |
| 7. | Drum Drying | Steam/hot air/vacuum, as is optimal |
| 8. | Visual Inspection/
Automatic leak detector | |
| 9. | Shot-blasting | Prepaint treatment of exterior |
| 10. | Paint-spray | |
| 11. | Hot air drying | |

Suppliers of equipment provide back-up service including:

Planning and design for individual plant requirements
Estimate/quoting for individual requirements

Delivery, erection, supervision through commissioning to contract completion

Provision of spares off the shelf

Operator training

Management training

Follow-up service visit as agreed by client

Assistance in arranging finance

Because pesticide drums would be reconditioned special facilities for collecting effluent, for solar evaporation to concentrate it, and for incineration of final waste would have to be built into the process.

There appear to be four organisation ways in which a factory could be established.

- State owned as a quasi - government corporation
- Private Sector
- Joint venture State/Private
- Co-operative e.g. Gezira tenants ownership

In view of the special problems where pesticide containers involved the second or third ways would be preferred. In all of them financial aid would be needed to meet foreign exchange requirements.

It is recommended that consideration be given to employing a specialist organisation, or Shell Sudan company, to carry out a full feasibility study on this option, the viability of which depends on the petroleum industry.

3.5 Solvent Cleansing

In all liquid pesticide formulations, oil-based or water-miscible, the active ingredient is dissolved in a solvent. Residues of formulations in empty drums may be removed by washing or rinsing the drums in relatively small quantities of a solvent followed by rinsing with a larger volume of water. An appropriate procedure would be:

Water miscible formulations

- i. Pre-wash with a large volume of water, either rinsing at the airstrip as for para 3.3 or at the store.
- ii. Wash with a powerful solvent such as acetone or dimethyl formamide (DMF) plus caustic soda (9:1); Two litres per drum, rolling the sealed drum to and fro for five minutes.
- iii. Final wash with water jet.

Oil based ULV formulation

- i. Pre-wash with xylene or toluene at store.
- ii. Wash with acetone or DMF as above.
- iii. Final wash with water jet.

This option based on chemical cleansing is attractive in that it is thorough and should give a decontaminated drum free of pesticide traces. It has serious drawbacks however:

- The solvents, being chemically reactive, have low flash points and tend to be volatile. They present serious fire risk hazards, acetone extremely so. Their vapours form ignitable and explosive mixtures with air, DMF less so than others.
- The solvents pose health hazards and require stringent safety precautions. Vapour and liquid of DMF, xylene and toluene are irritant to eyes, nose, throat, and the latter two are irritant to the skin. DMF can cause liver damage if absorbed in sufficient quantity.

- The solvents are expensive, ex-factory UK prices for 2 ton quantities are of the order of:

	£ Str/ton	Cost/drum Cleaned	
DMF	650	1.30	(L.S. 9.75)
Acetone	415	0.83	(L.S. 6.22)
Toluene	320	0.64	(L.S. 4.80)
Xylene	385	0.77	(L.S. 5.78)

Commercial exchange rate applied £ Str 1 = L.S. 7.50
Amount used 2 l/drum cleaned.

These exclude cost of freight, insurance, customs, inland transport.

The combination of fire and safety hazard make use of chemical solvent for drum cleansing unacceptable for Schemes stores staff to use. Only in the case of the Shell Chemical formulation plant at Wad Medani can this system be adopted. In fact Shell do cleanse drums purchased from Gezira for packing of locally formulated products with their Shellsol brand solvent.

This option will not be considered further.

Full chemical data is not therefore appended.

3.6 Pressurised Water Cleansing

3.6.1 Equipment and Procedures

Hot water or steam cleaners have been used in the motor, engineering and food processing industries for many years, with or without detergents or chemicals for removal of grease, grit and other resistant deposits. This method of cleansing drum is also used in drum reconditioning factories. Rahad scheme used high pressure hot water cleaners with their cotton harvesters and it is stated that the Maragan ginnery has used one.

Since the option of solvent cleaners must be rejected that of steam or hot water for washing pesticide drums is attractive. A range of machines is available from U.K., U.S.A., and Europe, examples delivering from 11 to 17 litres/minute hot water, or from 6.8 to 9.5 l/m steam, over a wide pressure range, are shown in Appendix E (makers catalogue copies). Models driven by electric motor, petrol or diesel, and fired by paraffin or propane gas, are available. All are fitted with detergent tanks.

The use of these cleaners is straightforward.

Empty drums would be mounted in two, or four, parallel rows on rack approximately one metre above the floor and sloping slightly forward. Caustic soda (pearl, flowable type) would be added as a concentrate to the detergent tank of the machine to apply a 4% solution into the drums in hot water or steam.

The application lance is passed through the larger drum opening and moved back and forward while spraying under pressure to ensure thorough coverage for about 30 seconds per drum, depending on output of the steam machine and whether the drums being treated were water-miscible or oil formulation drums. The applied solution would drain out of the large opening after rolling the drum over.

A rinsing with water alone would subsequently be applied, direct from mains connection, with a standard pressure nozzle.

Floor slope and drains below each row of drums would empty effluent into a solar evaporating tank, the size and capacity of which would be planned according to annual drum cleaning requirements. Based on a maximum of 5l/contaminated effluent per drum a pond capacity of 20 cu.m (1.5 x 6 x 2.25m) would suffice for 4000 drums.

Evaporation over two or three months should result in a concentrate ready for incineration. This would be pumped into barrels for transport for incineration which should be done using the Shell facility at Wad Medani. This is known to be expensive but effluent quantities would be relatively small. Estimated prices for 1989/90 season are:

-	Collection in Central Region	LS 510 per drum
-	Collection in Eastern Region	LS 575 per drum

An alternative to solar evaporation and incineration of concentrated liquid effluent would be use of the Allman/I.C.I. farm pesticide effluent disposal system that has recently been commercialised. This is the Sentinel/Carbo-flo equipment. It is described in more detail in Appendix F with the supplier's address given in Appendix E. In brief, water from drum washing would be pumped into the Sentinel holding tank, chemicals and flocculent are added and paddle-stirred, the mix is allowed to sediment, the super-nascent liquid drawn off through the carbon-filters and run into a pit soakaway. The liquid sludge from the bottom of the tank is drawn off into a sludge tank for coagulation. The dried sludge, and spent carbon filter modules are disposed of by deep burial in due course.

This system is attractive because it eliminates the need for constructing solar evaporation tanks, and rapidly disposes of the effluent water. It would however require the continued importation of the chemicals and carbon filters. If wished the clean water after treatment can be stored and reused for washing. It is easily operated with a minimum of training for proper use.

3.6.2 Costs and implementation

The Gezira scheme stores facilities are being upgraded. 16 main group stores are under development. All of these will hold substantial numbers of drums. Discussion with management resulted in preliminary agreement that a drum washing facility be included at each store as a room plus an evaporation tank. One end of the stores currently under construction can easily be partitioned off since floors, walls and roofs are not yet complete for many Group stores. Only four power washing machines would be needed, each one serving four stores since they are easy to transport from Group to Group.

Local currency costs for cement, labour, and construction should be met from funds raised in 1989 and 1990 by sale of drums under the present arrangements.

Foreign exchange costs would have to be met through donor aid finance. Costs for two models ex U.K. are given below. A total of ten machines is budgeted. One each for the Rahad, New Halfa, Suki and Blue Nile, 2 for White Nile (due to distances), 4 for Gezira.

	Ex Factory	C & F Port Sudan
1. Handy Dandy (Petrol)	£1750	£2000
2. Universal (Diesel)	£3290	£3450
Caustic Soda per ton	£335	FOB UK

Shipment as single container consignment (£2000)

Prices liable to change. Miscellaneous charges estimated.

The Universal is more expensive but a diesel engine is costed. This model also has the facility that water may be drawn from an auxiliary tank. Cost of USA models ex McMaster-Carr are given on their catalogue copies in Appendix E.

Foreign exchange cost would be from £Str 20335 to £ Str 35735, or 8% of the value of drums to be disposed of in 1989 (Table 2.1) at their lower valuation.

The cost of the Sentinel treatment system can be broken down as follows (guide prices 1989 only).

Foreign Exchange Capital Cost

Str £
C2F Sudan

Sentinel Treatment Plant with 1 set x 4
Chemical packs and sludge settling agent = **5,515**
=====

(Container shipment; 2 units/container)

Foreign Exchange Recurrent Cost

Ex Works UK

(Treatment of 4,000 drums)

Replacement Carbon Cartridge Assembly x 1 at £220 = 220
Replacement Chemical Packs x 20 at £18 = 360
Replacement Sludge Settling Agent 5l x 20 at £14.50 = 290

Total **870**
=====

Operational costs are simply calculated, on ex-works U.K. basis:

Pack of chemicals for 1000 l tankfill = 18.00
Replacement Carbon Cartridge (20 tankfills each)
£220 divided by 20 per 1,000 l tankfill = 11.00
Disposal of sludge (1,000 l giving 3.5kg dry) = 2.50
Disposal of Carbon Cartridge = 1.25

Cost per 1,000 litres treated **32.75**
=====

This gives a cost of £665 per 20,000 litres or 4,000 washed drums, where 5l/drum is used. The freight, customs, inland transport costs from U.K. to store are additional.

Stock of outdated pesticide at Rahad has increased slightly since 1986, although a few items were supplied for locust control to P.P.D. As will be seen from Table 2.3 quantities are substantial at 540 x 45kg drums of insecticide 6 ton Temik and over 13,000 gallons of herbicide. The state of drums is, considering their age, not too bad. Many appear sufficiently sound to be transported either for incineration at Wad Medani or burial in the desert.

The incineration of herbicides has to be carefully considered, however, due to the possibility of release of herbicidal vapour. That is a matter beyond the scope of this report, and advice from the manufacturers would be necessary. It is understood Shell are not prepared to incinerate herbicides.

The substantial stocks at New Halfa, Blue Nile and Suki include large numbers of corroded and holed drums which present serious transport problems, particularly those at Suki. However, much is very old and has sedimented out. This semi-solid "jam" cannot be incinerated by Shell's equipment, even if transport were not too hazardous over the distances involved. Deep burial seems more appropriate.

2.6 Cement Kiln Incineration (Ref 4)

It has been suggested that pesticides be incinerated through the cement kiln at Atbara (also Kosti?). This process is accepted in the U.S.A. A USAID consultant has done a feasibility study in Sudan and a trial has been recommended. Transportation to Atbara would be hazardous and costly. The Kosti kiln should be preferred if the method is approved.

4.2 Drum Recycling

It is recommended:

1. That the closed loading system to be introduced under the 1988/90 Airspray Contracts should include a pressurised rinsing system and that the decisions required to ensure this introduction is successful be taken before the end of April 1989.
2. A pressurised hot-water or steam cleaning system be introduced by all production corporations as soon as can be done.
3. That the IBRD be approached to finance the foreign exchange requirements for 2 under the ARP 111 programme as part of the Pesticide and Storage Facilities Sector.
4. That all Corporations allocate the funds accruing from disposal of empty containers to meet local currency costs of adapting stores to include a drum washing facility.
5. That as an option alternate to 2 consideration be given to establishing a drum reconditioning plant in conjunction with Shell Sudan, or to supporting any private venture Shell or others may establish. A feasibility study for a reconditioning plant would be an appropriate first step.
6. To reduce hazard at stores where repacking is undertaken manual rotary pumps for use with chemicals and protective clothing - notably goggles - should be provided by corporations.

4. SUMMARY OF RECOMMENDATIONS

4.1 Pesticide Container Regulations

It is recommended that the regulations covering disposal of empty pesticide containers be reviewed and updated without delay.

1. In particular that the responsibility to ensure that empty drums released on to the market are free of pesticide residues should be that of the Vendor.
2. That the former procedures whereby burning or firing of drums be accounted an acceptable decontamination procedure for recycling drums into the domestic market be rescinded.
3. That approved procedures for decontamination of drums be legislated for the various end uses to which containers may be put.

It is suggested that the National Co-ordinator and National Pesticide Committee register the need for new legislation with the Minister for Agriculture so that appropriate steps are taken to amend the Act covering the Regulation of Pesticide usage.

(It is noted that the Agricultural Commercial sector have established an association "the Product Stewardship Sudan Working Group", and it is suggested this organisation be invited to collaborate and be consulted regarding any changes in legislation).

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5. That as an option **alternate to 2** consideration be given to establishing a drum reconditioning plant in conjunction with Shell Sudan, or to supporting any private venture Shell or others may establish. A feasibility study for a reconditioning plant would be an appropriate first step.
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SUMMARY OF RECOMMENDATIONS

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3. That approved procedures for decontamination of drums be legislated for the various end uses to which containers may be put.

It is suggested that the National Co-ordinator and National Pesticide Committee register the need for new legislation with the Minister for Agriculture so that appropriate steps are taken to amend the Act covering the regulation of Pesticide usage.

It is noted that the Agricultural Commercial sector have established an association 'The Product Re-wrapping Sub-Working Group', and it is suggested this organisation be invited to collaborate and be consulted regarding any changes in legislation.

4.2 Drum Recycling
 It is recommended:

1. That the closed loading system to be introduced under the 1986/87 Agency Contracts should include a pressurised filling system and that the decisions required to ensure this introduction is successful be taken before the end of April 1988.
2. A pressurised hot-water or steam cleaning system be introduced by all production corporations as soon as can be done.
3. That the ERD be approached to finance the foreign exchange requirements for 2 under the ACP 111 programme as part of the Pesticide and Storage Facilities Sector.
4. That all Corporations allocate the funds accruing from disposal of empty containers to meet local currency costs of washing stores to include a drum washing facility.
5. That as an option alternate to 2 consideration be given to establishing a drum reconditioning plant in conjunction with Shell Sudan, or to supporting any private venture Shell or others may establish. A feasibility study for a reconditioning plant would be an appropriate first step.
6. To reduce hazard at stores where repacking is undertaken manual rotary pumps for use with chemicals and protective clothing - notably goggles - should be provided by corporations.

APPENDIX A

TERMS OF REFERENCE
FOR THE DEVELOPMENT OF A
RESEARCH AND EVALUATION DESIGN

The purpose of this document is to provide a clear and concise description of the terms of reference for the development of a research and evaluation design. This document is intended to be used as a guide for the development of a research and evaluation design and to ensure that the design is consistent with the objectives of the project.

A research and evaluation design is a plan that outlines the methods and procedures that will be used to collect and analyze data. It is a critical component of any research project and is essential for ensuring that the results are valid and reliable.

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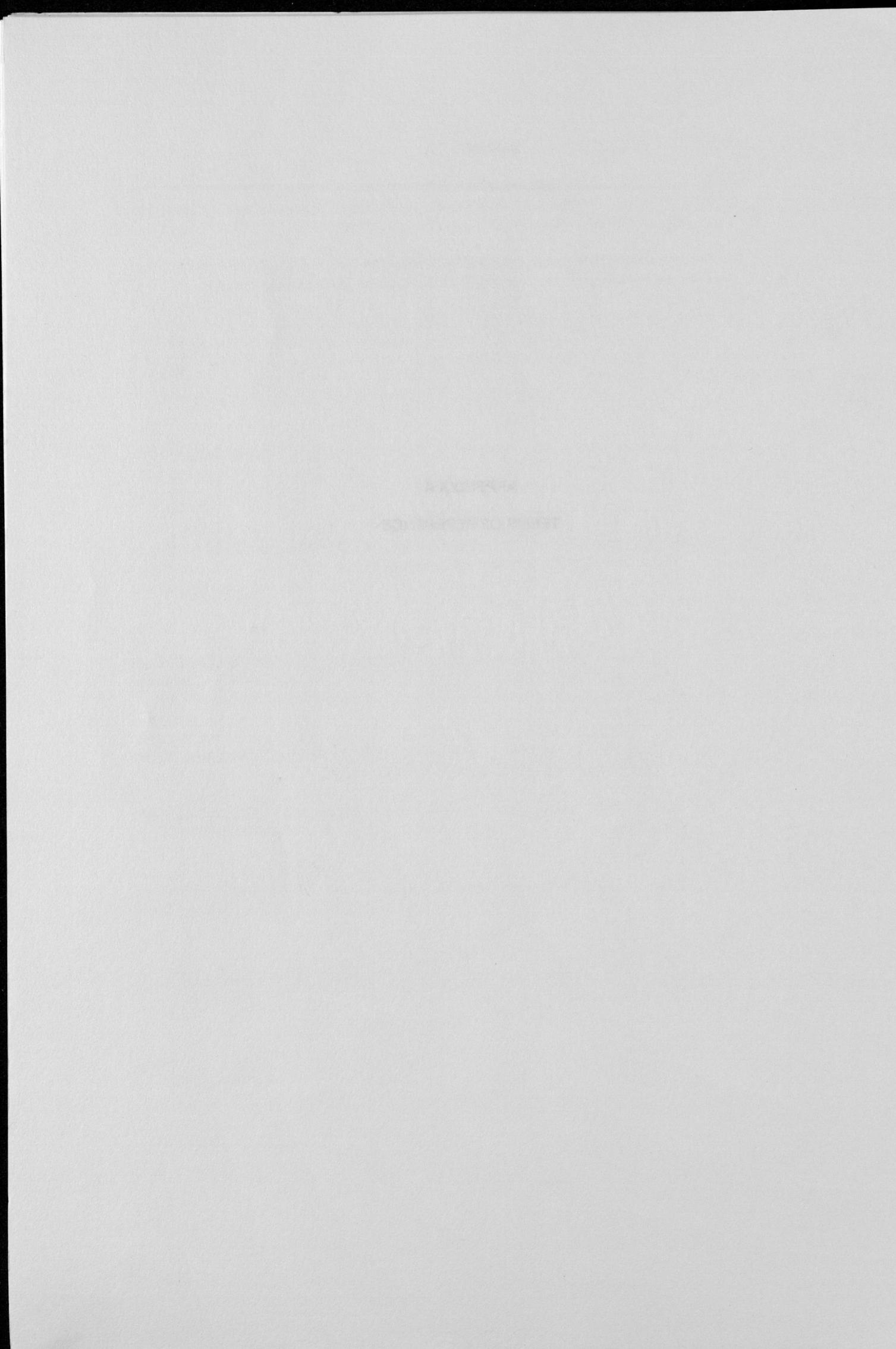
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APPENDIX A

TERMS OF REFERENCE CONSULTANCY AGREEMENT RECYCLING OF PESTICIDE DRUMS

The Republic of Sudan has received a Credit from IDA for the Agricultural Rehabilitation Project III. The World Bank and Government of Sudan are concerned with the safe handling and usage of pesticides, and this aspect is being addressed through the Integrated Pest Management Program being developed under the Project.

A Consultant is needed to advise the schemes regarding safe measures to clean and recycle old pesticide containers.

Terms of Reference

1. To review current practises on the irrigated schemes (Gezira, Rahad, New Halfa, Blue Nile and Suki) for collection and disposal of excess pesticide (residues in drums and containers) and empty drums, with particular attention to health and environmental hazards.
2. Together with Agricultural Corporations and local representatives of the pesticide industry to present options for establishing a system for handling excess (residues in drums and containers) pesticides and empty drums, including cleaning and re-use where appropriate, and safe destruction, and/or final disposal of non-re-useable items. Presentation of alternative approaches should include institutional requirements and an estimate of costs, and an assessment of health and environmental impact under practical field implementation conditions.
3. To ascertain stocks held and the condition of containers of outdated and/or banned production schemes, and to identify as far as possible practical and logistical problems that may be encountered for their destruction, with suggestions for possible options. The study would, however, exclude critical assessment of technical aspects or problems involved for the suggested options and assessment of related costs involved in the disposal of such pesticides.
4. Report findings in draft format for discussion with the AUAC/RPMU, and subsequently present a final report in 5 copies.

ANNEXURE A

TERMS OF REFERENCE
CONSULTANCY AGREEMENT
RECYCLING OF PESTICIDE DRUMS

The Republic of Sudan has received a Credit from IDA for the Agricultural Rehabilitation Project III. The World Bank and Government of Sudan are concerned with the safe handling and reuse of pesticides, and the aspect is being addressed through the Integrated Pest Management Program being developed under the Project.

A Consultant is needed to advise the schemes regarding safe measures to clean and recycle old pesticide containers.

Terms of Reference

1. To review current practices on the improper schemes (Khartoum, Khartoum, Khartoum, Khartoum, Khartoum) for collection and disposal of excess pesticides (drums, cans and containers) and empty drums with pesticide residues to identify and derive viable alternatives.
2. Together with Agricultural Organizations and local representatives of the pesticide industry to present options for establishing a system for handling excess (residues in drums and containers) pesticides and empty drums including cleaning and reuse where appropriate and safe destruction and final disposal of non-reusable items. Presentation of alternative approaches should include technical requirements and an estimate of costs and an assessment of health and environmental impact under different field implementation conditions.
3. To ascertain local laws and the condition of containers of collected and/or damaged production schemes and to identify as far as possible practical and technical programs that may be encouraged for their destruction with suggestions for possible options. The study would however, exclude critical assessment of technical aspects or programs involved for the suggested options and assessment of related costs involved in the disposal of such pesticides.
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APPENDIX A

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MAY 1964

APPENDIX B

CONSULTANT ITINERARY - MARCH 1989

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Tue 14 Thurs 16	- Khartoum
Fri 17	- to Wad Medani
Sat 18	Sudan Gezira Board; Central Stores
Sun 19	Wad Medani; Shell Incinerator; S.G.B. (Vehicle hire)
Mon 20	Wad Medani; S.G.B. Barakat Store, Ciba-Geigy
Tues 21	To New Halfa; Crop Prot. Dept
Wed 22	New Halfa: Crop Prot and Stores Depts
	To Fau - Rehad Scheme
Thurs 23	Rahad: Crop Prot and Stores Dept
	To Wad Medani: Shell Chem Formulation Plant
Fri 24	To Sennar
Sat 25	To Wad Tuktuk: Suki Scheme
	Suki: Crop Protection & Store Dept
Sun 26	Blue Nile Scheme: Crop Protection & Stores Dept
	To Wad Medani
Mon	Wad Medani: SGB Final Discussions. Commercial Organisations
Tues 28	To Khartoum Report Writing
Wed 29 - Thurs 30	Khartoum Report writing
Fri 31	Depart Sudan

APPENDIX B

CONSULTANT ITINERARY - MARCH 1990

Travel UK - Dublin	Mon 18
Kilshaura	Tue 19 - Thurs 19
To West Meath	Fri 17
Subs. Geoin. Board, Central Stone	Sat 18
West Meath, Birl. Inspector, G.G.B.	Sun 19
(Dublin area)	
West Meath, G.G.B., Birl. Stone (Droghda)	Mon 20
To New Hill, Carr. Fint. Dept.	Tues 21
New Hill, Carr. Fint. and Stone Dept.	Wed 22
To Carr. Fint. Stone	
Plant, Carr. Fint. and Stone Dept.	Thurs 23
To West Meath, Shell Chem. Pollution Plant	
To Carr. Fint.	Fri 24
To Carr. Fint. Stone Dept.	Sat 25
Stone, Carr. Fint. Stone & Stone Dept.	
Stone, Carr. Fint. Stone & Stone Dept.	Sun 26
To West Meath	
West Meath, G.G.B. Field. Discussion - Commercial	Mon
Discussion	
To Carr. Fint. Stone Dept.	Tues 28
Kilshaura, Carr. Fint. Stone Dept.	Wed 29 - Thurs 30
Dublin, Carr. Fint. Stone Dept.	Fri 31

APPENDIX C
NEW HALFA STORES SITUATION

EXHIBIT
METALLOGRAPHIC REPORT

APPENDIX C

NEW HALFA STORES SITUATION

1. Present Situation

Scheme management in collaboration with World Bank, are planning to upgrade their stores and storage procedure. It thus seems appropriate to comment on the store situation since if the recommended option regarding drum cleaning facilities is adopted its implementation must be integrated into any programme to upgrade, reconstruct, or resite pesticide stores.

Pesticides are currently stored at 2 Central store depots and at five of six Group stores. The last Group is supplied direct from the central store. The bulk of insecticides are held in a "temporary" open, fenced, store site immediately next to the main town fuel supply depot. All new insecticides are held there on arrival and are distributed to Group stores as required during a season. Empty drums from one group return there direct plus part drums during and at the end of the season from most groups. Some outdated chemicals are also there. The store site has been temporary since at least 1984-85.

The bulk of banned and outdated insecticides are held in the open at the main central store depot. These were never moved to the temporary store site because of the variable condition of the drums, some of which are rusted and holed.

The central store buildings are of excellent construction and of three main designs. The older ones are typical long warehouses, not too high, roofed, fully enclosed. The new ones are of very modern design with heavy steel girders, both vertical and roof. Their side height is some six or metres, central perhaps eight metres. Width is 10 metres; lengths are variable. One long store is fully enclosed with corrugated zinc sheets, two others are open; the smaller one being 15m long (3 spans).

Regrettably these stores are designed for vertical stack storing with fork left essential. The design is thus inappropriate for Sudan (or any underdeveloped country) where manpower and land area are freely available but facilities for high stacking are not. Thus these expensive stores cannot be used to their optimum. It is understood one of these open small stores is at each Group. Should new stores be constructed they should be long, low stores with a good roof overhang, with walls 1 to 1.5 high, allowing maximum ventilation.

2. Considerations for the future

Criteria for siting a store for pesticides should include:

- i. It must be accessible for delivery vehicles.
- ii. It should not be close to houses, shops, farm plots, factories, fuel depots.
- iii. It should not be near any source of public water supply.
- iv. There should be no hazard of pesticide spills entering drainage channels, water courses.
- v. There should be no possibility of flooding from a canal nor torrential rain i.e. there should be some slop for natural run off.
- vi. It must be possible to erect a surrounding security fence.
- vii. In addition if a drum cleansing facility is to be included the site requires a piped water supply and space for an evaporating pond. Electricity is not essential.

New Halfa Corporation appear to have four options:

- a) Fully develop the temporary site.
- b) Reorganise and develop part of the central store site.
- c) Select one of the group store sites for development.
- d) Find a completely new site near to but outside Halfa township.

APPENDIX C

NEW HALL STORES SITUATION

Present Situation

Scheme management in collaboration with World Bank, are planning to upgrade their stores and storage procedures. It has been suggested to construct on the store extension since the recommended stores regarding clean storage facilities is shown in the information that is presented in the programme to upgrade, reconstruct, or re-site buildings.

Facilities are currently stored at 2 Central store blocks and at one of six Distribution. The last Group is situated along from the central store. The bulk of materials are held in a "temporary" open layout store which is currently used to store materials. All new materials are held in an open and the distributed to Group stores as required during a season. Experiments from one group from the past few years have shown that the end of the season can be managed. Some outside storage facilities are available. The store site was used temporarily since at least 1987-88.

The bulk of parked and stacked materials are held in the open at the main central store block. These were never moved to the temporary store site because of the variable condition of the dirt, some of which are rutted and heeled.

The central store buildings are of excellent construction and of great main design. The other ones are built along with heavy steel girders, both vertical and horizontal. The new ones are of very modern design with heavy steel girders, both vertical and horizontal. The side height is some six or more, central height eight meters. Width is 10 meters, length six meters. One long wall is fully enclosed, with corrugated zinc sheets, two others are open, the smaller one being fully enclosed.

Presently these stores are designed for vertical stack, stored with top left reversal. The design is thus long, narrow for (any underdeveloped country) where the power and land are not available and facilities for (any) stacking are not. The three expensive stores cannot be used in their present state. It is suggested one of these open small stores is to be Group. Should new stores be constructed they should be long low stores with a good roof overhang with walls to a high level of maximum ventilation.

Conditions for the future

- i) Criteria for setting a store for materials should include
- ii) It should be possible for delivery vehicles
- iii) It should not be close to houses, shops, farm plots, factories, fuel depots
- iv) It should not be near any source of public water supply
- v) There should be no reason for pesticide and/or other storage channels, water courses
- vi) There should be no possibility of flooding from a canal or torrential rain fall
- vii) There should be some land for natural air flow
- viii) It must be possible to erect a surrounding security fence
- ix) It should not be near a main drainage facility to be included the site and this is piped water supply and space for an evaporating pond. Electricity is not essential.

New Hall Corporation appears to have four options

- a) Fully develop the temporary site
- b) Reorganize and develop part of the central store site
- c) Select one of the group store sites for development
- d) Find a completely new site near to but outside the townships

Option a) should be rejected since it lies immediately next to the fuel depot. In the event of a fire at the depot pesticide drums would probably explode and release toxic fumes over the town.

Option b) appears feasible and has the advantage of meeting criteria i, ii, iii, vi and vii. Additionally the small store could be easily converted to a drum cleaning facility (it is currently wasted as a lubricant drum store). The site does not meet criteria iv and v at present since a drainage canal runs about 10 metres away from the small store. That canal might be diverted or a fully protecting bund constructed. There is ample space for storage of empty drums on the ground and for construction of a suitable long, low-roofed, part-walled (1-1.5m), and thus well ventilated, store for pesticides. There is also an old fully enclosed store available for herbicides and powder products.

The main disadvantage of this as a site is that the new Training Centre is being constructed about 100m away to one side, but this is not a serious hazard. The other three sides of the site are a large vacant plot, the rest of the central store with large grounds, and the main corporation workshop beyond a fence and a high hedgerow.

Options c) and d) would no doubt be considered by Halfa management and should also take account of possible relocation of the main airstrip. It is, however, suggested that all these matters be treaded with some urgency. There is time for careful consideration and presentation of proposals to donor or government agencies, but if discussions with the other authorities (Municipality, Health Dept, Water Supply) are not got underway there could be a last minute rush, leading to an unsatisfactory decision.

Note: A parallel situation exists with regard to the Rahad Corporation central store. The general comments about New Halfa may be helpful for Rahad also.

Option 5) should be rejected since it lies immediately next to the fuel depot. In the event of a fire at the depot pesticides drums would probably explode and release toxic fumes over the town.

Option 6) appears feasible and has the advantage of meeting criteria i, ii, iii, iv and v. Additionally the small store could be easily converted to a drum cleaning facility (it is currently used as a hazardous drum store). The site does not meet criteria iv and v at present since a drainage canal runs about 10 metres away from the main store. This canal might be diverted or a fully protected bund constructed. There is ample space for storage of empty drums on the ground and for construction of a suitable long low-walled (1-1.5m), and thus well ventilated, store for pesticides. There is also an old fully enclosed store available for herbicides and powder products.

The main disadvantage of this site is that the new Training Centre is being constructed about 100m away to one side, but this is not a serious hazard. The other three sites of the site are a large vacant plot, the rest of the central store with large gutters and the main corporation workshop beyond a fence and a high hedgerow.

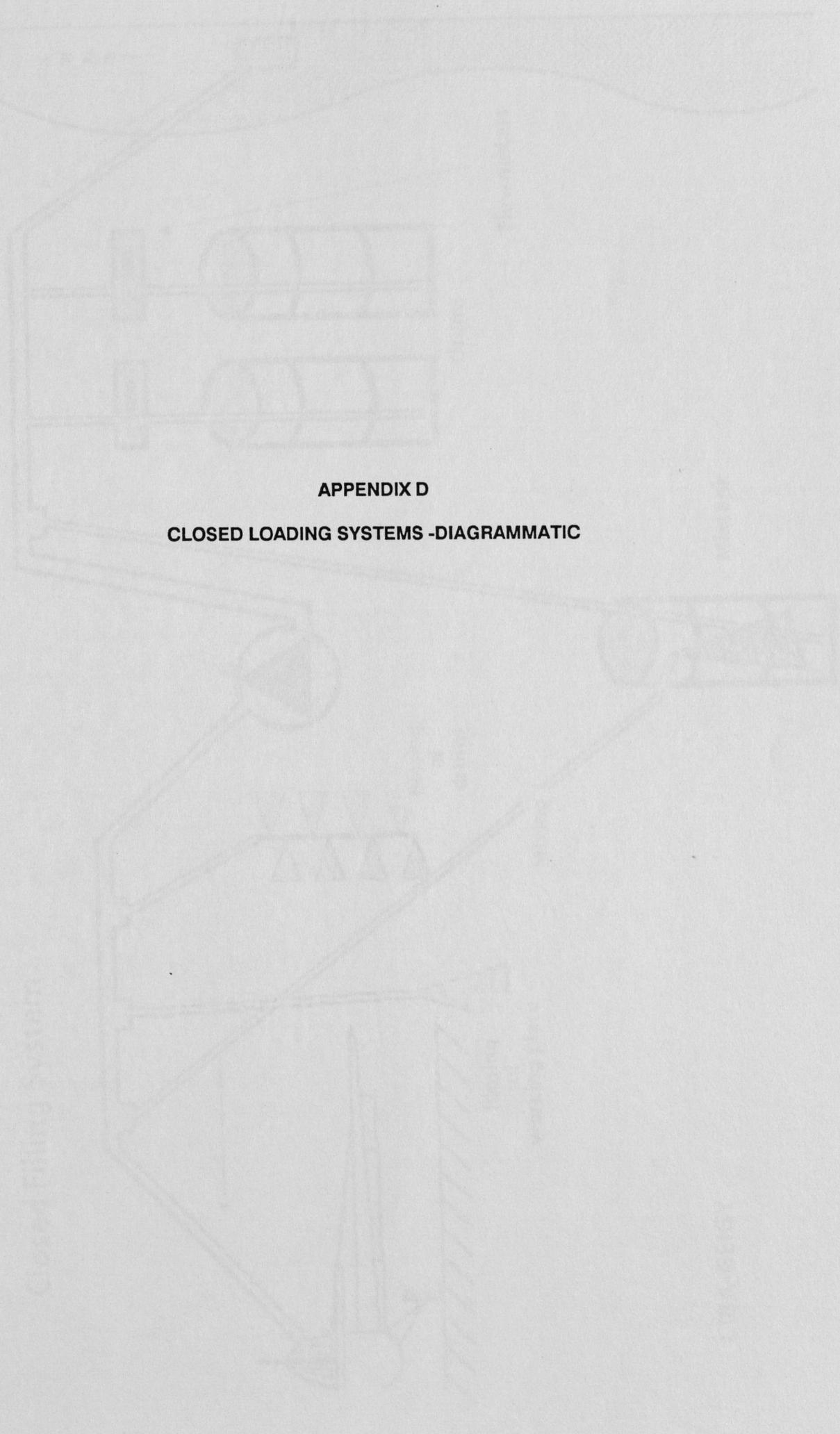
Options c) and d) would no doubt be considered by Ratsid management and should also take account of possible relocation of the main workshop. It is, however, suggested that all three sites be treated with some urgency. There is time for careful consideration and presentation of proposals to donor or government agencies, but if discussions with the other authorities (Municipality, Health Dept, Water Supply) are not got underway there could be a real minute rush leading to an unsatisfactory decision.

Note: A parallel situation exists with regard to the Ratsid Corporation central store. The general comments about New Falls may be helpful for Ratsid also.

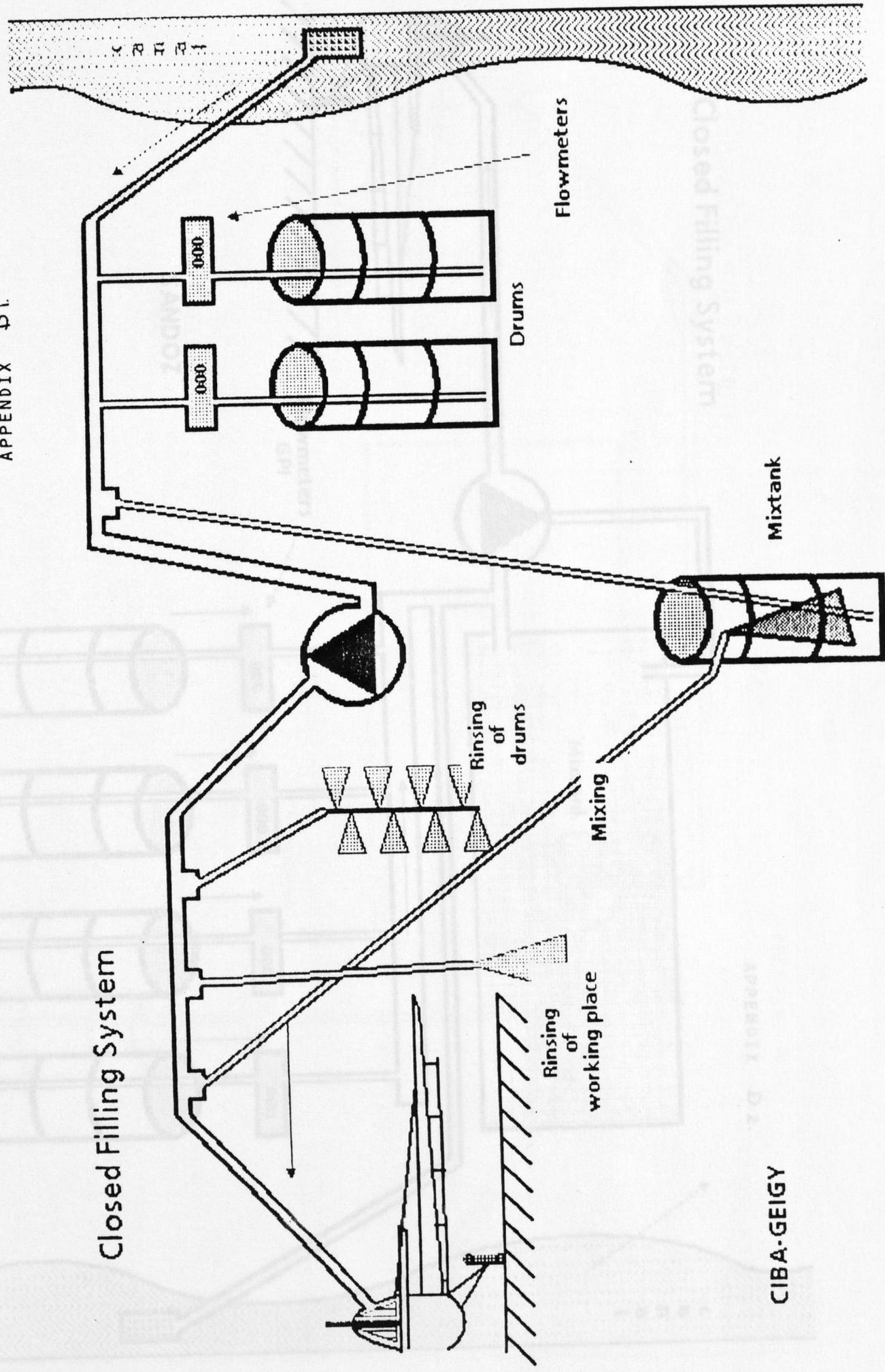
APPENDIX D

CLOSED LOADING SYSTEMS -DIAGRAMMATIC

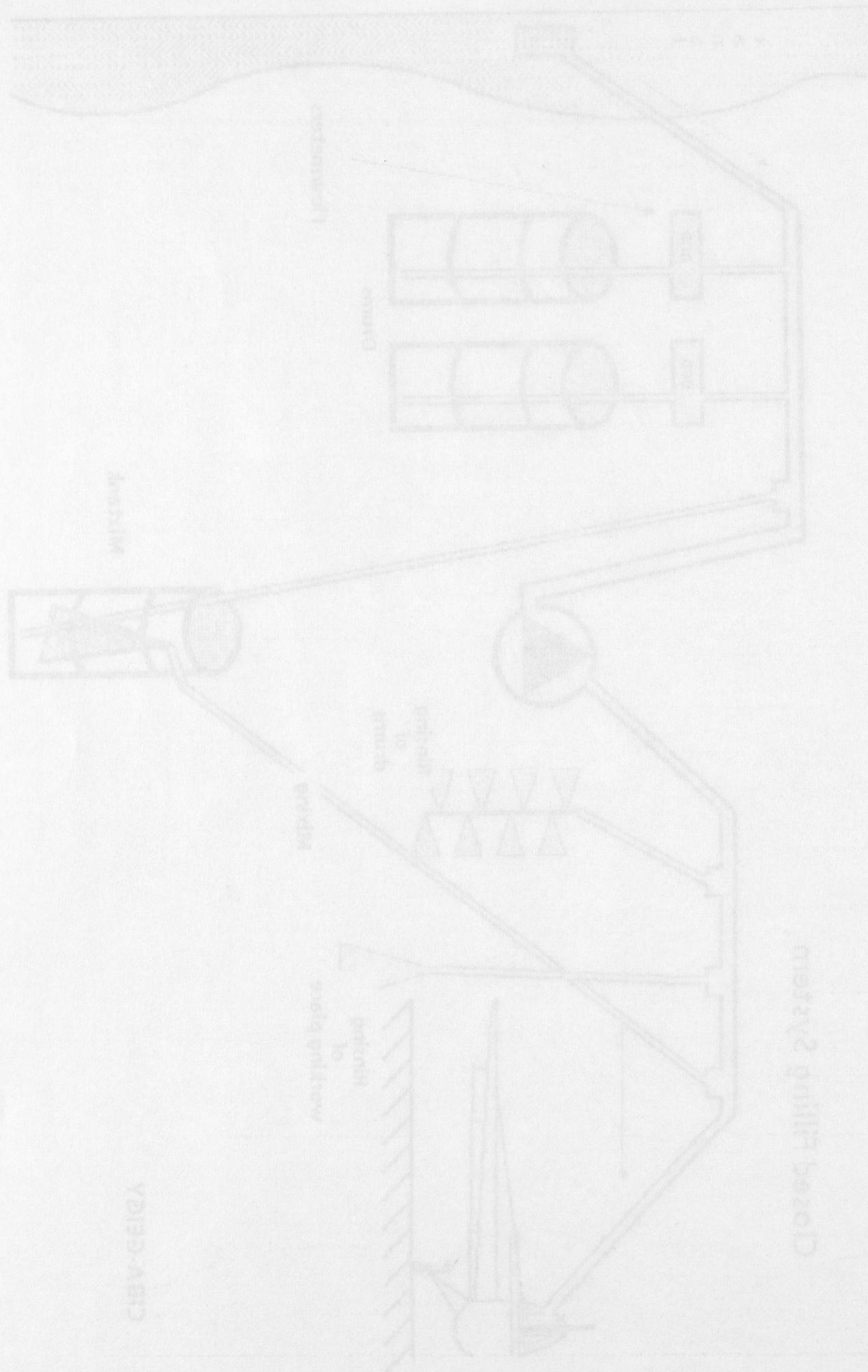
Closed Filling System



APPENDIX B
CREDIT RISK MANAGEMENT SYSTEMS



CIBA-GEIGY



Кухня

Зал

Гостиная

Спальня

Ванная

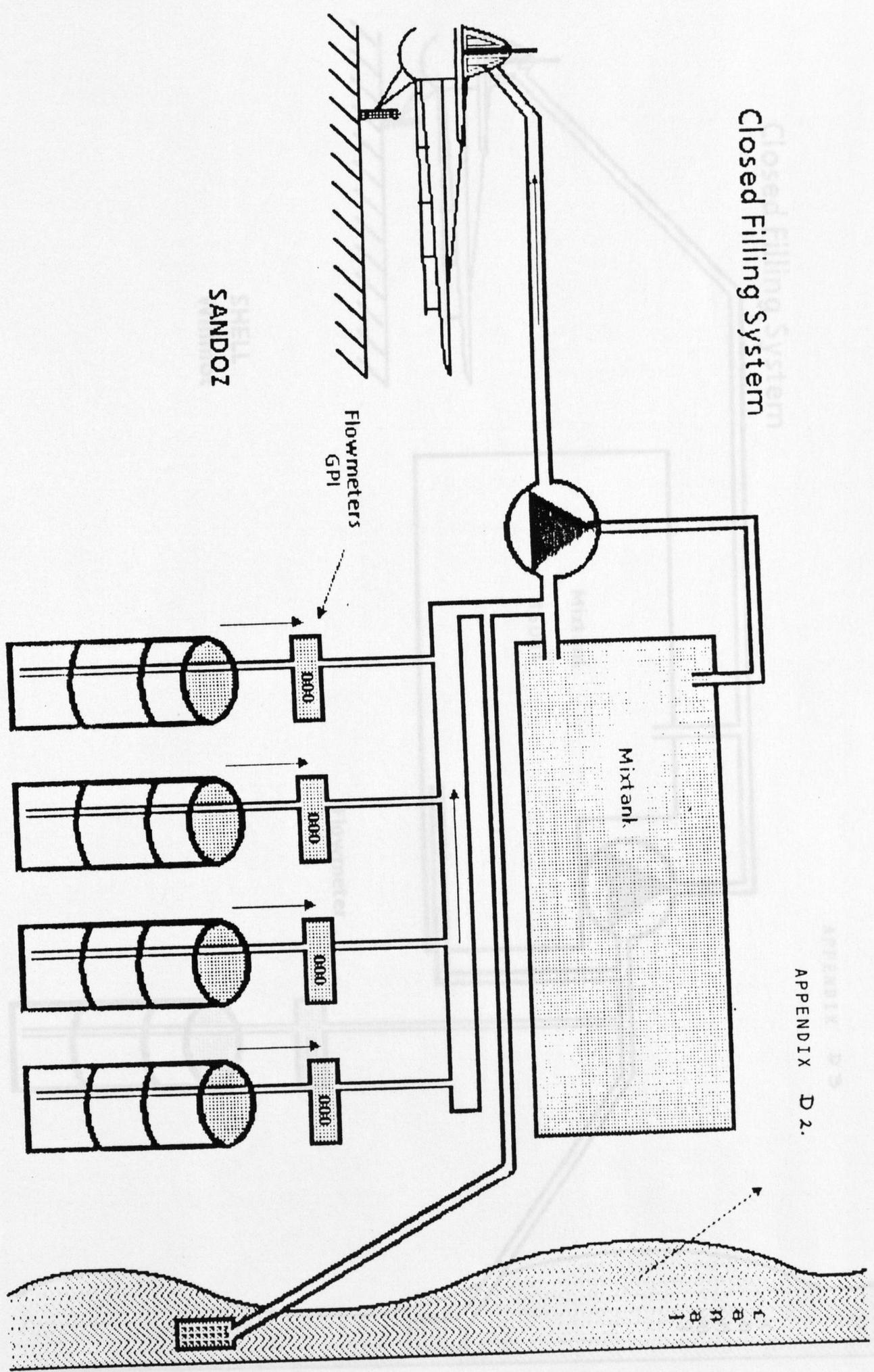
Туалет

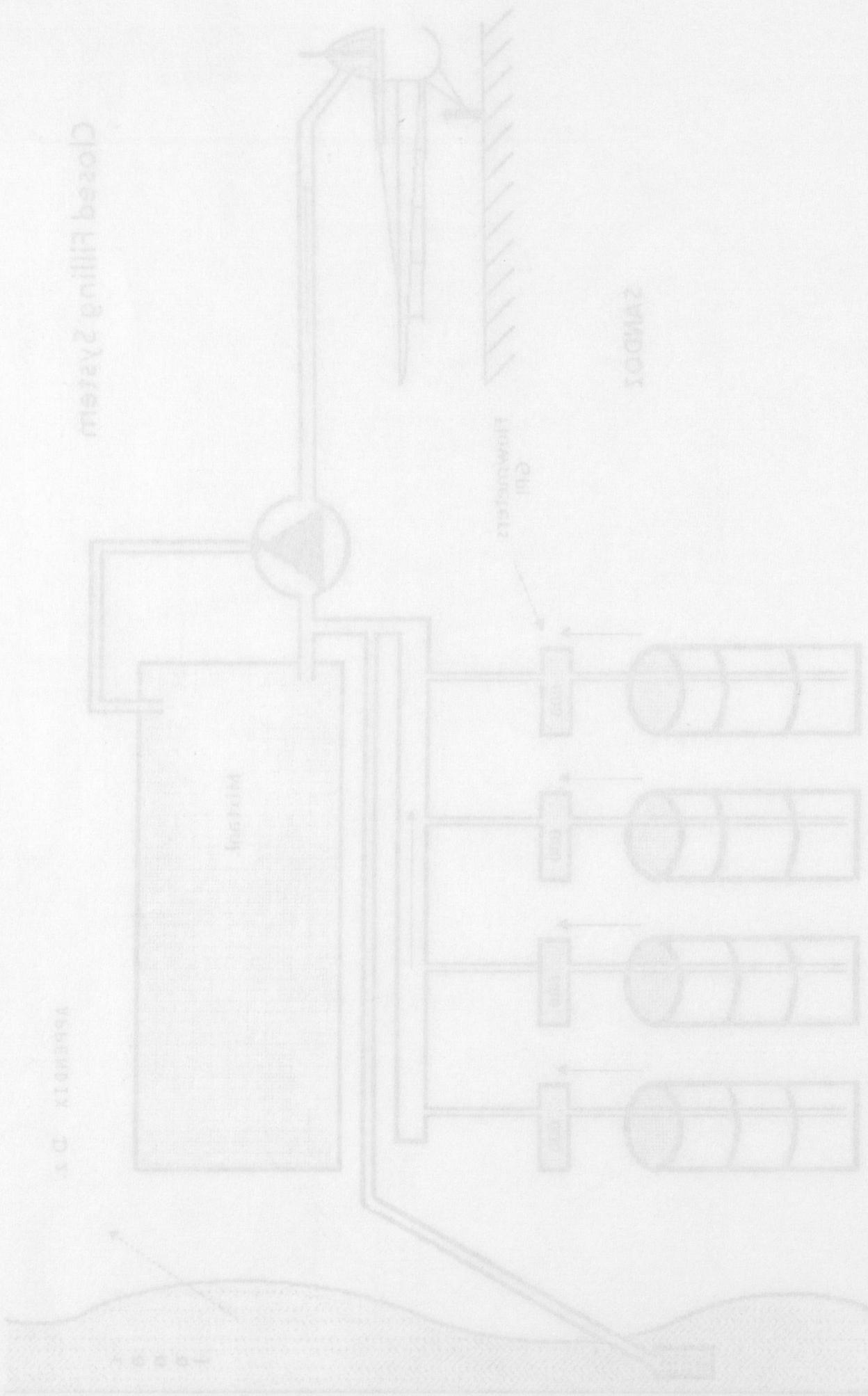
Склад

Вход

Архитектор

Closed Filling System

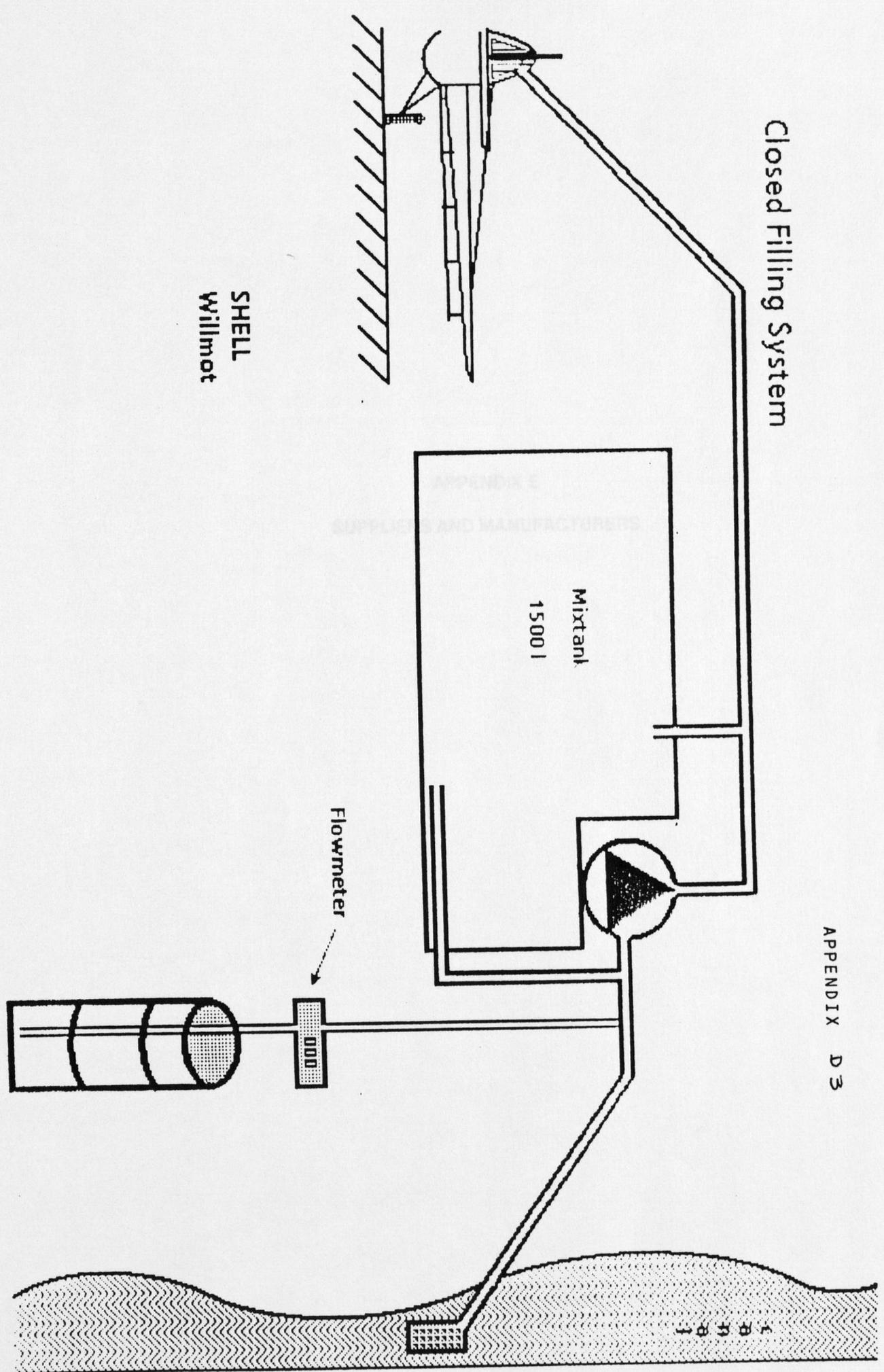




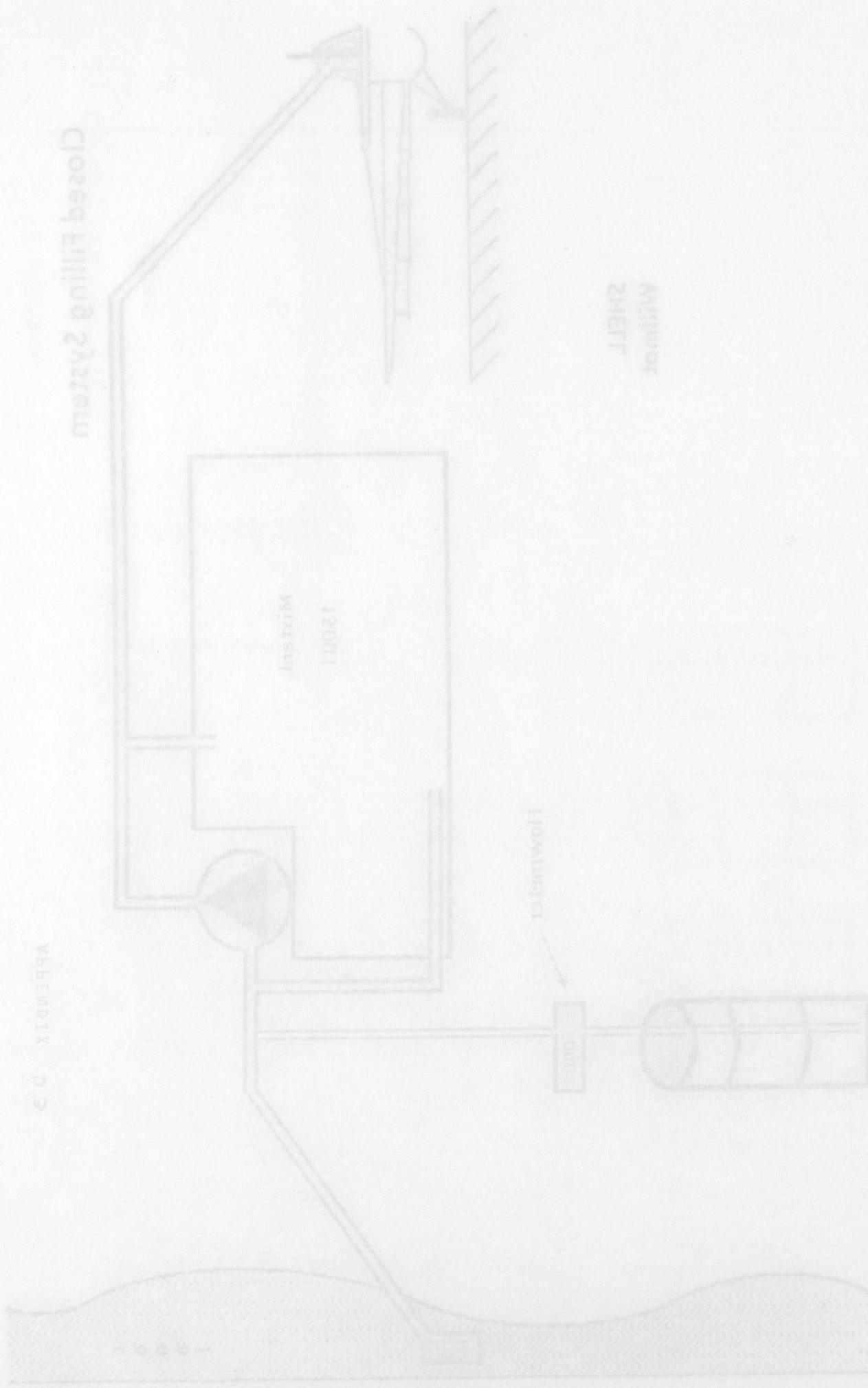
Closed Filling System

APPENDIX D.1

Closed Filling System



SHELL
Willmot



Closed Filling System

Water Meter

APPENDIX D.3

APPENDIX E

SUPPLIERS AND MANUFACTURERS

METEOR

APPENDIX E

SUPPLIERS OR MANUFACTURERS OF EQUIPMENT

1. Drum Reconditioning Plant

DRUMTECH
Stockholm Road, Sutton Fields Industrial Estate
Hull HU8 OXL
England
Telex: 592525

2. Pressurised Water/Steam Cleaners

W S SHEPHERD
280 Hertforbury Road
Hertford
England

MCMASTER CARR
PO Box 4355
Chicago
Illinois 60680

3. Caustic Soda (ICI pearl type industrial)

ELLIS & EVERARD
Billericay
Essex
England

4. Solvents

SAM BANNER & CO LTD
59/61 Sandhills Lane
Liverpool L5 9X4
England

T R INTERNATIONAL
7-9 Crow Lane
Rochester
Kent ME1 1RF
England

5. Sentinel/Carbo-flo Water Effluent Treatment Plant

E. ALLMAN AND COMPANY LIMITED
Birdham Road
Chichester
West Sussex PO20 7BT
England

APPENDIX B

SUPPLIERS OF MANUFACTURED EQUIPMENT

1	Drum Reconditioning Plant DRUMTECH Duckhorn Road, 2 Lion Works Industrial Estate Hill Top OX1 England Tel: 0225 222222
2	Reconditioned Water/Steam Cleaners W2 SHEPHERD 200 Kentonway Road Hendon England
3	MCMASTER CARP PO Box 222 Chicago Illinois 60602
4	Castle Goods (CI) Saw-type equipment EELS & EVERARD Barnway Essex England
4	Solvants SAM BAWNER & CO LTD 141-143 Sandringham Lane Liverpool L6 9XA England
5	T R INTERNATIONAL 1-9 Cow Lane Rochester Kent ME1 1RF England
5	Sentinel, Cadeo for Water Effluent Treatment Plant E ALMAN AND COMPANY LIMITED Briham Road Chichester West Sussex PO20 1BT England

METEOR

TRIPLE PURPOSE STEAM CLEANER AND HIGH PRESSURE HOT OR COLD WATER WASHER



SPECIFICATION

METEOR 1300 METEOR 2000

Pump type	Triple plunger	Triple plunger
Pump motor	2.2 Kw (3HP)	4 Kw (5.5 HP)
Pump output	13 l/min (2.8 gpm)	15 l/min 3.3 gpm)
Max pressure	90 Bar (1300 psi)	145 Bar (2000 psi)
Hot water temperature	85°C	85°C
Steam pressure	42 Bar (600 psi)	68 Bar (1000 psi)
Steam temperature	120°C	120°C
Fuel consumption	8 lph (1.75 gph)	9 lph (2.0 gph)
Electricity supply	13 amp 1 ph	3 phase 415V
Water supply	17.5 l/min (4 gpm)	20 l/min (4.5 gpm)
Case length	9 m (30 ft)	9 m (30 ft)
Weight empty	160 kgs (385 lbs)	180 kgs (398 lbs)
Overall length	104 cms (41")	125 cms (49")
Overall height	71 cms (28")	75 cms (30")
Overall width	69 cms (27")	71 cms (28")
Fuel tank size	20 litres (4.5 gals)	20 litres (4.5 gals)
Detergent tank size	20 litres (4.5 gals)	20 litres (4.5 gals)

OPTIONAL EXTRAS

Lance extensions – Rotating brush – Vehicle washing brush – Variety of special jets – Alternative voltage motors – Earth leakage circuit breaker – Drain cleaning jet – Sand blaster.

SAFETY FEATURES

A full range of safety features include Water failure cut out – Unloader valve – Excess pressure release valve – Thermal overload protection – Trigger controlled hand lance – Over temperature cut out switch.

Supplied by :-

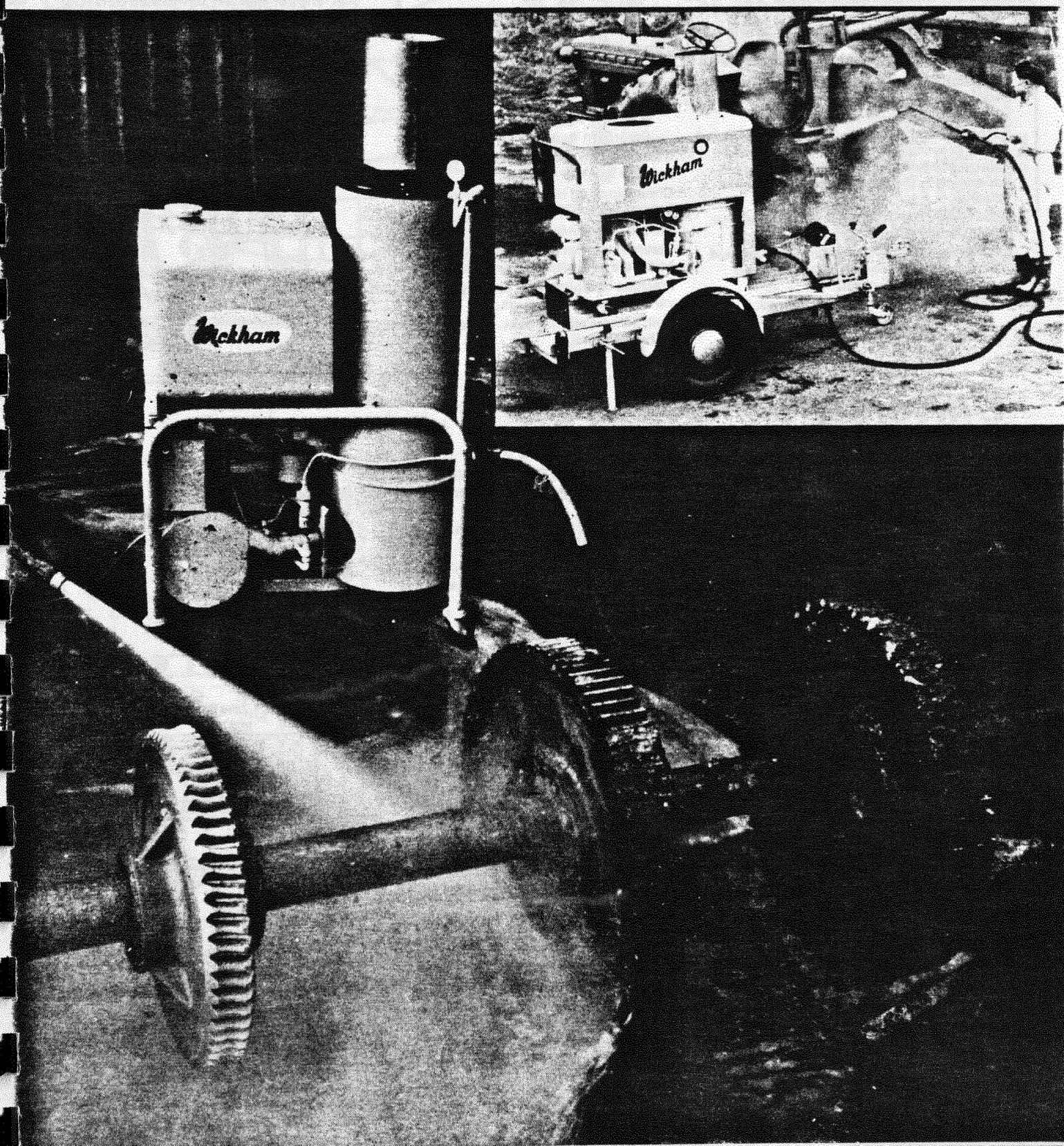
W. S. SHEPHERD

**280 HERTINGFORDBURY ROAD
HERTFORD.**

W (WARE)

WICKHAM
**Steam
Cleaners**

*a range of steam cleaners
to meet every cleaning requirement*



Handy Dandy

Driven by electric motor, petrol engine or propane engine

Fired by paraffin or propane gas

Control automatically adjusts working pressure between 80 and 100 psi (5.5 and 7 bar)

Fuel and steam filters

Wheel mounted for complete manoeuvrability

Variety of steam jets

Built-in water, fuel and detergent tanks

Water tank with approved type ball valve

A simple to operate, reliable and economically priced machine that has proved itself as probably the world's best selling steam cleaner. More Handy Dandys are in operation in the UK than any other steam cleaner.

The Handy Dandy is successfully used in a wide variety of applications, including:-

- Removal of grease and hard packed mud from vehicles, construction plant and workshop equipment.
- Cleaning and sterilizing buildings, abattoirs, food carrying vehicles, kitchens, and food containers.

- High speed cooking of animal foodstuffs.
- Removal of preservative wax from new vehicles using specially formulated Gensol solvents.

Specification

Steam Output: 409 litres (90 gals) of wet steam per hour at adjustable pressures up to 7 bar (100 psi).

Motor: 1/3 HP single phase electric motor or 150cc petrol/propane engine.

Pump: Slow speed diaphragm type.

Burner: Air atomising type for use with paraffin.

Tank capacities:

Fuel Tank - 38.5 litres.

Detergent Tank - 43 litres.

Consumption per hour: 9 litres (2 gals) of paraffin ¼ kW/hr electricity.

Dimensions on tricycle: 1450mm long, 610mm wide, 1300mm high.

Weight on tricycle: 200 Kg.

Steam Hose: 9m (30ft) reinforced steam hose complete with steam lance jets.

Machine complete with safety pressure relief valve and pressure gauge.

Coil: 44mm (148ft). 3 pass. Pressure tested to 35 bar (500 psi).

Optional Extras:

Mounted on road trailer

Lance extension

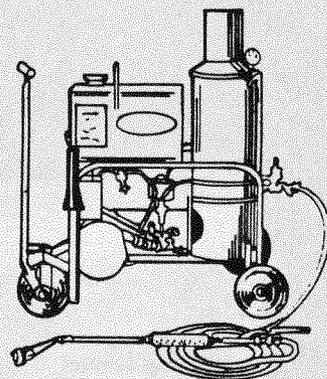
50mm flat jet

Dewaxing lance and fittings

Descaling bucket and hose

Back pressure gauge and tap, to test for scale formation in hard water areas.

A range of specially formulated GENSOL cleaning compounds is available for use with this steam cleaner to cater for every cleaning problem.



Universal

Driven by electric motor, petrol engine or air engine

Fired by paraffin or gas gas

One or two gun operation

Dual purpose automatic ignition (electric motor driven models only)

Control automatically adjusts working pressure between 80 and 100 psi (5.5 to 7 bar)

Fuel and steam filters

Variety of steam jets

Built-in water, fuel and detergent tanks

Water may be drawn from auxiliary tank when mains supply not available

Wheel mounted for complete manoeuvrability

Water tank with approved type ball valve

The senior member of the Wickham steam cleaning family. A hard hitting machine for the very toughest cleaning jobs in transport sections, building sites, around the factory or on the farm.

Specification

Steam Output: 545 litres (120 gals) of wet steam per hour at adjustable pressures up to 7 bar (100 psi).

Motor: 1/2 HP single or three phase electric motor, diesel engine or air motor.

Pump: Slow speed diaphragm type.

Burner: Air atomising type for use with paraffin or gas oil.

Tank capacities:

Fuel Tank - 45.5 litres.

Detergent Tank - 59 litres.

Consumption per hour: 13.5 litres (3 gals) of paraffin or gas oil. .4 kW/hr electricity.

Dimensions on tricycle: 1650mm long, 760mm wide, 1250mm high.

Weight on tricycle: 360 Kg.

Steam Hose: 9m (30ft) reinforced steam hose complete with lance and jet.

Complete with safety pressure relief valve and pressure gauge and back pressure testing kit to ascertain when descaling is required.

Coil: 53mm (175ft). 3 pass. 12.7mm bore.

Mounted on rugged tricycle.

Automatic and manual ignition.

Optional Extras:

Two gun operation complete with 9m extra hose, lance and jets.

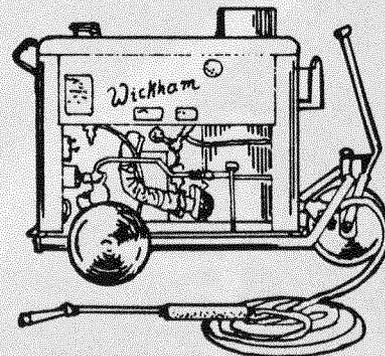
Mounted on road trailer

Lance extension

50 and 76mm flat jet

Dewaxing lance and fittings

Descaling bucket and hose



Nationwide Sales & Service

ASSESSED TO DEFCON STAN AQAP 9



Free demonstrations anywhere in the UK.

Wickham Industrial manufacture the most comprehensive range of vehicle cleaning equipment.

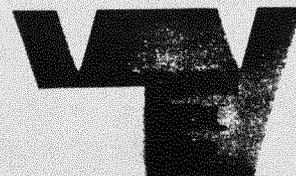
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High
'Ger

Supplied by :-

W. S. SHEPHERD

WI

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The 2255 page McMaster-Carr Catalog, listing 140,000 items has been designed to satisfy the supply needs of business men all over the world. The McMaster-Carr Export Department is organized to process an order the day it is received. Over 90% of all lines are shipped from inventory assuring that you have our quality material when you need it. McMaster-Carr's full service distribution centers are located only minutes away from major international air-ports and ocean ports to give our overseas customers the fastest possible service. Your satisfaction is our guarantee.

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Several methods of ordering your merchandise are available: mail, cable, telex, teletype, FAX or telephone. To order simply identify the items and quantities you require from the McMaster-Carr Catalog, using your own purchase order form. List the items and include the correct McMaster-Carr part number for each item (where items have several sizes or different technical specifications be sure to select the appropriate part numbers). Describe the item to include size, and any other specific characteristics. Designate the method of shipment and the address to which the material should be shipped. For methods of shipment and payment see below. For countries that require import licenses on certain items consult with your local authorities, Chamber of Commerce, import office, etc. If a license is required send it and the necessary copies of information with your order.

METHODS OF SHIPMENT

The McMaster-Carr Export Department is prepared to efficiently and expeditiously handle your order by any means of transport—air or ocean freight, air parcel post, parcel post, UPS Air, or courier.

METHODS OF PAYMENT

Cash with order. This is the simplest method of payment for new customers who have not yet established a business relationship with McMaster-Carr. Include with your order a check or bank draft to cover the estimated amount of the material and freight. You will be credited for any overage or billed in the event the estimate was for more than actual cost. If your local regulations permit freight cost can be handled on a collect basis. Letter of credit. This method of payment is especially valuable for customers in countries where currency controls are in effect. Simply open a Letter of Credit in favor of McMaster-Carr for the cost of merchandise. permit freight and handling to be charged against the Letter of Credit at actual cost. Our bank is Continental Illinois National Bank and Trust Company of Chicago, Chicago.

Illinois, U.S.A.

Cash against Documents or sight draft: Have your bankers agree with a correspondent bank in the United States, (preferably Continental Illinois) to pay upon presentation of proof of shipment documentation the cost of materials, freight and charges to our bank or a correspondent bank. In your order designate bank and specific documents required.

Cash on delivery: Where the transportation mode and International Regulations permit you may specify cash on delivery.

Open account: Regular customers may request establishment of credit on an open account basis by providing the following information: 1. Name of bank, 2. Name and address of 3 (three) U.S. suppliers with whom you currently do business, or 3. Name and address of 3 (three) local suppliers with whom you currently do business. Acknowledgement and acceptance requires approximately one month.

Financing: McMaster-Carr will assist in processing applications for Foreign Credit Insurance Association guarantees, U.S. Export-Import Bank and conventional loans. Write for details. McMaster-Carr will accept time Letters of Credit at the prevailing discount rate.

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The McMaster-Carr Export Department is prepared to provide you with quotations or pro forma invoices on request. Simply state your requirements as you would for an order and request either a pro forma invoice or a quote. If the items required are not listed in the catalog, please provide complete item descriptions. Please specify mode of shipment and port of discharge so that freight costs may be accurately estimated. Freight costs will always be charged at actuals.

McMaster-Carr has no representatives or agents therefore no commissions are charged or added. Quotations are valid for 90 days and may be extended subject to the approval of McMaster-Carr.

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Ocean Freight	Time	Freight Charges	Minimum Charges
North European Ports	10-20 Days	\$160.00	\$135.00
Middle East Ports	23-30 Days	180.00	210.00
West African Ports	32-39 Days	200.00	190.00
South American Ports	23-30 Days	300.00	210.00
Approximate charges based on 2240 lbs./40 cubic feet			
Air Freight			
Frankfurt, Germany	24-48 Hours	\$2.28/kg	\$28.00
London, England	24-48 Hours	2.35/kg	28.00
Paris, France	24-48 Hours	5.10/kg	55.00
Dhahran, Saudi Arabia	96-148 Hours	3.20/kg	70.00
Quito, Ecuador	96-120 Hours	3.15/kg	20.00
Santiago, Chile	96-120 Hours		

* Plus normal charges for documentation which vary. N.B. Charges are for General Freight. Charges for specific classifications are usually lower.

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El departamento de Exportación de McMaster-Carr está en condiciones de manejar su pedido de manera eficiente y rápida por cualquier medio de transporte, sea flete aéreo o marítimo, paquete postal aéreo, paquete postal, UPS, aéreo, o expreso económico.

MÉTODOS DE PAGO

De contado con el pedido: Este es el método de pago más sencillo para los nuevos clientes que todavía no han establecido una relación de negocios con McMaster-Carr. Con su pedido incluye un cheque o giro bancario para amparar la cantidad estimada del material y el flete. Cualquiera sobrepago se le acreditará o se le facturará en caso de que el estimado sea menor al precio actual. Si las regulaciones de su país lo permiten, el costo del flete podrá efectuarse a base de pago a la entrega. Carta de Crédito: Este método de pago es especialmente valioso para clientes en países donde los controles sobre la moneda corriente rigen. Simplemente abra una Carta de Crédito en favor de McMaster-Carr por el costo de la mercancía y permita que el flete y el acarreo sean cargados contra la Carta de Crédito al costo actual. Nuestro banco es: Continental Illinois National Bank and Trust Company of Chicago, Chicago, Illinois, U.S.A.

Dinero de Contado contra Documentos o Giro a la Vista: Haga que su banco convenga con un banco correspondiente en los Estados Unidos (preferentemente el Continental Illinois) pagar el costo de los materiales a la presentación documental de embarque, pagar flete y cargos a nuestro banco o a un banco correspondiente. En su pedido sírvase designar el banco y los documentos específicamente requeridos. Pago de contado a la entrega: En los casos en que el modo de transportación y las regulaciones internacionales lo permitan, usted podrá especificar pago de contado a la entrega.

Cuenta abierta: Los clientes regulares podrán solicitar establecimiento de crédito sobre la base de una cuenta abierta. Les proveen la siguiente información: 1. Nombre de su banco, 2. Nombre y dirección de 3 (tres) Proveedores en los Estados Unidos con quienes usted efectúa negocios actualmente; o 3. Nombre y dirección de 3 (tres) Proveedores locales con quienes usted hace negocios actualmente. El acceso de recibo y aceptación requiere aproximadamente un mes.

Financiamiento: La casa McMaster-Carr le ayudará en procesar solicitudes que se hagan a Foreign Credit Insurance Association para garantías, Export-Import Bank y a préstamos corrientes. Para mayor información, sírvanos escribimos. La casa McMaster aceptará Cartas de Crédito a Plaza al precio de descuento general.

COTIZACIONES

El Departamento de Exportación de McMaster-Carr está preparado para proveer a usted con cotizaciones o facturas pro forma a petición. Simplemente exponga cuales son sus necesidades lo mismo que lo hará en un pedido y solicite una factura proforma o cotización. Si lo requerido no está incluido en el catálogo, favor proveeremos descripción completa del artículo. Sírvase especificar la clase de embarque y puerto de descarga, de manera que los costos del flete puedan ser correctamente estimados. Los costos del flete se cargarán siempre a los precios actuales o vigentes.

McMaster-Carr no tiene representantes o agencias, por lo tanto ningunas comisiones son cargadas o agregadas. Las cotizaciones son válidas por 90 días y podrán extenderse sujetas a la aprobación de McMaster-Carr.

Ejemplos de Plazos de Entrega y Cargos*

Flete Marítimo	Plazos de Entrega	Costo Flete	Cargos Mínimo
Puerto Europa del Norte	10-20 Days	\$160.00	\$135.00
Puerto Medio Oriente	23-30 Days	180.00	210.00
Puerto Africa Occidental	32-39 Days	200.00	190.00
Puerto América del Sur	23-30 Days	300.00	210.00
El costo aproximado del Flete Marítimo se basa en 2240 libras/40 pies cúbicos			
Flete Aéreo			
Frankfurt, Alemania	24-48 horas	\$2.28/kg	\$28.00
London, Inglaterra	24-48 horas	2.35/kg	28.00
Paris, Francia	24-48 horas	5.10/kg	55.00
Dhahran, Arabia Saudita	96-148 horas	3.20/kg	70.00
Quito, Ecuador	96-120 horas	3.15/kg	20.00
Santiago, Chile	96-120 horas		

* Además de los cargos corrientes por la documentación, los cuales están sujetos a cambios. Nota: Los cargos corresponden a Flete General. Los cargos por clases de flete específicas son generalmente más reducidos.

Parts Washers & Steam Cleaners

Variable Flow High-Pressure Washer

A Delivers 0.7 to 3.1 gpm @ 145 to 1300 psi. The control of nozzle angle and pressure used are completely in your hands. This variable-flow feature permits switching the angle of the spray as well as the pressure with a simple twist of the wrist. The chemical on/off control is right on the wand. Stainless steel ball bearing inside holder nozzle moves back and forth by turning the wand one way or the other. Bearing is held in place with water pressure. By turning the seating ring on the 25" nozzle tip out until it stops, the nozzle tip is unseated, allowing high-volume, low-pressure wide-angle chemical suction and application. Maximum water temperature is 140°F. The 2-hp unit operates on 220-230-volts. Has volume-pressure control, chemical injection, 33-foot high-pressure hose, trigger gun, 36" wand, and roll-over nozzle that accommodates two nozzle tips. Size: 25" L x 14" W x 17" H. Weighs 79 lbs. No. 3394K51 NET EACH \$1085.45

Heavy Duty Mobile Pressure Washers

B All electric units are lightweight, portable, compact, and economical. The 500-psi unit is ideal for small firms; 600- and 700-psi units can rapidly clean heavy equipment and machines. Self-contained 11-gallon capacity detergent tank operates on gravity feed.

The inlet float tank has 3.6 gallon capacity with a 1/2" float valve. The 1-phase, 60 Hz capacitor-start motors are thermal-overload protected. Units roll on 8" ball-bearing swivel casters with rubber-tired wheels. Welded 14-gauge steel with brass and iron fittings and 1/8" mesh panels. Comes with glycerin-filled pressure gauge, 35-foot high-pressure hose, trigger gun and extension, detergent metering valve, float-tank drain valve, three stainless steel nozzles (0", 15", and 25") and fittings.

Motor hp	psi	Cap. gpm	No.	NET EACH
115-VOLTS, AC. Size: 28" Lg. x 21" Wd. x 36" High				
3/4	500	2	3332K11	\$913.68
1 1/2	600	4	3332K13	1389.47
230-VOLTS, AC. Size: 42" Lg. x 20" Wd. x 44" High				
2	700	4	3332K14	\$1575.25

High-Production Gas-Powered Pressure Washers

C Roll wherever needed to cut through the toughest caked-on grime and grit. The powerful gasoline-powered engine produces variable pressures as listed, according to the horsepower. Three models available. All feature a nozzle-controlled on/off wash-and-rinse gun, pressure-sensitive devices to relieve pressure on pump when the gun trigger is closed, spray tip, and a built-in easy-to-read pressure gauge. Supplied with 2.5 gallon carbony siphon injection system. A wet-sandblasting attachment is available that will fit both the 3.5 gpm and 4.5 gpm model.

Motor hp	psi	Cap. gpm	No.	NET EACH	
5	1500	3	3436K11	\$1516.75	
8	2100	3.5	3436K21	1922.56	
11	2050	4.5	3436K31	2226.93	
Sandblasting Attachment				3436K51	390.00

Hot Water High-Pressure Washer

D Delivers 2.1 gpm @ 1000 psi. Oil-heated and pump-driven washers have switch for producing hot or cold detergent cleaning water. Hot water temperature rise is 147°F. Soap-adjustment control on front of machine. Fuel tank holds four gallons of kerosene or #1 home heating oil. Fuel consumption is 1.7 gallons per hour. 1 1/2 hp burner motor has automatic thermal-overload protection. Two-cylinder positive-displacement pump is direct driven. Water input connection is 3/8" standard garden hose. Includes 33-foot rayon-braid high-pressure hose, a 2-foot long wand, a 3, 12-gauge, 3-conductor cord and plug for 115-volts, 60 Hz, AC, a steel handle and 10" heavy duty rubber wheels. No. 3209K11 NET EACH \$1844.26

Sanitizing High-Pressure Washer

E Delivers 3.3 gpm @ 1230 psi. Built especially for the food and sanitizing industries, so it meets their rigorous demands! Special seals and pump accommodate hot water up to 180°F. Made exclusively of corrosion-resistant materials: stainless steel, plastic, and bronze. Scuff-proof wheels and a 33-foot long high-pressure hose. Also features chemical on/off switch and metering pressure and volume control at the trigger gun. 40 spray wand with a 25" nozzle, and a detachable 5-gallon chemical tank. Washer operates on 220-volts, 3-phase. Size 4' x 19" x 32". Weighs 132 lbs. No. 3427K11 NET EACH \$2563.64

Drum-and-Barrel Washer and Sanitizer

F Designed for washing, sanitizing, rinsing, and deodorizing cans. Handles small and large round, square, and oblong cans, drums, barrels, and waste receptacles up to 25" in diameter. All units have safety locks and foot-control pedals. Nonelectrical unit requires only a water or steam line connection. Equipped with a 1 1/2" drain and 3/4" garden hose supply line pipe connection. Can be operated by hot water, cold water, or steam. Designed to clean by the pressure and centrifugal force produced from a revolving jet spray rotary nozzle. Made entirely of corrosion-resistant materials: stainless steel, bronze, brass, and aluminum. Overall height is 29 1/4". Bowl diameter is 25". No. 3335K12 NET EACH \$1361.82

FOUNTAIN BRUSH ATTACHMENT—Permits scrubbing exterior surfaces. Comes with 5-ft. flexible high-pressure hose with hand valve and fittings. Has a stiff-fiber brush. No. 3335K16 NET EACH \$177.27

Miniature Wet Steam Pressure Washers

G Two models available: one delivers 1 gpm @ 500 psi wet steam or 250 psi hot water; the other delivers 1.7 gpm for faster cleaning. Ideal in applications where the grease-cutting action of heat is needed. Super-heated compressed water is heated in a continuous flow heat exchanger with 200 feet of heat exchanger tube. Steam is formed in the nozzle. Maximum operation temperature is 300°F. Automatic safety shut-down at 350°F. Chemical is nozzle-injected from a built-in pressurized tank. Chemical never enters the water system, pump, or heating coil. Chemical flow is controlled at the wand. The 1/2 hp motor operates on 115-volts, 60 Hz. Tank size is 7 1/2 gallons. Units include 2 feet of LPG regular and LPG hose, heavy duty cleaning wand with two handles and quick disconnects for nozzles, two nozzles, and instruction manual. Semi-pneumatic 10" wheels. Each unit is 32" H x 17" W x 22" D and weighs 100 lbs. gpm @ psi Steam Hose No. NET EACH

1 @ 250	15-Ft.	3459K51	\$1687.93
1.7 @ 250	25-Ft.	3459K61	1705.17

All Electric Steam Cleaner/Pressure Washer

H Delivers 32 gph @ 150 psi steam and 100 gph @ 600 psi water. This totally electric, quiet combination cleaner is ideally suited for institutional, food processing, and industrial maintenance applications. Provides the most economical solution to indoor, close-quarter cleaning and sanitizing where fumes, odors, smoke, flame, or excess water may be objectionable. This easily mobile unit changes to either a steam cleaner or pressure washer at the turn of a valve. Requires 4 gpm free flow at 40 to 60 psi. 3-phase, totally enclosed, fan-cooled, 1 hp motor operates on 230 volts. Equipped with spray gun with automatic shut-off and temperature controls, 5-gallon solution tank, and a 25-foot long 3/8" hose. Water-tight switches are in full view of the operator. Unit comes pre-wired with pigtail and connector of correct wire size and safety cap. Mating receptacle is supplied. Overall size is 24" wide x 24" deep x 44" high. Weighs 160 lbs. No. 3392K12 NET EACH \$3463.31

McMASTER-CARR

Combination Steam C

Versatility at your finger tips. These units perform three operations: steam cleaning for heavy duty cleaning, sterilizing, or sanitation, and both hot and cold high-pressure cleaning for a wide variety of washing and rinsing applications. A single pump operates both steam and high-pressure washing. Automatically mixes cleaning compounds in the correct amount. Inlet water reservoir is float-controlled to draw water as required. Steam gun comes with both steam and wash nozzles and a swivel grip. Steam

Fuel	Motor hp	Steam @ 100 psi	High gph
LP-Gas	3/4	60	
LP-Gas	1	90	
#1 Fuel Oil/Kerosene	3/4	60	
#1 Fuel Oil/Kerosene	1	90	

Heavy Duty

The big jobs are much easier with these portable, all-purpose cleaners. Remove dirt, grease and grit from parts and motors; sanitize bottles and cans. Ideal for cleaning all kinds of building exteriors, interiors, windows, floors, and walls. Automatically mix cleaning compound and water in correct amounts. Inlet water reservoir is float-controlled to draw water as required. Steam gun has insulated handle. The heavy duty 25-foot 1/2" diameter steam gun provides ample operating radius for the really big jobs. Capacitor-start, drip-proof motor operates 115-volts, 1-phase, 60 Hz. Units roll easily on semi-pneumatic rubber-tired wheels.

Fuel	Motor hp	Cap. @ 100 psi
LP-Gas	1/2	12
#1 Fuel Oil/Kerosene	1/2	12
LP-Gas	1/2	15
#1 Fuel Oil/Kerosene	1/2	15

Also available for use with natural gas. To c

Portable LP-

Produces high pressure, high velocity steam that removes grease, grime, and other contaminants. Provides wet or dry steam and cold pressure. Uses steam or hot water in combination with degreasing solution, powered by compressor and LP gas. UL approved fuel gas component. Detergent reservoir, LP gas bottle, and dried stainless steel cleaning gun are mounted on two-wheel hand truck. Simply hook up compressor

CFM @ 60 PSI	BTU/Hr.	Detergent Tank Cap. Gal.
9	65,000	1.5
12	100,000	3.0
21	175,000	5.0

Portable In-

Versatile, safe, and efficient for all kind cleaning, sanitization, and maintenance. Cleaner fits directly on your steam lines carrying 80 to 120 psi, and adjusts to deliver from 12 to 190 gph of cleaning solution. Unit regulates mixture of steam and cleaning solutions and controls temperature and velocity at the gun nozzle. Simple and dependable cleaner separates steam into wet and dry components. Dry steam cleans soap and solution up through the intake hose into a drum. When solution is injected into wet boiler steam, it is heated, partially vaporized, and charged under pressure through hose and gun.

Venturi

Lightweight! Complete steam-cleaning kit operates on steam pressure between 40 and 100 psi. For in-plant steam systems. The gun picks up cleaning solution by a Venturi vacuum system in the gun—no pump needed. Features completely adjustable control and a cool grip handle. Includes a 55" steam gun with shut-



See page 1044 for a l:

Sanitizing Cleaners

Sanitizing High-Pressure Washer

Delivers 3.3 gpm @ 1230 psi. Built especially for the food and sanitizing industries, so it meets their rigorous demands! Special seals in accommodate hot water up to 180°F. Exclusively of corrosion-resistant materials—stainless steel, plastic, and bronze. Scuff-proof hose and a 33-foot long high-pressure hose. Also includes chemical on/off switch and metering, pressure control at the trigger gun, 40° wand with a 25° nozzle, and a detachable 5-gallon chemical tank. Operates on 220-volts, 3-phase. Size 41" x 32". Weighs 132 lbs. #27K11 NET EACH \$2563.84

Drum-and-Barrel Washer and Sanitizer

Designed for washing, sanitizing, rinsing, and deodorizing cans. Handles small and round, square, and oblong cans, drums, barrel waste receptacles up to 25" in diameter. Units have safety locks and foot-control pedestrian electrical unit requires only a water-line connection. Equipped with a 1 1/2" drain garden hose supply line pipe connection operated by hot water, cold water, or steam. Used to clean by the pressure and centrifuge produced from a revolving jet spray rotary. Made entirely of corrosion-resistant materials—stainless steel, bronze, brass, and aluminum. Height is 29" x 4". Bowl diameter is 25". #35K12 NET EACH \$1361.82

MOUNTAIN BRUSH ATTACHMENT—Permits cleaning exterior surfaces. Comes with 5-ft. flexible high-pressure hose with hand valve and fittings. #35K16 NET EACH \$177.27

Miniature Wet Steam Pressure Washers

Two models available: one delivers 1 gpm @ 500 psi wet steam or 250 psi hot water; the other delivers 1.7 gpm for faster cleaning. Ideal in situations where the grease-cutting action of steam is needed. Super-heated compressed water is in a continuous flow heat exchanger with a 1/2" of heat exchanger tube. Steam is formed in a nozzle. Maximum operation temperature is 350°F. Automatic safety shut-down at built-in pressure. Chemical never enters the water system, or heating coil. Chemical flow is led at the wand. The 1/2 hp motor operates on 60 Hz. Tank size is 7 1/2 gallons. Units include 2 feet of LPG regular and LPG hose, heavy-duty cleaning wand with two handles and quick connects for nozzles, two nozzles, and instructional manual. Semi-pneumatic 10" wheels. Each unit is 17" x 17" x 22 1/2" D and weighs 100 lbs. #3459K51 NET EACH \$1687.93 #3459K61 NET EACH \$1705.17

All Electric Steam Cleaner/Pressure Washer

Delivers 32 gpm @ 150 psi steam and 100 gpm @ 600 psi water. This totally electric, quiet action cleaner is ideally suited for institutional food processing, and industrial maintenance applications. Provides the most economical way to indoor, close-quarter cleaning and rinsing where fumes, odors, smoke, flame, or steam may be objectionable. Easily mobile unit changes to either a steam or pressure washer at the turn of a valve. Delivers 4 gpm free flow at 40 to 60 psi, 3-phase enclosed, fan-cooled, 1 hp motor operates on 220 volts. Equipped with spray gun with auto shut-off and temperature controls, 5-gallon chemical tank, and a 25-foot long 3/8" hose. Water valves are in full view of the operator. Comes pre-wired with pigtail and connector of correct wire size and safety cap. Mating receptacle applied. Overall size is 24" wide x 24" deep. Weighs 160 lbs. #26K12 NET EACH \$3463.31

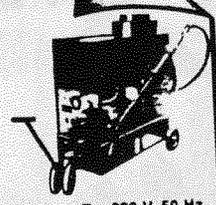
MASTER-CARR

Steam Cleaners

Combination Steam Cleaners/Pressure Washers

Versatility at your finger tips. These units perform three operations: steam cleaning for heavy-duty cleaning, sterilizing, or sanitizing, and both hot and cold high-pressure cleaning for a wide variety of washing and rinsing applications. A single pump operates both steam and high-pressure washing. Automatically mixes cleaning compound in the correct amount. Inlet water reservoir is float-controlled to draw water as required. Steam gun comes with both steam and wash nozzles and a swivel grip. Steam

hose provides ample operating radius. Units roll easily to the job on 8" rubber-tired wheels. Sturdy steel construction with brass and black iron fittings, wire mesh side plates with red lead undercoating and a baked enamel finish. Furnished with 4-foot steam gun, 25 feet of 1/2" steam hose, pressure gauge, temperature control, relief valve, inlet float tank, detergent metering valve, detergent metering valve, and check valve, plus all the necessary fittings. The LP-gas models are equipped with rack for 100-lb tank.



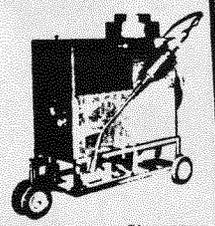
Fuel	Motor hp	gph		Output BTU/Hr.	Overall Size Lg. x Wd. x Ht.	For 115-V, 60 Hz		For 220-V, 50 Hz	
		Steam @ 100 psi	High Pressure @ 500 psi			No.	NET EACH	No.	NET EACH
LP-Gas	3/4	60	120	145,000	52" x 24" x 47"	3195K32	\$1778.16	3195K42	\$1848.33
LP-Gas	1	90	180	230,000	55" x 28" x 48"	3195K63	2118.84	3195K73	2185.96
#1 Fuel Oil/Kerosene	3/4	60	120	145,000	52" x 24" x 47"	3195K21	1703.16	3195K41	1773.33
#1 Fuel Oil/Kerosene	1	90	180	230,000	55" x 28" x 48"	3195K61	2118.84	3195K71	2185.96

Heavy Duty Steam Cleaners

The big jobs are much easier with these portable, all-purpose cleaners. Remove dirt, grease, and grit from parts and motors, sanitize bottles and cans. Ideal for cleaning all kinds of building exteriors, interiors, windows, floors, and walls. Automatically mix cleaning compound and water in correct amounts. Inlet water reservoir is float controlled to draw water as required. Steam gun has insulated handle.

wheels and have a front-pull handle. All feature durable welded 14-gauge steel construction with brass and black iron fittings and wire mesh side plates with red oxide undercoating and baked enamel finish. Furnished complete with 4-foot steam gun, steam hose, temperature control, relief valve, steam pressure gauge, inlet float tank, detergent tank with fill valve, detergent metering valve, and a replaceable check valve, plus all the necessary fittings. All units are available with 220-volt, 50-Hz operation. Specify No. 3156K999, 220-volt, 50 Hz, LP-Gas or Fuel Oil, and capacity required in gph. Prices on request.

Fuel	Motor hp	Cap. gph @ 100 psi		Output BTU/Hr.	Overall Size Lg. x Wd. x Ht.	Steam Cleaner No.		NET EACH	
		Motor	Cap. gph @ 100 psi			No.	NET EACH	No.	NET EACH
LP-Gas	1/2	120	120	281,000	52" x 24" x 47"	3156K37	\$1537.89	3156K48	1537.89
LP-Gas	3/4	120	120	281,000	52" x 24" x 47"	3156K39	1849.66	3156K49	1882.11
#1 Fuel Oil/Kerosene	1/2	150	150	350,000	55" x 28" x 50"	3156K99	1849.66	3156K99	1882.11
#1 Fuel Oil/Kerosene	3/4	150	150	350,000	55" x 28" x 50"	3156K99	1849.66	3156K99	1882.11



Portable LP-Gas Steam Cleaner

Produces high pressure, high velocity steam that removes grease, grime, and other contaminants. Provides wet or dry steam and cold presoak. Uses steam or hot water in combination with a degreasing solution, powered by compressed air and LP gas. UL approved fuel gas components. Detergent reservoir, LP gas bottle, and direct-fired stainless steel cleaning gun are mounted on a two-wheel hand truck. Simply hook up compressed

air and water supply and push the ignitor button on the gun. No steam coil, exposed flame, electricity, motor, pump, or other moving parts. Includes hand truck, detergent tank, hose assembly (fuel mixture, water, and detergent), propane tank, POL valve/hose (that connects propane bottle to regulator), valve manifold with gauges and regulators for air and gas, ignitor and electrode with pushbutton start, stainless steel gun.

CFM @ 60 PSI	BTU/Hr.	Detergent Tank Cap. Gal.	Propane Tank Cap. Lbs.	Hose Assembly Lg. Ft.	No.	NET EACH
9	65,000	1.5	30	15	3213K81	\$883.93
12	100,000	3.0	40	25	3213K82	1480.87
21	175,000	5.0	60	25	3213K83	1878.26



Portable In-Line Steam Cleaner

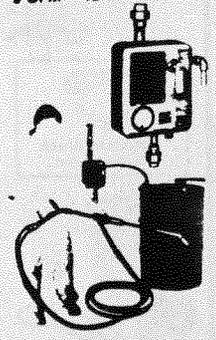
Versatile, safe, and efficient for all kinds of cleaning, sanitizing, and maintenance. Cleaner fits directly on your steam lines carrying 80 to 120 psi, and adjusts to deliver from 120 to 190 gph of cleaning solution. Unit regulates the mixture of steam and cleaning solutions and controls temperature and velocity at the gun nozzle. Simple and dependable cleaner separates steam into wet and dry components. Dry steam draws soap and solution up through the intake hose from a drum. When solution is injected into wet booster steam, it is heated, partially vaporized, and discharged under pressure through hose and gun.

Steam consumption per hour (BHP) is 8 to 11. Any open top 55-gallon steel drum can be used for solution. Connects to 3/4" steam outlet. Mixing and control cabinet is made of cast steel and brass. Size is 8 1/2" x 7" x 3 1/4". Complete with pressure gauge, 5-foot cleaning gun with swivel handle, fan and round nozzles, and a 5-foot suction hose with strainer assembly plus all couplings and fittings. Steam hose and drum are not furnished. #3157K1 NET EACH \$487.50 DELUXE—Same as above, plus 25-foot, 1/2" dia. steam hose and soap-saver float tank. #3157K3 NET EACH \$868.75

Venturi Steam Gun Kit

Lightweight! Complete steam-cleaning kit operates on steam pressure between 40 and 100 psi. For in-plant steam systems. The gun picks up cleaning solution by a Venturi vacuum system in the gun—no pump needed. Features completely adjustable control and a cool grip handle. Includes a 55" steam gun with shut-off

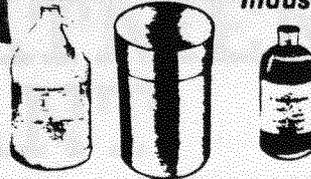
valve and solution valve, solution strainer, two hose clamps and one 1/2" x 1/2" connector nipple. Available with 1/2" steam hose and solution hose in 25-foot and 50-foot lengths. Weighs 6 1/2 lbs. #3458K11 NET EACH \$249.04 #3458K21 NET EACH \$345.19



*** See page 1044 for a listing of chemicals, solvents, and cleaners.**

Chemicals, Solvents & Cleaners

Industrial Chemicals



Chemicals	Size	No.	NET EACH
Ethyl Alcohol (Denatured Alcohol)	1-gal.	3190K13	\$10.30
Glycerine	1-pint	3190K86	5.70
Glycerine	1-gal.	3190K17	28.55
Methylene Chloride	1-pint	3177K42	6.14
Methyl Ethyl Ketone	1-pint	3177K41	5.20
Sodium Silicate (Water Glass)	1-gal.	3190K25	7.27
Sodium Silicate (Water Glass)	5-gal.	3190K26	37.50

Pressure Washer/Steam Cleaning Solutions

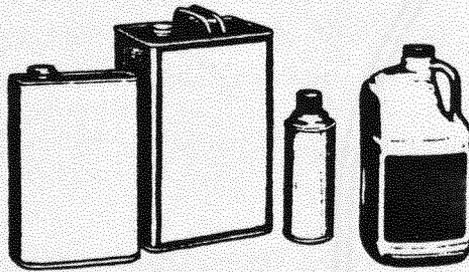
MEDIUM DUTY LIQUID—For cleaning machinery, tires, motors, and other equipment. High-foaming, nonphosphate solution comes in a 5-gallon container.

No. 3360K12.....NET EACH \$37.13

HEAVY DUTY ALKALINE CONCENTRATE—For cleaning extra-heavy grease and soil build-up. Non-scaling. Not for use on aluminum. Nonphosphate solution comes in a 5-gallon container.

No. 3360K14.....NET EACH \$50.38

Parts Cleaning and Degreasing Solutions



Heavy Duty Grease Cleaner

Concentrated liquid solvent contains alkaline builders for removing heavy deposits of grease, oil, ink, wax, and soil. Nonflammable mixture is USDA approved. Contains 13% Butyl Cellulosolve.

Container Size	No.	NET EACH
1-Gallon	3352K11	\$7.08
5-Gallon	3352K12	36.88

Nonphosphate Grease Cleaner

This water-soluble emulsion cleaner expertly removes industrial oil, grease, and soil. Perfect for garage floors, grease pits, and other grimy areas. May be used in high-pressure units or applied by hand. When diluted with kerosene or fuel oil, solution must be kept agitated or separation occurs.

Container Size	No.	NET EACH
1-Gallon	3417K12	\$13.33
5-Gallon	3417K13	50.56

Stainless Steel Cleaner

Ideal for removing slag, scale, and tarnish on large surfaces. Effective where scale must be removed from stainless steel to prevent corrosion and contamination. Cleans up weld beads. Eliminates costly grinding and sandblasting. Available in liquid or paste forms for immersible or stationary applications. Paste formula will not harden, and can be rinsed off.

Container Size	Liquid No.	Liquid NET EACH	Paste No.	Paste NET EACH
1-Gallon	3373K11	\$37.05	3373K21	\$61.10
5-Gallon	3373K12	114.04	3373K22	218.67

DRY CHEMICALS

Chemicals	Size	No.	NET EACH
Sodium Bicarbonate (Bicarbonate of Soda)	25-Lbs.	3190K34	\$23.33
Sodium Bicarbonate (Bicarbonate of Soda)	100-Lbs.	3190K35	59.33
Calcium Chloride	100-Lbs.	3190K37	40.92
Sodium Hydroxide (Caustic Soda)	10-Lbs.	3190K38	16.36
Sodium Hydroxide (Caustic Soda)	100-Lbs.	3190K39	97.67
Powdered Soapstone (Gray Talc)	50-Lbs.	3192K14	9.41
Copper Sulfate	100-Lbs.	3190K45	141.64
Sodium Carbonate (Soda Ash)	100-Lbs.	3190K47	42.42
Sulfur (Commercial Flour)	50-Lbs.	3190K61	36.67
Trisodium Phosphate (Phosphate Cleaner)	100-Lbs.	3190K54	76.00

HEAVY DUTY BIODEGRADABLE DETERGENT—May be used with steam cleaners, hot water pressure washers, and combination cleaners. Formulated for speed and ease of cleaning.

Quickly cleans away grease, oil, and heavy dirt. Rinses completely and leaves no residual film. Has built-in corrosion inhibitors. USDA approved for use in food-handling processes.

No. 3156K21—5-Gallon Can.....NET EACH \$40.28

No. 3156K22—30-Gallon Drum.....NET EACH \$207.41

Degreasers

Dissolves engine grime and removes grease, oil, and dirt from iron, steel, aluminum, magnesium, and copper. Will not harm metal, rubber, plastic, or concrete. Rinses off with water.

No. 3205K10—16-Ounce Aerosol Can.....NET EACH \$2.63

General purpose cleaner for handling the really tough jobs on engines, floors, ducts, and parts. Squirt-spout application.

No. 3206K11—1-Quart Can.....NET EACH \$3.94

Sulfur-free cleaning compound, ready for use without mixing. Cuts oil, sludge, grease, and dirt from metal parts. Safe for plastics and painted surfaces. No rinsing required.

No. 3207K1—5-Gallon Pail.....NET EACH \$47.55

Degreaser Concentrates

Penetrates into grit and caked-on grime on machinery and engines. Dilute with kerosene: one part concentrate with nine parts kerosene or petroleum solvent. Rinses off with water.

No. 3191K33—5-Gallon Can.....NET EACH \$56.06

Parts Cleaning Solvent

Flushes away oil residues from oil lines and intricate mechanisms. Dries fast, no flash point, and is noncorrosive to metals.

Container Size No. NET EACH

20-Ounce Aerosol Can.....3422K13.....\$3.72

1-Gallon Can.....3422K12.....22.75

Odor-Free Degreaser

Excellent for schools and industrial applications. This general-purpose safety solvent cuts oil, grease, and sludge and is odor free! Flash point is 140°F.

Container Size No. NET EACH

5-Gallon.....3457K11.....\$60.00

Decarbonizing Solution

Extra strength, fast-acting solution quickly removes carbon, varnish, paint, aniline dyes, and gummy residues. Safe for use on metals, and requires no mixing.

No. 3264K1—5-Gallon Can.....NET EACH \$95.59

Easy-On-The-Hands Degreasers

UL listed. Lanolin-based formula is ideal for use where the cleaning fluid is in frequent contact with the operator's hands. Quickly removes cutting oils, grease, rust preventatives, dirt, and gummy oxidized oils from metal equipment and parts.

Container Size No. NET EACH

5-Gallon Can.....3189K12.....\$41.00

30-Gallon Drum.....3187K6.....299.58

50-Gallon Drum.....3187K7.....448.00

McMASTER-CARR

These guns deliver instant, flameless air intake lets you vary the velocity. Or decrease temperature, close shutter to fire. Has a 1 1/2" diameter nozzle. Three roll finger-tip rocker switch for 50 60 Hz. wire grounded cord and plug.

All 120-volt models are UL listed and 220 240-volt units are supplied with cord.

Temperature Range, °F	Volts	Amps
200-300	120	5
300-300	220/240	3
300-500	120	12
300-500	220/240	6
500-750	120	14
500-750	220/240	7
750-1000	120	18
750-1000	220/240	9

ACCESSORIES
Molded Carrying Case For All Models
Attachments For Tubing Up to 3/4" OD
Attachments For Tubing From 3/4" to 2" OD
Concentrated Pin-Point Heat Attacher

Amp-Mi

These guns do a good, fast job without drawing a lot of energy, thanks to a low draw. All 120-volt models are UL listed and approved. Versatile—use for shrink wrap, insulating with heat-shrink tubing, ther welding, melting solder, stripping, and more. Grilled nozzle guard helps prevent burns. Extended length eliminates back-

Temp. Range, °F	Volts	Amps	Velocity fpm
300-500	120	5	2000
300-500	230	2.5	2000
500-700	120	5	4000
500-700	230	2.5	4000
700-1000	120	8.3	3500
700-1000	230	3.75	3500

ACCESSORIES
Attachment for Heat-Shrink Tubing to 1" Attachment for 1/4" Needle-Point Heat

Pin

Concentrate heat in a small 1/8" diameter area and avoid flooding adjacent areas with unwanted heat. Typical applications include insulating unused terminals on circuit board by shrinking small tubing without affecting surrounding areas. Can also melt small solder sleeve connectors.

Guns have rugged steel housing with chrome-plated barrel and

Variable

Now you can select a heat setting to repeat jobs. Flip the switch, set the dial and a stream of flameless heat is at your command. Eliminate the danger of overheating or burning materials that are sensitive to high temperatures.

Temperature range is indicated in 100° increments. Electronic dial permits selecting heat as desired, from ambient to 750° (220/240-volt) and 1000° F. (120-volt). Stu-

Multi-T

Balanced, lightweight design with high impact plastic housing. Heats up in 5 seconds, and requires no "cool-down" cycle. Used to shrink tubing, strip paint, remove tile, and solder.

Encapsulated heating element. Double insulated and UL listed. Air volume is 14 cfm. Comes with support stand attachment to hand grip. Available with dual setting temperature range or with variable temperature range. Operate on 110-volts, AC

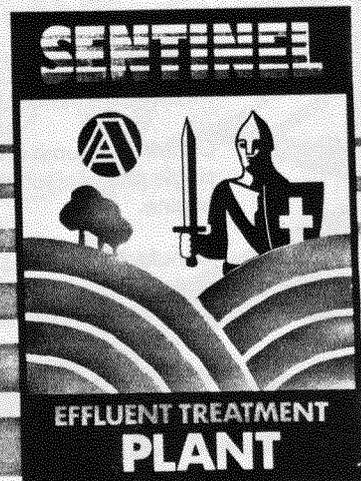
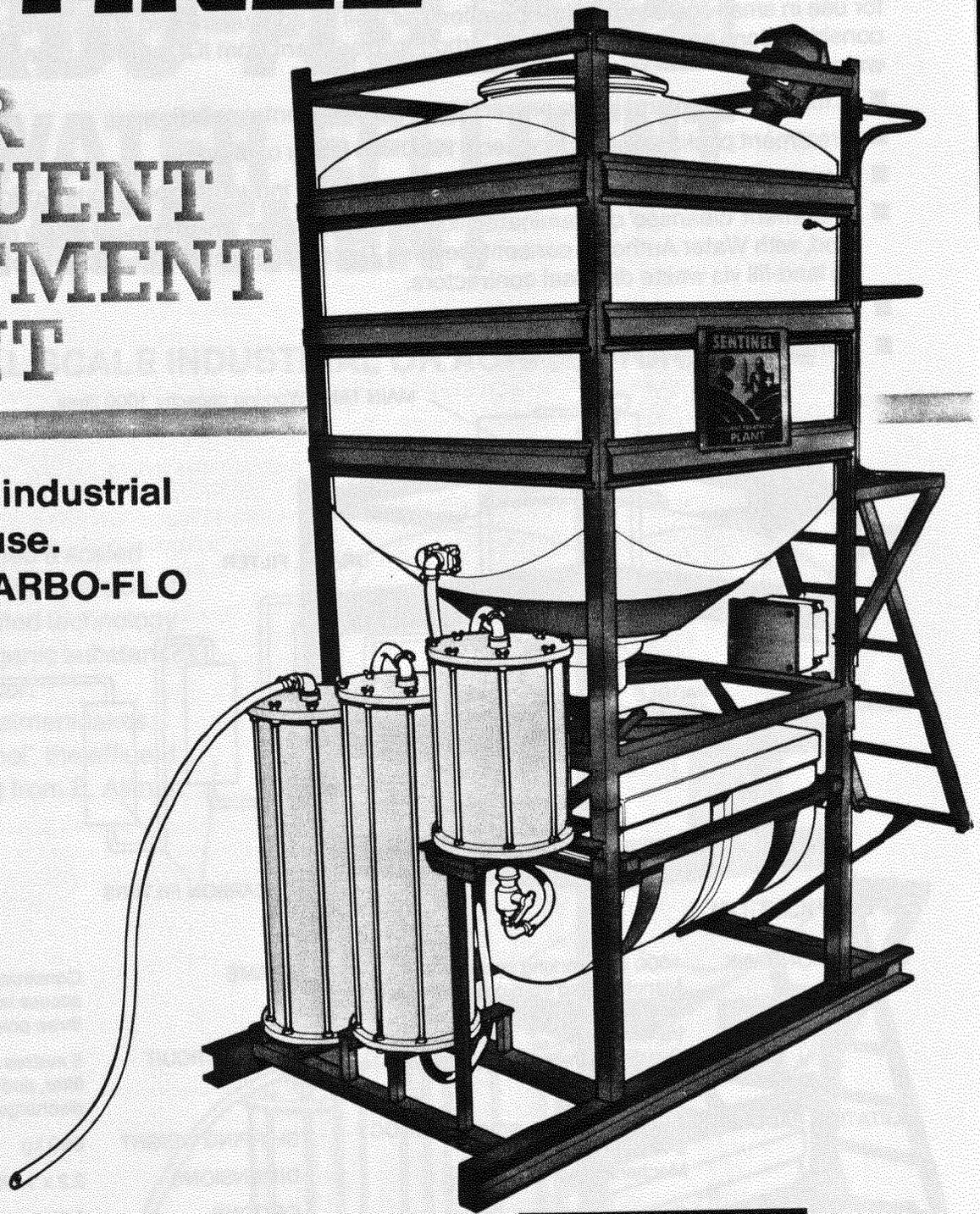
in Cleaners

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100

SENTINEL

WATER EFFLUENT TREATMENT PLANT

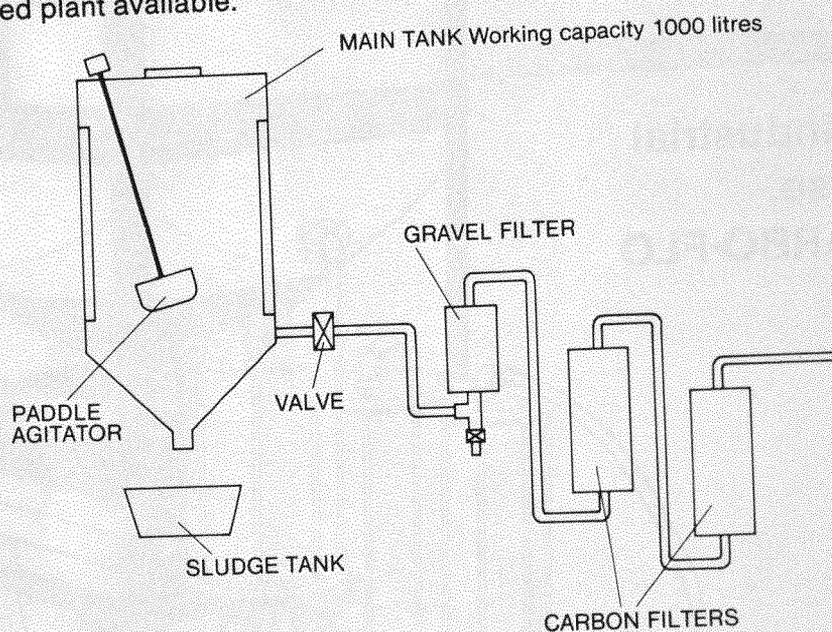
For small scale industrial
or agricultural use.
Designed for CARBO-FLO
Water Effluent
Treatment
from ICI



SENTINEL

ALLMAN in conjunction with ICI have developed the SENTINEL WATER EFFLUENT TREATMENT PLANT for use in small scale industrial operations as well as agriculture and other areas where environmental considerations are important. (The Carbo-Flo Treatment from ICI removes organic substances from the water.)

- A major step forward in the prevention of environmental pollution.
- Treatment packs designed for each 1000 litre batch of effluent.
- A tried and tested system used by ICI in large scale industrial operations worldwide.
- Treatment 'cleanses' contaminated liquors to give water which can be safely discharged into soakaways and, with Water Authority consent, sewers. The small quantities of sludge produced can be disposed of to land-fill via waste disposal contractors.
- Tell-tale colour indicator for filter saturation.
- Portable or fixed plant available.



SPECIFICATION

COLLECTION TANK	1000 litre working capacity. Manufactured from polyethylene, rotational moulded with sludge transfer valve. Overflow safety cut-out to prevent accidental overflow.	FRAME	Constructed from mild steel, c/w access ladder and guard rail, facility for three point linkage and/or fork lift.
AGITATION PADDLE	Electrically driven motor, 12 volt DC / 240 volt AC single phase. Mechanical action.	LIQUID CIRCUIT	5 metres of suction hose c/w floating filter, and all necessary valves and discharge pipes.
FILTERS	One gravel pre-filter with back flow cleaning facility. Two activated carbon filters with replaceable elements.	SHIPPING WEIGHT	680 kg
FILLING PUMP	Centrifugal pump driven by 2 hp single phase electric or 3 hp petrol engine.	DIMENSIONS	2.2 x 1.16 x 3.0 m
SLUDGE COLLECTION VESSEL	Manufactured from polyethylene c/w sludge drain device.	OPTIONS	Active agent infusion system. Castor wheels. Remote electronic control. Operator protective kit. Spray boom collection kit. Clean water tank.

Sentinel is designed for use with *dilute* solutions of organic chemicals. Follow the directions in the instruction manual.
 'Carbo-Flo' is a trade mark of ICI
 'Sentinel' is a trade mark of E. Allman & Company Ltd.
 E. Allman & Company Ltd reserve the right to alter specification or design without notice.



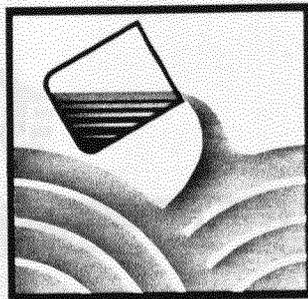
ALLMAN

E. Allman & Company Ltd

Birdham Road, Chichester, West Sussex, PO20 7BT, England

Telephone: (0243) 512511 Telex: 86286 Facsimile: (0243) 511171

CARBO-FLO

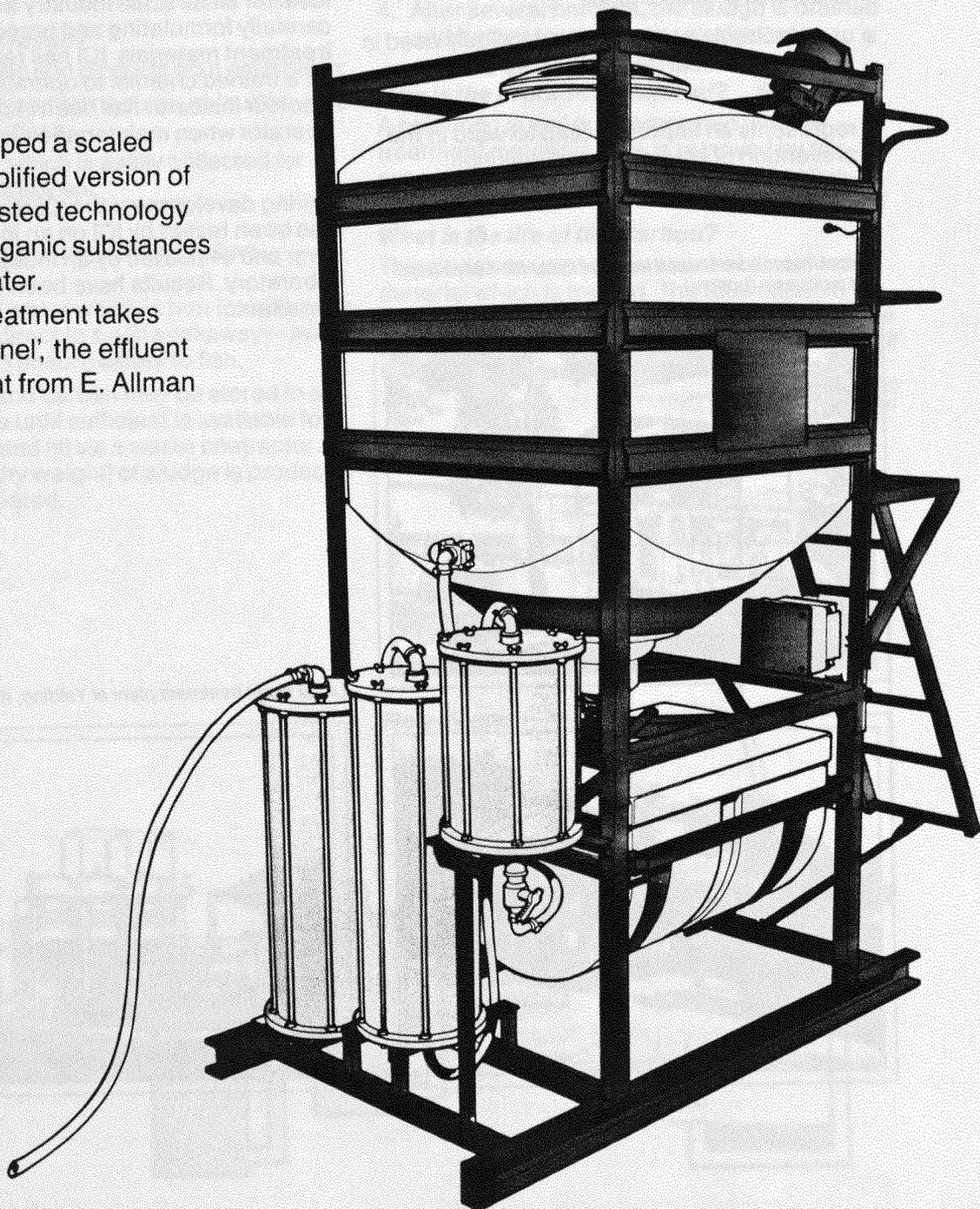


WATER EFFLUENT TREATMENT

FOR SMALL SCALE INDUSTRIAL OR AGRICULTURAL USE

ICI has developed a scaled down and simplified version of its tried and tested technology for cleaning organic substances from waste water.

'Carbo-Flo' treatment takes place in 'Sentinel', the effluent treatment plant from E. Allman & Co Ltd.



CARBO-FLO

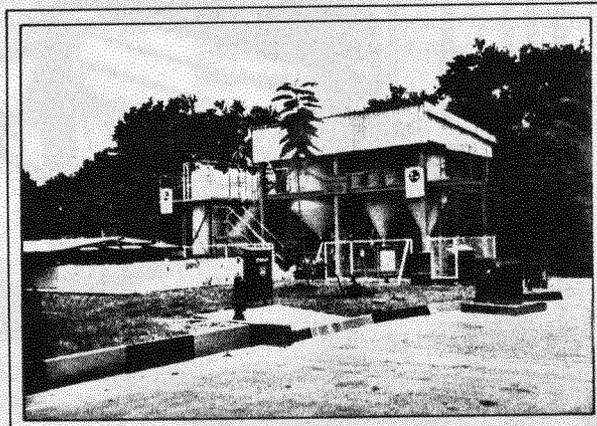
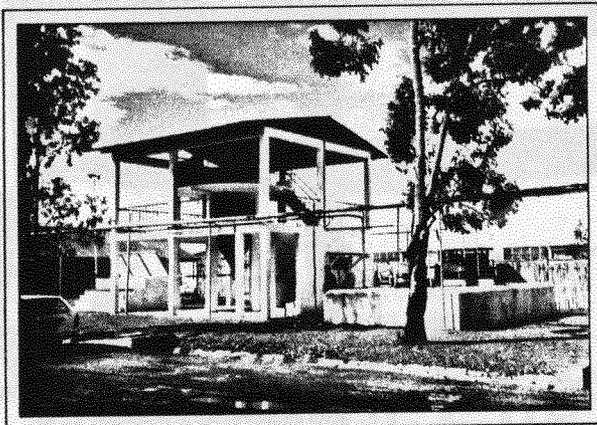
THE PROCESS

Small volumes of dilute contaminated waste water can now be cleaned quickly, effectively and inexpensively before disposal.

'Carbo-Flo' treatment:

- is a simple batch system
- uses measured and pre-packaged materials
- does not require technical staff to operate or monitor
- produces cleaned water, which can be discharged into a soakaway, plus small quantities of solid sludge
- uses technology that has been widely used in ICI agrochemical factories in the UK and overseas
- represents an important step forward in the prevention of environmental pollution.

Typical intermediate-sized treatment plant in Kenya (top) and Indonesia (bottom).



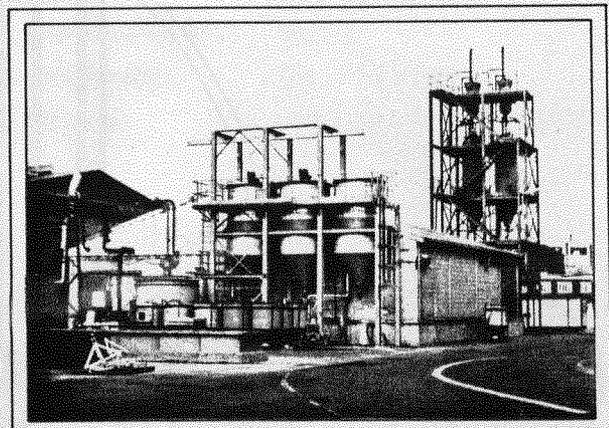
ITS PEDIGREE

ICI has used the 'Carbo-Flo' technology for over 15 years. At the Yalding works of ICI Agrochemicals up to 50,000 litres of strong factory effluent is cleaned every working day. Many smaller plants are operated on other ICI sites around the world and these protect the environment from contamination with pesticide residues.

ICI has combined with E. Allman & Co Ltd to produce a very simple batch process. The small, lightweight, low cost equipment is ideal for small scale industry and agriculture. By carefully formulating and prepacking the treatment materials, ICI has removed the need for a trained chemist to operate the process. A colour indicator has been included to show the operator when maintenance is required.

During development the 'Carbo-Flo' treatment has been tested by ICI on an intensive arable farm and evaluated by an independent laboratory. Results have been consistently excellent.

Large scale treatment plant at Yalding, Kent.



CARBO-FLO

QUESTIONS & ANSWERS

What does 'Carbo-Flo' treatment do?

Removes most unwanted organic substances from waste water.

How does it work?

There are two main stages:

- (i) Flocculation and sedimentation of suspended solids. The sludge produced is then further concentrated prior to disposal.
- (ii) Filtration through gravel and carbon modules to remove dissolved organic matter.

What is the end result?

There are two main end products from each batch:

- (i) Cleaned water which is clear, colourless and -virtually odourless.
- (ii) Solid sludge which is easily collected for storage and disposal.

How are the water sludge and carbon disposed of?

- (i) The cleaned water which is non toxic may be discharged direct to a soil soakaway—away from water to ensure safety to fish.
- (ii) The sludge and carbon may be stored in a secure place until sufficient is available for disposal to land fill via a waste contractor. About 3kg (dry weight) of sludge is produced per batch treated.

What does the operator have to do?

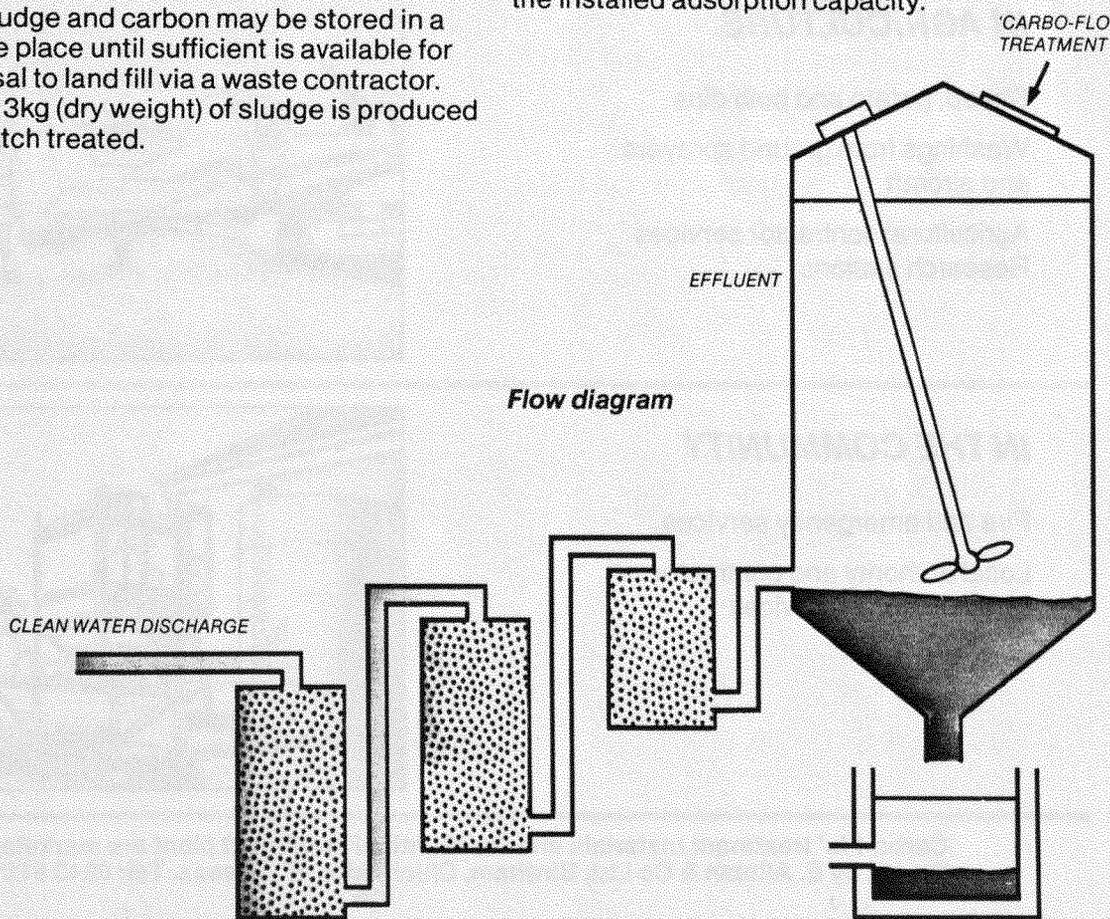
1. Dilute effluent must be collected in a suitable tank or sump or in the main tank of the 'Sentinel' plant.
2. Prepacked treatment materials are then added to a full tank of effluent (1000 litres). The tank contents are agitated and allowed to stand.
3. After about 45 minutes the main valve is opened and the second stage operates automatically by gravity, taking about 3 hours.
4. After several batches, the sludge is drained and further treated in the sludge tank.

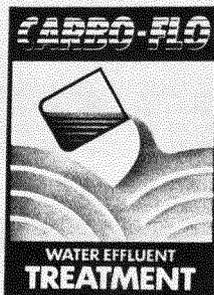
How is the process monitored?

A colouring agent is incorporated into the treatment materials. This is removed by the second stage while the carbon is still active.

What is the life of the Carbon?

This depends upon the amount of dissolved material which is treated. The total capacity of one carbon module is up to 20 batches of dilute pesticide or other equivalent effluent. This is half the installed adsorption capacity.





Many industries produce contaminated water which can be cleaned by the 'Carbo-Flo' treatment before disposal.

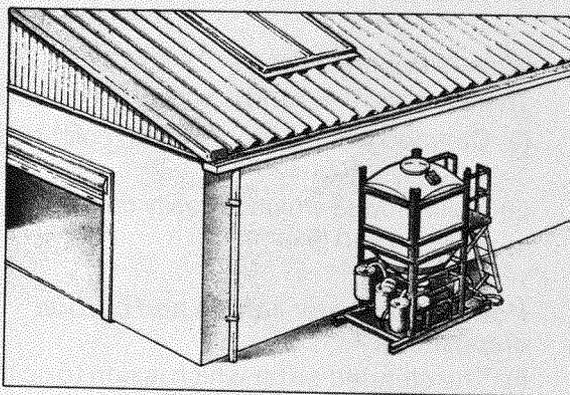
The 'Sentinel' plant has been specially developed to use the 'Carbo-Flo' treatment. It is a low cost, portable unit and is designed to stand outside. It can also be used for occasional or emergency purposes where a conventional plant would be too large or too expensive.

POSSIBLE USES

IN INDUSTRY

Chemical formulation, packing or storage plants.

Small or medium scale sites which use detergents, dyestuffs, insecticides, preservatives or similar organic materials.

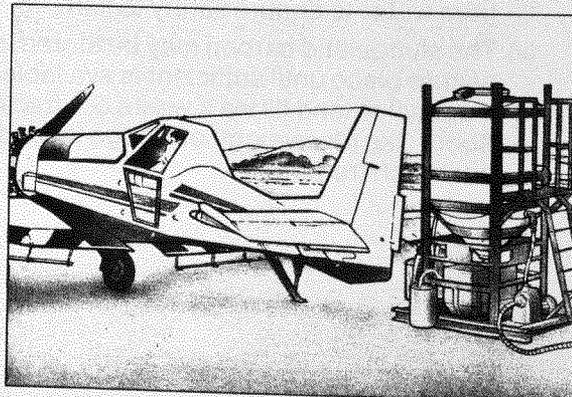


IN AGRICULTURE

Sheep, potato and bulb dips.

Washings from ground sprayers and aircraft

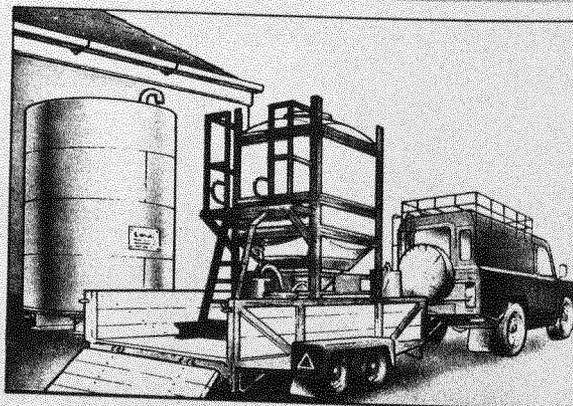
Agricultural contractor services
Research stations



IN THE COMMUNITY

Fire and emergency services.

Local authority and contractor
waste disposal services



'Carbo-Flo' treatment materials and the 'Sentinel' treatment plant are marketed in the UK by E. Allman & Co Ltd, Birdham, Chichester, W. Sussex. Tel: 0243 512511



Agrochemicals

Fernhurst Haslemere Surrey England

'Carbo-Flo' is the trademark of ICI

'Sentinel' is the trademark of E. Allman & Co Ltd

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APPENDIX F

THE SENTINEL CARBO-FLO WATER EFFLUENT TREATMENT PLANT



APPENDIX F

THE SENTINEL CARBO-FLO WATER EFFLUENT TREATMENT PLANT

The attached photocopies illustrate and describe the system. This has been developed by ICI for industrial use and then scaled down in conjunction with Allman Sprayer Company for on farm use. The technology has been in proven industrial use for around 15 years and equipment is now in use in a number of tropical countries.

The system has been tested at the Rothamsted Research Station England and is under official test in some other countries, with very good results. At Rothamsted the concentrations of all eight pesticides in the treated mixture were reduced to below 0.02 micrograms/ml from an initial mixture prepared to represent a liquid containing about 25 per cent of the highest concentrations recommended in UK for crop spraying, i.e. the sort of mixture that would be expected in a typical farm "waste and washings" sump-tank. This trial mix contained from 25 to 580 micrograms/ml of the various pesticides (actual chemicals were demeton-S-methyl, H.C.H., pirimicarb, propiconazole, cypermethrin, 2,4-D, mecoprop, paraquat).

In Sudan concentrations after washing drums of E.C. formulations would be well below the 25 per cent and ULV container washings might be of the order of 15 per cent.

Procedures envisaged in a Sudan drum washing facility would involve collection in a sump of the effluent draining from the washing line. This effluent would be pumped into the Sentinel tank, capacity 1000 l, in which it is stirred by a stirrer paddle powered either by battery or mains electricity. Four chemicals, pre-packed in the correct quantities, numbered and colour coded, are added in sequence to the 1000 l batch at defined time intervals to cause flocculation and adsorption of the pesticides. After flocculation the stirrer is switched off, the settling agent is added, and the flocculated material is allowed to settle into the sludge sump for about one hour. The main valve is then opened and the supernatant liquid is run off through one gravel and two carbon filters, taking about 3 hours. After several batches the sludge is drained and further coagulated and dried off in a sludge tank. The cleaned, non-toxic water may be drained into a soil soakaway or pumped into a high storage tank and recycled for further drum washing. The sludge and carbon filters would be stored prior to deep burial in a selected waste products dump in the desert.

The life of the carbon filters are monitored by a colouring agent incorporated into the treatment materials. When this colour indicator is not removed by filtration, the carbon module must be changed since it is no longer active.

MEMORANDUM FOR THE RECORD

On 10/10/50, the following information was received from the [redacted] regarding the [redacted] of the [redacted] in the [redacted] area.

The [redacted] was observed on [redacted] at approximately [redacted] hours. The [redacted] was [redacted] and [redacted] in appearance. The [redacted] was [redacted] and [redacted] in behavior.

The [redacted] was [redacted] and [redacted] in the [redacted] area. The [redacted] was [redacted] and [redacted] in the [redacted] area.

The [redacted] was [redacted] and [redacted] in the [redacted] area. The [redacted] was [redacted] and [redacted] in the [redacted] area. The [redacted] was [redacted] and [redacted] in the [redacted] area.

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PERSONS CONTACTED

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S V Sastry

Director, AUAC, Min. of Agric.
Financial Adv. AUAC/RPMU Min. of Agric.

Sudan Gezira Scheme

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Sd Salah Dousougi
Sd Awad Karim
Sd Abdulla Aziz
Sd Mohammed Ali
Sd Awad

Agric. Prod. Manager S.G.B.
Dep. Crop Protection Manager - South Gezira
Dep. Crop Protection Manager - North Gezira
Ass. Entomologist
Storeman. Barakat Group
Administrative Assistant

New Halfa Scheme

Sd Fatih Mohd Halim
Sd Nouh Modh. Achmed

Head Crop Protection
Chief of Stores Dept.

Rahad Scheme

Sd Hunza Abu Gaballa
Sd Khidir el Hussan
Sd Yousif Dien

Managing Director
Agric. Production Manager
Head Crop Protection

Es Suki Scheme

Sd Hassan Osman Achmed
Sd Abdullah Ali Obeld
Sd Makmond

Head Crop Protection
Operations Manager
Storeman Mahalla

Blue Nile Scheme

Sd Reduwan Mohamed
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Sd Kamal el Jack
Sd Ali Mohd Osman
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Sd Sir el Khatim

Country Manager Shell Intl.
CIBA - Geigy Basle
E. Allman Spraying Co Ltd
Agric. Mgr. Bittar & Co Ltd
Mgr. Bittar Wad Medani
Agric. Mgr. Shell Sudan
Factory Mgr. Shell Chemicals W. Medani
Agric. Mgr. Ciba Geigy W. Medani

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