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TECHNICAL PRODUCTION ASSISTANCE VISIT TO MEDIPHARM INDUSTRIES KAMPALA, UGANDA

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I. Purpose/Objectives

The purpose/objectives of the visit to Medipharm are listed below:

1. Evaluate production and productivity for the past 12 months, recommend techniques to improve productivity to reach 1992 goals, and make an action plan for 1992.

2. Evaluate manufacturing records and quality control (QC) results of batches produced since the last review in July 1991, make recommendations to improve QC performance indicators, and establish goals for quality for 1992.

3. Review quality assurance (QA) policies and evaluate adherence to the QA Policies and Guidelines Manual.

4. Assist in planning and installation of new equipment.

5. Introduce a production planning and inventory control system, present a model that plans Medipharm's products for a 24-month horizon, and discuss organizational and technical requirements to implement such a plan.

6. Evaluate Medipharm's capability of developing a network of local vendors, suppliers, and service/repair organizations, and organize a visit to a local company with a developed procurement and engineering/maintenance departments.

7. Evaluate adherence to good manufacturing practices (GMPs) in the areas of production, process, and laboratory controls, organization and personnel, and building and facilities, and make recommendations for improvement.

8. Hold discussions with USAID/Kampala and PRITECH/Kampala regarding Medipharm's production status and capability for sustainability.

II. Summary of Findings

Medipharm produced 1.12 million sachets in 1991 against an initial target of 1.08 million. Their overall efficiency was only 40 percent. Of the 158 batches produced since July 30, 1991, five batches did not meet the WHO/CDD/SER/85.8 specifications and were rejected. An action plan for 1992 was made using the market forecast and production capacities, and efficiency and quality targets were set. The 1992 production goal was set at 2 million sachets. The 1992 efficiency target was set at 71 percent with zero reject and zero rework. Recommendations were made to achieve the goals using cause and effect analysis to identify and eliminate causes of low productivity, batch rejections and rework/reprocess, and wastage. Recommendations were made for the rework/reprocess of 50,000 sachets and for the disposition of 15,000 sachets used for seal integrity testing.

A review of the PATH QA Policies and Guidelines Manual revealed that most of the QA policies have not yet been implemented; strategies were developed to implement them. Plans, drawings, and recommendations were made for the installation of new equipment scheduled to arrive in late March 1992. A one-day session was held to train Medipharm personnel in developing a production planning and inventory control system; three products were used as a model to plan 24 months of production and raw and packaging materials inventory. Medipharm has not yet developed a network of local, regional, and/or international sources of machinery spares parts and service/repair organizations. To achieve this objective, a visit to British/American Tobacco, which is one of the largest and most organized companies in Uganda, was arranged. As a result, local and regional sources were identified. After an evaluation was made of Medipharm's adherence to GMPs, several recommendations were made for improvement.

III. Evaluation of 1991 Production and Productivity

A. One half-day was spent in training the Medipharm production, QC, marketing, and general management staff to evaluate productivity indicators of the previous year and to establish 1992 goals for production and productivity. (Productivity measures the extent that resources of an organization are used to transform inputs to outputs. Production measures the total output. Productivity = outputs divided by inputs. Production = total outputs.)

Productivity and efficiency factors were derived by summarizing the data collected on production forms created by Project SUPPORT, such as the Monthly Production Report and the Production Performance Indicators, and implemented during previous visits (see Attachment A for a summary).

Medipharm produced 1.12 million sachets of oral rehydration salts (ORS) in 1991 against an initial target of 1.08 million. Medipharm's overall efficiency in 1991 was 40 percent, which translates into 1,038 hours of machine down time (time when the machine is not operative) of the standard 1,725 machine hours per year.

Low productivity results from machine down time. The major causes of the down time were found to be absenteeism (38%), adjustments to machines (17%), unavailability of facilities (12%), and power failures (12%). In addition to these factors, 341 hours of down time were not reported (see Attachment A).

B. Production Goals for 1992

UNICEF officials have conveyed to both PATH and Medipharm on several occasions that the 1992 minimum annual requirement for ORS in Uganda will be 2-3 million sachets. In 1993 UNICEF wishes to receive at least 3 million sachets.

Medipharm's goal for 1992 is to produce 2 million sachets. This is a 79 percent increase over 1991. Medipharm can only meet this challenge if it increases its productivity.

C. Productivity Goals for 1992

In order to meet the production goal of 2 million sachets in 1992, Medipharm will have to increase its efficiency to approximately 71 percent from the present 40 percent. This means that Medipharm will need to reduce its machine down time by at least 540 hours in 1992. Medipharm can do this if it can identify the critical causes and remove them.

IV. Cause and Effect Analysis to Solve Problems of Low Productivity

A one-day session was dedicated to training Medipharm production, QC, marketing, and general management staff to use the cause and effect analysis. Cause and effect analysis is a powerful tool widely used to search for the causes of quality and productivity problems in the areas where problems are most likely to occur. Senior managers and the managing director were trained to brainstorm and generate ideas about the likely causes of low productivity. Ideas were evaluated and categorized under a five-factor (people, equipment, material, methods, and environment) "fishbone" diagram (see Attachment B) to help isolate cause and effect relationships among variables. Many striking facts were uncovered during this analysis. *The cause and effect relationship dictates that 80 percent of quality and productivity problems in a process result from only 20 percent of the potential causes.*

Absenteeism, the largest reported cause of down time, was also analyzed and causes are listed on the fishbone diagram in Attachment C. The most critical causes for the absenteeism were found to be:

- Lack of purpose and goals. Management conceded that the management itself had not defined the goals and had not set any indicators of production or productivity.

- Low morale. Low morale runs throughout the organization; hence, late arrivals, excessive absenteeism, early departures, or stopping work early result. For example, if a batch finishes before the end of the day, the second batch is not started until the beginning of the next day, even if two to three hours remain before the close of the day.

- Unaccessible medical treatment. Most employees cannot afford private treatment for common illnesses and must spend an entire day traveling to a public hospital located downtown to have themselves, their spouse, or their children treated.

- Funeral attendance. Due to cultural factors, employees attend funerals of people not immediately related to them. This amounts to

employees attending several funerals during the month, sometimes taking an entire day or even many days.

- Management planning. The company van that transports employees from downtown to the factory and from the factory to downtown is often late, causing late arrival or late departure. Often times the van service has been discontinued.

Recommendations:

It was agreed to implement the following action items which will have immediate effects:

1. Remove all the critical causes that are identified on the fishbone diagrams, particularly those mentioned above. The managing director is to meet with the production/plant manager and the department managers every day for one-half hour to discuss the implementation of the action plan to remove the critical causes. This meeting should be conducted until all causes are removed and all indicators are being met.

2. The managing director will meet with the production/plant manager, QC manager, and materials manager every week to evaluate the production, productivity, and quality goals. If these goals are not being met, the cause and effect analysis should be used to determine and remove the causes.

3. Hire a part-time nurse and provide basic medical treatment for common illnesses for employees and their immediate family (spouse and children) on the factory premises.

4. Define the company mission and set daily, weekly, monthly, and yearly goals. Discuss the mission and goals with all employees and infuse a sense of purpose and direction. This will contribute to eliminating low morale and lack of motivation and purpose.

5. All employees will use discretion in attending funerals and give priority to only close family members. In the event that a relative of an employee passes away, the company will send one representative from the factory instead of the entire staff to attend the funeral.

6. Management will ensure that the company van is punctual both in picking up the employees in the morning and dropping off the employees in the evening.

7. Use the cause and effect analysis to determine and eliminate the cause(s) for 341 hours of unreported down time and the three largest contributors to reported machine down time: 117 hours of adjustments, 85 hours of bulk not available, and 85 hours of facilities not ready. Unreported down time forms the single largest category of machine down time.

V. Evaluation of Manufacturing and QC for Batches Produced Since Last Review

Since the last review on July 30, 1991, an additional 103 batches of ORS were produced, which represents approximately 733,875 sachets. Five batches failed due to the chemical composition being out of specification.

The minimum, maximum, mean, and standard deviation values for each of the elements that failed in the five batches are listed below:

Batch number	Element out of spec.	Min.	Max.	Mean $\bar{X}$	Std. Deviation σ
112156	sodium (83.2-94.0)	87.55	102.61*	91.14	3.1
112157	sodium	81.54	94.21	90.32	2.91
112158	chloride (74.4-85.6)	76.34	88.19	82.07	2.59
112160	sodium	76.68	95.00	89.07	5.61
	potassium (18.7-21.5)	18.31	20.82	19.99	0.55
	chloride	70.91	85.44	81.72	3.15
112161	sodium	89.17	94.56	91.59	1.33

* Shaded values indicate the value is out of specification.

All other batches met the WHO/CDD/SER/85.8 specifications. The quality graphs, which plot the minimum, maximum, and standard deviation values for each assay for batch numbers 108081 through 112155 are provided as Attachment D.

A statistical review of the distribution of the batches produced indicates that there continues to be a large variation in the assay values within and among the batches.

VI. Cause and Effect Analysis to Eliminate Rejects and Rework/Reprocessing

A one-day session was dedicated to using the cause and effect analysis to investigate the batch rejections. In addition to the production and

QC managers and supervisors, dispensing and packaging technicians and senior QC analysts were included in this training session.

The five-factor fishbone diagram listing all the possible "common" and "special" causes of batch reject and rework/reprocess is provided as Attachment E.

A "special" cause is an extraordinary occurrence in a process and is also known as an abnormal variation (from the process). It is usually unpredictable. An example of a "special" cause is a batch defective raw material or a faulty machine setting or function.

A "common" cause is present in every process and is also known as a normal variation (from the process). It is predictable and is due to the combination of the existing people, methods, equipment, environments, and materials. An example of a "common" cause is a slight variation in raw materials, a loose/worn out bearing in the machine, or a vibration in the machine.

Key to process improvement is to identify and eliminate the "special" causes and minimize the "common" causes.

A number of "common" causes were identified at Medipharm that must be addressed immediately. An observation and some of the "special" causes identified that are unique to the rejected batches are listed below:

- All five of the rejected batches were produced in December 1991.

- There was considerable overtime in production during December 1991. Due to the Christmas season, late arrivals, absenteeism, and a festive atmosphere were prevalent in the factory and may have resulted in a "special" cause.

- The rollers of the drum hoop mixer broke down and, some batches had to wait for several days after being weighed. Also, several interruptions occurred during the mixing because of the malfunction of the rollers. This underscores the need for a preventive maintenance and spare parts inventory program.

- Rain water leaked through the roof of the drying/milling/sieving room onto the chemicals in the Gruenberg drier. The chemicals were physically inspected and found to be visually uncontaminated.

Recommendations to Obtain Zero Rejects and Rework/Reprocesses:

1. The managing director will meet with the production/plant manager and the QC manager every day for one-half hour to evaluate the implementation of the action plan to eliminate the critical causes of rejects and rework/reprocesses identified in the fishbone diagram.

2. The managing director will discuss the quality indicators during the bi-monthly meetings.

3. The most critical "common" causes of batch reject and rework/ reprocess identified that need to be addressed are:

   - The production supervisor and the production/plant-manager must train the production packaging technicians to accurately fill out the data on the in-process forms and to evaluate and interpret the data. If negative trends in quality and productivity are found, the technicians must immediately coordinate with the production and QC supervisors to investigate and eliminate the cause(s).

   - The data on the in-process control forms must be evaluated and interpreted randomly (at least twice every batch) by the production supervisor (Ms. Christine Akullo) and the production/plant manager (Mr. Peter Ssali). This will ensure accuracy of data and identify deteriorating trends in quality and productivity.

   - The production/plant manager must convey to the production and packaging technicians the importance of accurately reporting the in-process data.

   - Within 15 minutes of the completion of each batch, the production and packaging technicians, production supervisor, and QC and production managers must review the in-process data; the same should be done as soon as the assay results are known and plotted. Data interpretation and evaluation should not take, in most cases, more than 5-10 minutes.

Recommendations to Test the Rejected Batches:

The complete data on the five rejected batches was received from Medipharm on March 6, 1992. A complete analysis and recommendations will be provided as an addendum to this trip report.

VII. Adherence to QA Policies and Guidelines Manual

Every policy in the manual was reviewed with the QC manager. Most of the QA policies included in the PATH QA Policies and Guidelines Manual have not yet been implemented at Medipharm, although some progress has been made especially in the areas of maintaining QC records and testing procedures and methods. The following critical policies have yet to be implemented:

POLICY NUMBER	COMMENTS
01-04	A formal team in charge of the rejected batch investigation and disposition is not in place.
01-05	A reprocessing procedure and master record does not exist.
01-11	Although excellent records are maintained for retained samples, a proper storage room for retained samples is not yet available.
01-12	The QA audit conducted in July 1991 was only partially completed. A formal GMP team has not yet been created. A GMP manual has not yet been developed.
01-14	All reference standards have been depleted. Some new ones have been obtained from local sources whose quality is questionable. Medipharm will request UNICEF's procurement department to acquire the reference standards for ORS compounds, and then secondary standards, or working standards, will be made as stated in Policy Number 02-02.
02-02	Secondary standards, or working standards, have not been determined.
02-02	There is no calibration schedule available. Calibration is performed on an ad hoc basis. There is no government agency that validates the scales. A Uganda Standards Board is just beginning to be formed.
03-01	A recent change in manufacturing procedure (mixing time) was not reviewed and properly documented.
03-06	QA is not presently responsible for issuing records/procedures or changes in manufacturing procedures.
06-01	A system of using approved disinfectants and chemical sanitizing agents is not in place by the QA department. Presently, approval is performed on an ad hoc basis.
06-02	Minimum standards for microbial environmental monitoring and corrective actions are not in place.
07-07	There are no procedures for returned goods.

VIII. New Equipment

A. Installation and Evaluation

At the time of the visit, two pieces of equipment had arrived at Medipharm: the compressor for the flame photometer and the air compressor for the form/fill/seal (FFS) machine.

1. Compressor for the flame photometer

   The compressor for the flame photometer was already installed but was placed on top of a drum that was unstable and not level; however, readings taken were indicated as stable.

2. Air compressor for the FFS machine

   Medipharm built a special room to house the air compressor for the FFS machine. This room has a concrete floor, is well ventilated, and has adequate clearance space. Medipharm is preparing to install a 40-meter long cable in order to install the controls of the compressor in the FFS machine room. Medipharm was advised by PATH to install the control near the compressor, which is a standard and efficient way of installation, and not in the FFS room. As a result of this change, Medipharm saved about US$4,000 in material and labor costs with this new design. The compressor was operating with temporary connections and it provided the required amount of pressure. The amps and the vibrations were found to be in the normal range. The mounting design and the piping sizes were discussed.

3. Automatic timer for the drum hoop mixer

   A programmable timer for the drum hoop mixer was hand carried to Medipharm. The timer will aid in keeping the mixing time accurate, which will ensure conformance with the process specifications. The installation of the timer was discussed with the electrician.

Recommendations:

1. The compressor for the flame photometer should be placed on a solid, level surface and must be checked with a spirit level.

2. The compressor should be mounted by grouting four bolts in the floor. The compressor manual provides instructions along with a drawing to mount the compressor. The piping design was discussed and two elbows were identified as unnecessary. The removal of the two elbows will enhance the pressure and reduce the moisture in the line. Although the diameter of the pipe that runs from the compressor outlet to the FFS machine will remain the same, at two locations the adapters were of a larger

size than necessary. These adapters will need to be changed from the present one inch size to 3/4 inch. The collecting tank outside the FFS room needs to be removed, and the filter that came with the compressor should be installed at this location. Medipharm is urged to develop a preventive maintenance program for the air compressor. Of particular importance is drainage of the receiver tank and air filter twice a day.

3. The automatic timer on the drum hoop mixer should be validated after installation.

B. Planning for New Equipment

Attachment F provides a list of new equipment that is expected to arrive at Medipharm. The critical equipment that requires preparation is:

1. Torit dust collector

This dust collector can be used for both the Fitzpatrick mill as well as the UPI FFS machine. The dust collector will be placed in the milling/drying/sieving room, and the canopy will be hung from the ceiling above the Fitzpatrick mill. The control switch is recommended to be installed in the FFS room, because the Fitzpatrick mill operates only two to three hours a day, whereas the FFS machine operates eight hours or more. Because the dust collector has a heavy motor and consumes a lot of energy, it should be turned off while not in operation. The location of the control switch in the FFS room will ensure this.

The layout of the dust collector and the ducting drawing is provided as Attachment G.

2. Voltage stabilizer for QC lab equipment

The voltage stabilizer is rated at 3kVa. All the QC equipment was evaluated, and it is recommended <u>not</u> to connect the Gallenkamp oven and the Memmert dryer to the stabilizer. It is not critical that these two pieces of equipment be connected to the stabilizer. If connected, this equipment alone will utilize more than half of the capacity of the stabilizer. The stabilizer should be connected to the instruments in the instrument room and to the flame photometer and its compressor.

The electrical wiring in the QC laboratory is unbalanced and inadequate. Currently, electrical wiring for the lab equipment branches off from many different circuits. In order to bring the electrical wiring to code, a dedicated 60-amp distribution panel (sub-circuit) needs to be connected to the bus bar in the sub station; Medipharm has agreed to carry this out. The

design was discussed with Mechelectro Engineering Systems, the Medipharm electrical consultant. The electrical drawing in Attachment H was approved; the new distribution panel of the lab should be configured as shown in this drawing.

IX. Production Planning and Inventory Control System

Presently, Medipharm does not have a production planning and inventory control system. As a result, there are frequent shortages of materials for Medipharm's pharmaceutical products, the production mix is not planned to maximize the productivity of resources, and there is no planning for cash flow. Also, the value of the inventory, the current assets, is not known and therefore cannot be leveraged for bank loans.

A one-day training session was held to train Medipharm personnel in developing a production planning and inventory control system. Three Medipharm products, ORS, Oradex, and Metrin (Co-trimoxazole), were used as a model to plan 24 months of production and raw and packaging materials inventory based on the marketing forecast. An example with formulas and explanations was worked out using hand-held calculators. Attachment I contains the model. Personnel and system recommendations to implement this plan were also made.

The benefits of a production planning and inventory control system were explained to the management. The implementation of the system will:

- Eliminate shortages of finished product and raw and packaging materials, ensuring production orders/deliveries wil be on time (product availability).
- Reduce the cost of capital because less cash will be tied up in inventories (better profitability).
- Optimize cash flow, and consequently decrease interest expenses and dependence on loans because of the ability to forecast the material requirements.
- Increase the productivity of labor and quality. Better planning will result in eliminating shortages, making more of the right product at the right time.
- Eliminate disorder in production and increase utilization of management time to further improve quality and productivity and/or to develop new products.

It was estimated that it will take the equivalent of one person working full time (8.5 hours per day, 5 days per week) to develop the production planning and inventory control system. After the system is developed, it will take fewer hours per day and days per month to maintain and update the system.

The management appointed Mrs. Justin Seguya as the materials manager. Mrs. Seguya will dedicate roughly 40 percent of her time, about 3 hours every day, to setting up the production planning and inventory control system in addition to carrying out other duties of the department. Ms. Sara Nakayima will be the main back-up person dedicating 40 percent of her time to this activity. Ms. Sara Nakayima is also responsible for the warehouse controls and maintaining the Kardex system. Mr. Eliphaz Mukasa will dedicate approximately 30 percent of his time on this activity. This will provide two back-up people to the materials manager for this important function.

Recommendations:

1. Medipharm will formalize the setting up of the materials management department and organize the setting up of the production planning and inventory control system, using the model introduced during the visit as an example.

2. Medipharm will send to PATH a working model of the production planning and inventory control system by April 15, 1992. PATH will review and make recommendations during the next visit in early May.

X. Medipharm's Capability to Develop Contacts and a Company Visit

A complete list of all vendors and manufacturers of machines and spare parts that are used in the manufacturing of ORS at Medipharm was given to Medipharm.

A plant visit was arranged for Medipharm to go to British/American Tobacco (BAT). BAT is one of the largest and the most organized companies in Uganda. Medipharm's managing director, production/plant manager, and maintenance engineer met with the plant manager of BAT, who gave them a plant tour and discussed a few of its sources, vendors, and machine shops where BAT has its parts, machines, and equipment fabricated. He also welcomed Medipharm to contact him if they wish to meet the BAT procurement manager.

Every machine that Medipharm uses is imported. Consequently, it has to pay a high price to import spare parts. Local and regional sources of spare parts and machines will reduce the dependence on imported spare parts, thereby saving a substantial amount of foreign exchange and reducing lead time and procurement costs.

Recommendations:

Medipharm will develop local, regional, and international sources of machinery, spare parts, raw materials, and service/repair organizations. Medipharm can do this by taking the following steps:

1. Request the plant manager of BAT to arrange a meeting with the procurement manager of BAT, whose office is in Jinja.

2. Visit machine shops suggested by BAT plant and procurement managers and develop a short list of those that have good technical and servicing capabilities.

3. Invite the engineers of the machine shops to Medipharm to show them the machines and parts that Medipharm uses and discuss the parts that can be locally fabricated. Obtain a quotation and compare costs. If economically feasible, develop and test the parts.

4. Visit pharmaceutical factories in Kenya that have been in operation for a number of years. Obtain from the factories names and addresses of vendors, suppliers, and service/repair organizations.

XI. GMPs

Production and process controls, laboratory controls, organization and personnel, and buildings and facilities were evaluated in terms of their adherence to GMPs, and a number of recommendations and methods of corrective action were identified. There was definite improvement in GMPs since the last visit in July 1991. The areas that need improvement are included in the recommendations.

A. Production and Process Controls

1. In 1991 approximately 50,000 sachets needed rework/reprocessing because they were out of specifications for weight or the cut of the foil was not centered. These sachets are being stored outside of the factory in the top container of two containers which serve as the warehouse. Similarly, 15,000 sachets used for seal integrity testing are stored in the same container. The temperature and humidity of this container is exceptionally high due to exposure to sun, and it does not have any ventilation and/or adequate insulation. To date, no decision has been made on the disposition of these sachets.

2. Some of the 34 bags of glucose that were damaged by rodents and were rejected are still in the rejected materials container.

3. Presently, ten sachets are tested for seal integrity every 30 minutes. The seal integrity results have been excellent.

Recommendations:

1. Store all sachets to be reworked/reprocessed and those tested for seal integrity at a location that is cooler than that currently used. One possible location is the room where the foil is stored. Transfer the sachets having this status from the present containers to this location immediately. Storing the sachets in a cooler location will prevent the ORS from rapidly deteriorating.

2. Use the criteria provided in Attachment J to rework/reprocess sachets.

3. Make a complete reprocessing protocol and a reprocessing manufacturing record.

4. Validate the mixing time for the reprocessing.

5. Inspect 100 percent of the sachets in the container that were used for seal integrity testing for clumping. Sachets that pass this test should be packed in bags of 20 or 30 and marked "FOR DONATION ONLY" and donated to hospitals, orphanages, employees' families, or needy organizations.

6. Reduce the number of sachets to be tested for seal integrity from 10 every 30 minutes to 5 every 30 minutes.

B. Laboratory Controls

The original reference standard of each chemical that came with the original reagents ran out at batch number 135 and new reagents were purchased locally. The reagents are sourced from Riedel-Delhaèn, Switzerland. The container did not bear any date of manufacture or expiration. The reference standard for glucose has completely run out and raw material is used as a reference standard. The deterioration of the reference standard biases the results and makes them inaccurate.

Water is not tested and, as a result, the purity of the water is not known. If the water that is used for testing is impure, it will result in inaccurate assay results.

During testing and assay, the same glassware is used for 20 samples; however, the glassware is only rinsed with distilled water and is not washed with soap or validated.

Currently, reference samples of all the batches that are one-year old are tested for chemical composition as well as all other tests.

Recommendations:

1. Request that UNICEF/Kampala obtain reference standards. Develop secondary reference standards per the PATH QA Policies and Guidelines Policy Number 02-02.

2. Test water on a regular basis per the PATH ORS QC Manual Test Number 05-01.

3. Validate the glassware to provide accurate and precise results when it is rinsed with water only in between each test of the same batch.

4. Per the PATH QA Policies and Guidelines Manual Policy Number 01-10, assay reference samples of only three batches per year for stability testing instead of testing the reference samples of all the batches produced the previous year. However, reference samples of all the batches must be tested for:

   - Seal integrity (2 sachets) (test number 9.1.3. in the WHO/CDD/SER/85.8 manual).

   - Appearance of product (test number 9.1.5. in the WHO/CDD/SER/85.8 manual).

   - Appearance of solution (test number 9.1.6. in the WHO/CDD/SER/85.8 manual).

   - pH of solution (test number 9.1.7. in the WHO/CDD/SER/85.8 manual).

C. Organization and Personnel

Administrative duties (housekeeping, food/refreshments, protective gear, etc.) are managed by Mrs. Justin Seguya. As a result, the production manager's time, who previously handled this function, was freed up for production issues. However, since Mrs. Justin Seguya has been appointed materials manager, a full-time job, another staff person will have to assist her or replace her as the administration manager.

Medipharm has not been able to find a replacement for the electrician. Currently, the electrical work is being carried out by a consultant, Mr. M. Kafaluma. Preventive maintenance work will be neglected unless Medipharm finds an electrician.

Mr. John Ruberantwari, plant manager, has resigned. Mr. Peter Ssali-Mukasa has been appointed as production/plant manager. This move further reflects the trend towards a lean organization.

D. Buildings and Facilities

Recommendations:

Most of the following recommendations were already presented in previous visits:

1. Install a metal frame filter on the return air ducts of the air conditioner.

2. Negotiate a semi-annual and annual contract for servicing the air conditioner.

3. Waterproof the roof and the skirting with a certified waterproof sealant. Coal tar, which is available locally, is an excellent sealant if applied properly.

4. Install screens on the windows of the QC areas.

5. Upgrade and maintain the toilets for the production staff, and maintain a regular supply of running water, soap, and single-service towels.

6. Construct a new workshop area where all tools, drills, and frequently used minor parts (V belts, pulleys, screws, bushes) can be organized and stored. The location of the workshop and the future plant room was discussed and finalized.

7. Paint the pulley cover of the Gruenberg dryer with an oil-based paint of the same color as that of the dryer.

8. Build an incinerator for the disposal of all labels.

9. Build a roof over the raw materials containers

10. Cage the quarantine area to avoid unapproved products being mistaken for approved products.

11. Write and implement a formal procedure in the form of an SOP for the control of pests and rodents in the warehouse and plant. Attachment K provides instructions for the cleaning and maintenance of pharmaceutical storage areas which will help to eliminate rodents and pests. Brochures for an ultrasonic rodent killer and an insecticide are also provided in Attachment K.

XII. Discussions with USAID/Kampala and PRITECH/Kampala

A meeting was held with David Puckett and Joan La Rosa, USAID/Kampala, and Sjoerd Postma, PRITECH/Kampala. Discussions during the meeting included (1) the scope of work of this visit; (2) Medipharm's current inventory levels and raw materials purchases for the next consignment; and (3) Medipharm's production goals for 1992, 1991 efficiency levels, and the need to increase its efficiency levels. Also discussed were Medipharm's achievement of quality and the limitations due to the five failed batches, as well as the strategy to eliminate the causes of future rejections.

D. Puckett discussed whether Medipharm would be sustainable by July 1993, when the supply of the USAID/UNICEF-donated raw materials will cease. Specifically, D. Puckett was concerned about whether Medipharm will be able to completely or partially purchase raw materials and what measures would be necessary to bring Medipharm to that level of

ability. D. Puckett requested that PATH submit a discussion draft to him for continued technical assistance to Medipharm through 1993.

S. Postma inquired as to the feasibility of Medipharm producing colored/flavored ORS. PATH informed him that from a production perspective the present time is not appropriate for Medipharm to become involved in producing another ORS product. PATH emphasized that the production efficiency of Medipharm is only 40 percent and that Medipharm has not yet fully implemented the QA policies and procedures or preventive maintenance and inventory control system—all vital elements to guarantee product deliveries and quality at a cost that is lower than the price. PATH advised S. Postma that it will take Medipharm at least another year of dedicated, guided, and uninterrupted work to increase its efficiency and implement these vital systems. If Medipharm management is distracted in the next six months by developing and producing colored/flavored ORS, its efficiency and quality will drop further, and Medipharm will not have the management time to concentrate on optimum efficiency.

Debriefing meetings were held with D. Puckett (S. Postma was informed but was not present at the meeting) in which Medipharm's need for continued technical assistance was highlighted to achieve the production and efficiency goals for 1992 and beyond.

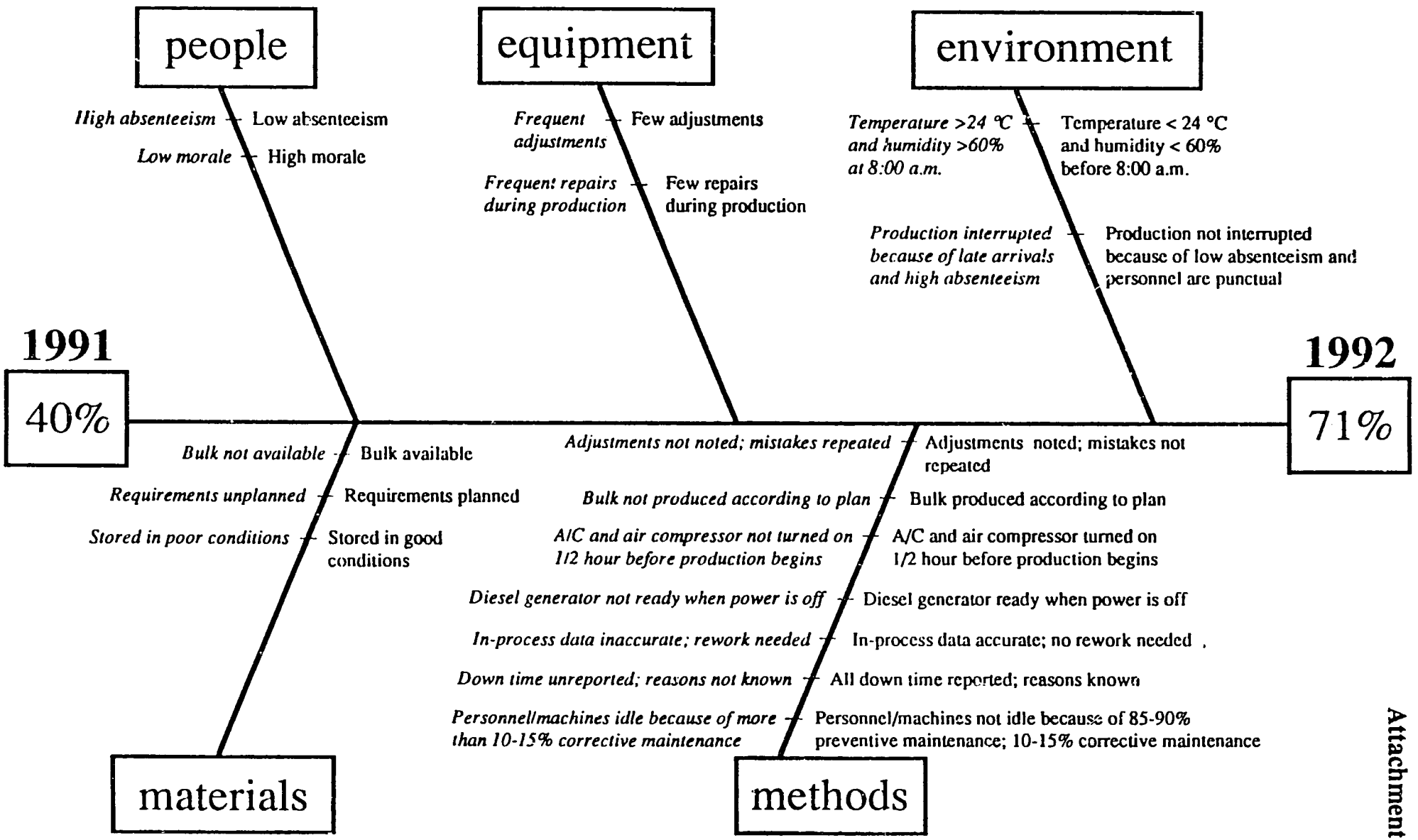
MEDIPHARM INDUSTRIES (EA) LTD.
SUMMARY OF PRODUCTION INDICATORS - MARCH 1991 - DECEMBER 1991
HOURS OF DOWN TIME

REASON FOR DOWN TIME	MARCH	% of total	APRIL	% of total	MAY	% of total	JUNE	% of total	JULY	% of total	AUG	% of total	SEP	% of total	OCT	% of total	NOV	% of total	DEC	% of total	YTD TOTAL	% of total
ABSENTEEISM	18	25%	39	46%	96	92%	25	51%	17	22%	13	24%	29	60%	12	9%	14	22%	0	0%	261	38%
ADJUSTMENTS	23	32%	35	41%	0	0%	4	8%	1	1%	6	11%	0	0%	43	32%	6	10%	0	0%	117	17%
BULK NOT AVAILABLE	0	0%	0	0%	8	7%	5	10%	22	29%	22	41%	14	29%	0	0%	15	24%	0	0%	85	12%
FACILITIES NOT READY	0	0%	0	0%	0	0%	0	0%	0	0%	5	9%	0	0%	80	59%	0	0%	0	0%	85	12%
POWER FAILURE	19	26%	5	7%	1	1%	4	8%	10	13%	2	3%	2	5%	0	0%	1	2%	1	8%	46	7%
UTILITIES NOT AVAIL.	0	0%	0	0%	0	0%	7	13%	24	32%	4	8%	1	2%	0	0%	3	4%	9	64%	48	7%
REPAIRS	9	12%	0	0%	0	0%	5	9%	0	0%	0	0%	0	0%	0	0%	14	22%	4	27%	31	4%
REWORK	4	6%	5	6%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	8	12%	0	0%	17	2%
GMP ORIENTATION	0	0%	0	0%	0	0%	0	0%	2	3%	2	4%	2	4%	0	0%	3	4%	0	0%	9	1%
TOTAL REPORTED DOWN TIME - HRS	73	100%	83	100%	104	100%	49	100%	76	100%	52	100%	48	100%	135	100%	62	100%	15	100%	697	100%
TOTAL UNREPORTED DOWN TIME - HRS	61		9		13		35		43		65		17		-4		35		69		341	
STANDARD TIME - HRS	196		148		176		159		184		182		170		177		174		160		1,725	
REP. DOWN TIME-% OF STD.	37%		56%		59%		31%		41%		29%		28%		76%		36%		9%		40%	
AVAILABLE TIME - HRS	124		65		72		110		108		129		132		42		112		146		1,028	
NO. OF BATCHES: IN STANDARD TIME	45		34		40		36		42		42		39		40		40		37		399	
IN AVAILABLE TIME	28		14		16		25		24		29		28		9		25		33		237	
ACTUAL PRODUCTION	14		12		13		17		14		20		24		10		17		17		158	
UNACCOUNTABLE PROD.	14		2		3		8		10		15		4		(1)		8		16		79	
UNACCOUNTABLE PROD. VARIANCE	-50%		-14%		-19%		-32%		-42%		-31%		-14%		11%		-32%		-48%		-33%	
EFFICIENCY actual/standard	31%		35%		33%		47%		33%		48%		62%		25%		43%		46%		40%	

24-Jan-92 File: causefec.wr1 14:21

Attachment A

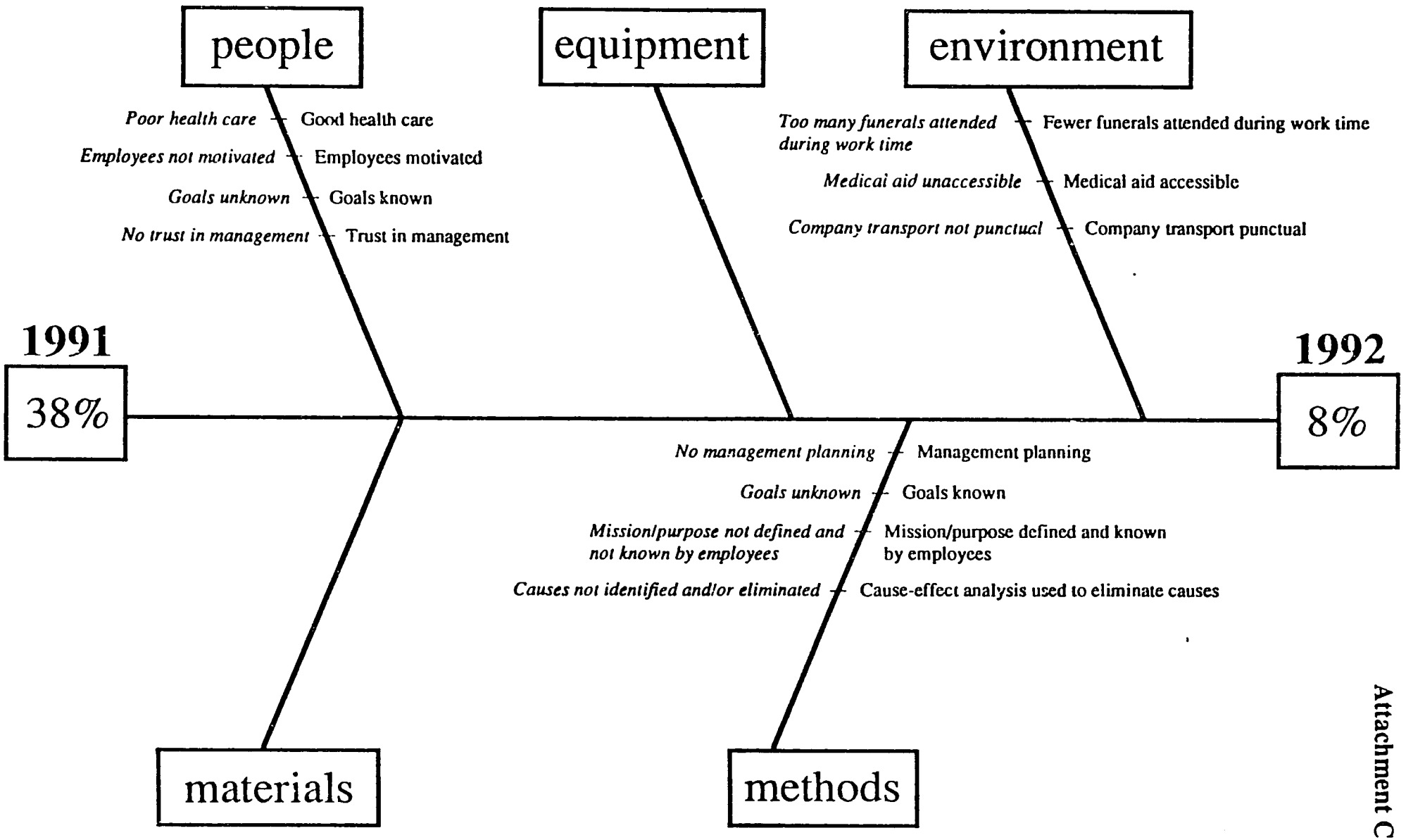
Cause-Effect Analysis
(Fishbone Diagram)
Productivity



Attachment B

Cause effect/production, 1/31/92
C Sutter5

Cause-Effect Analysis
(Fishbone Diagram)
Absentieesm



Attachment C

Cause-effect/absenteeism 3/31/92
CSutter5

Attachment D

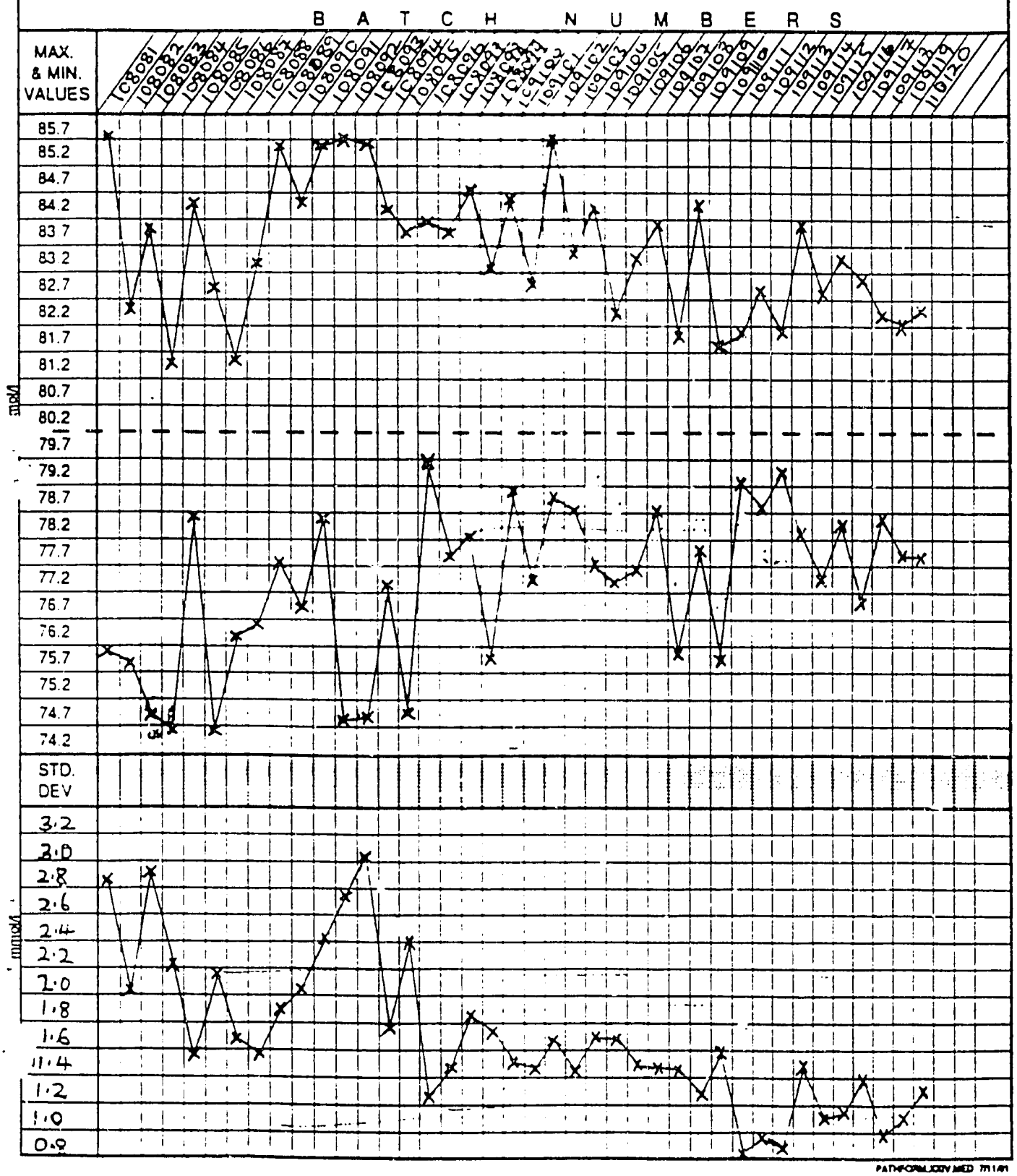
RECEIVED JAN 0 2 1992

KMahmood
HZarde
654.03V

MEDIPHARM INDUSTRIES, E. A.
ORS QUALITY GRAPHS
CONTROL CHART FOR CHLORIDE ASSAY

SPECIFICATIONS: U = 85.6 mmol/l L = 74 4 mmol/l
Theory 0 mmol/l

CONTROL ATTRIBUTES: MAXIMUM VALUE, MINIMUM VALUE, STANDARD DEVIATION



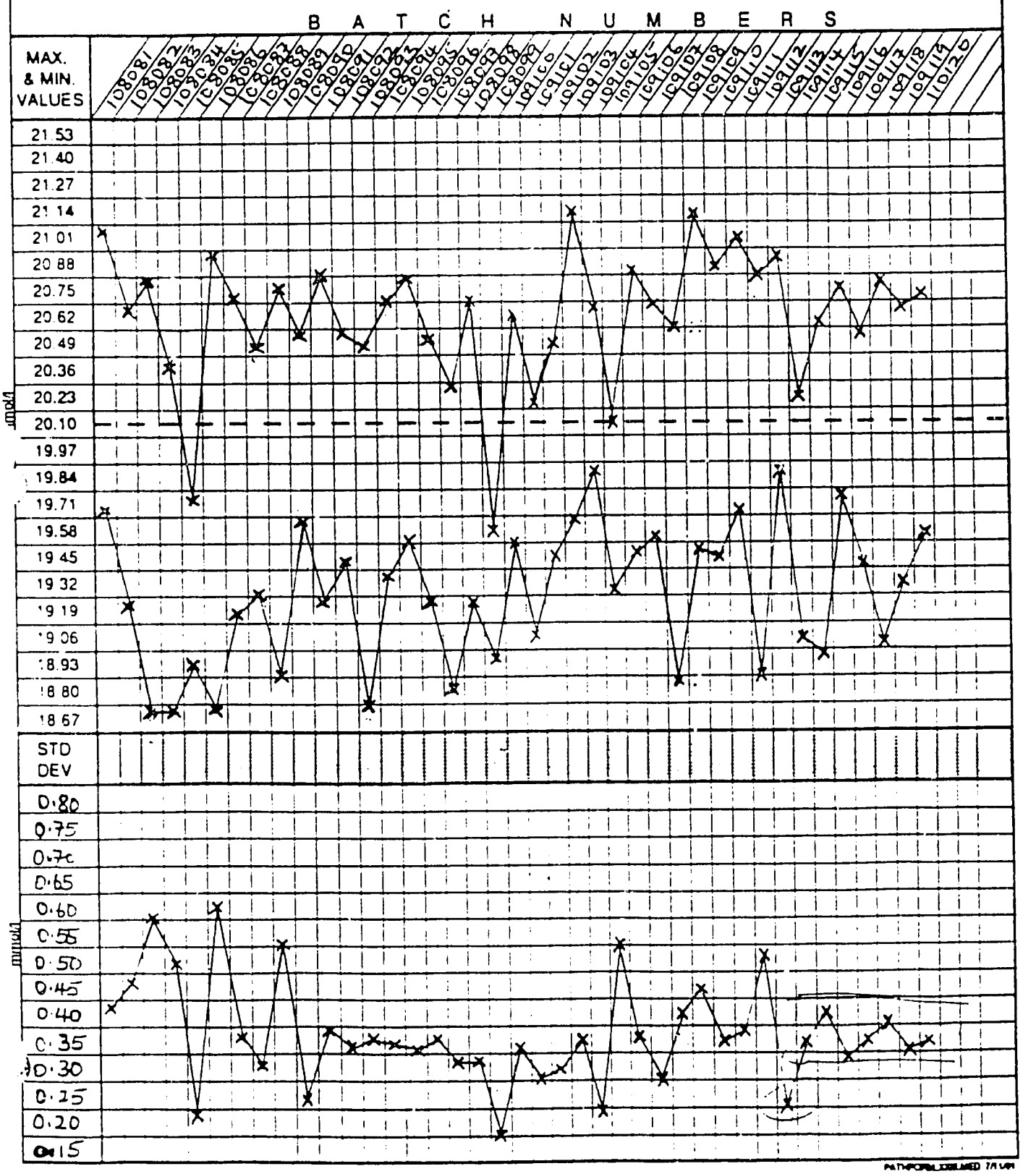
PATHFORM LOCKY MED 7/1/91

- 21 -

MEDIPHARM INDUSTRIES, E. A.
ORS QUALITY GRAPHS
CONTROL CHART FOR POTASSIUM ASSAY

SPECIFICATIONS: U = 21.5 mmol/l L = 18.7 mmol/l
Theory = 20.1 mmol/l

CONTROL ATTRIBUTES: MAXIMUM VALUE, MINIMUM VALUE, STANDARD DEVIATION

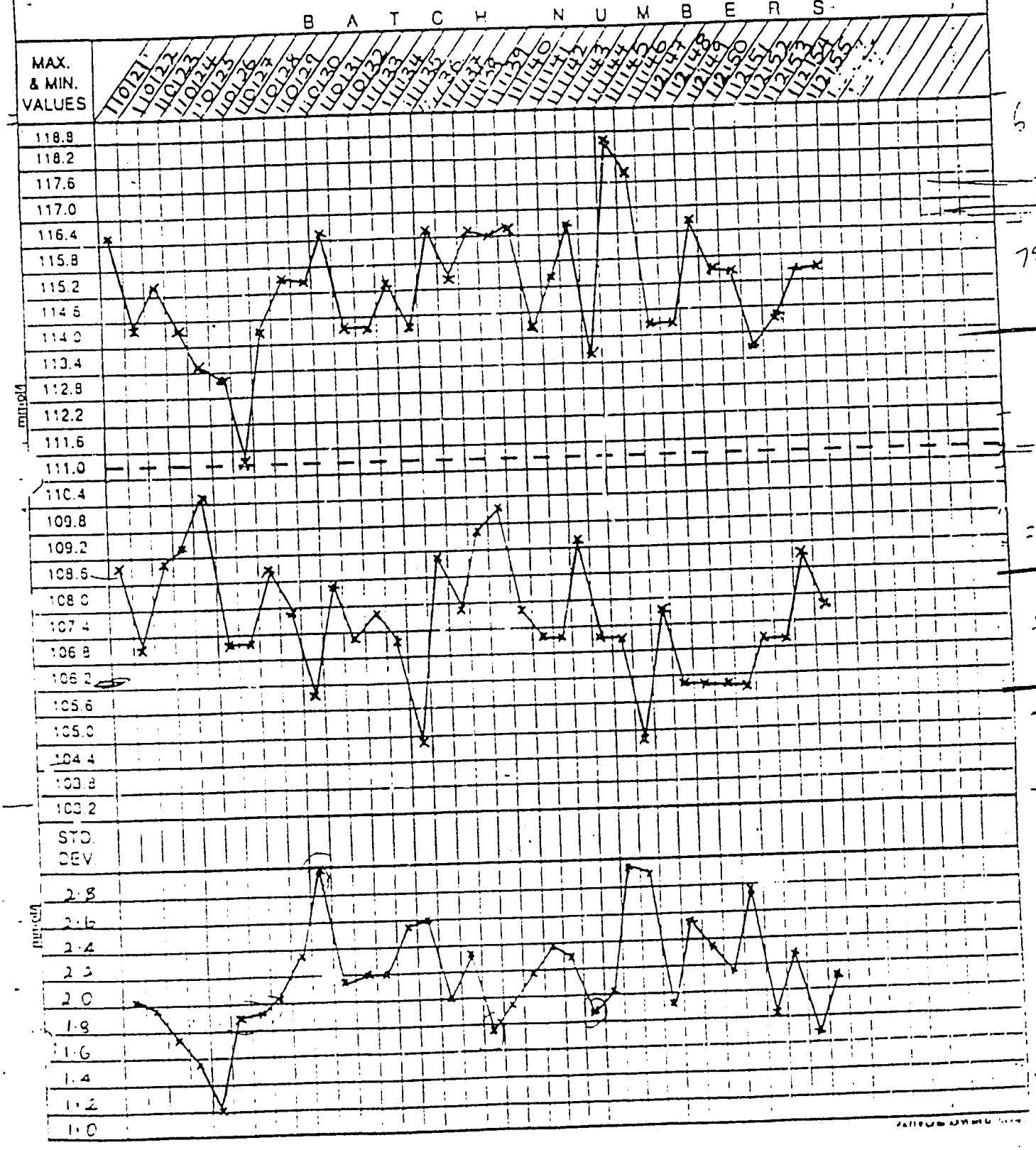


RECEIVED JAN 1 3 1992

MEDIPHARM INDUSTRIES, E. A.
CRS QUALITY GRAPHS
CONTROL CHART FOR GLUCOSE ASSAY

SPECIFICATIONS: U = 118.8 mmol/l L = 103.2 mmol/l
Theory = 111.0 mmol/l

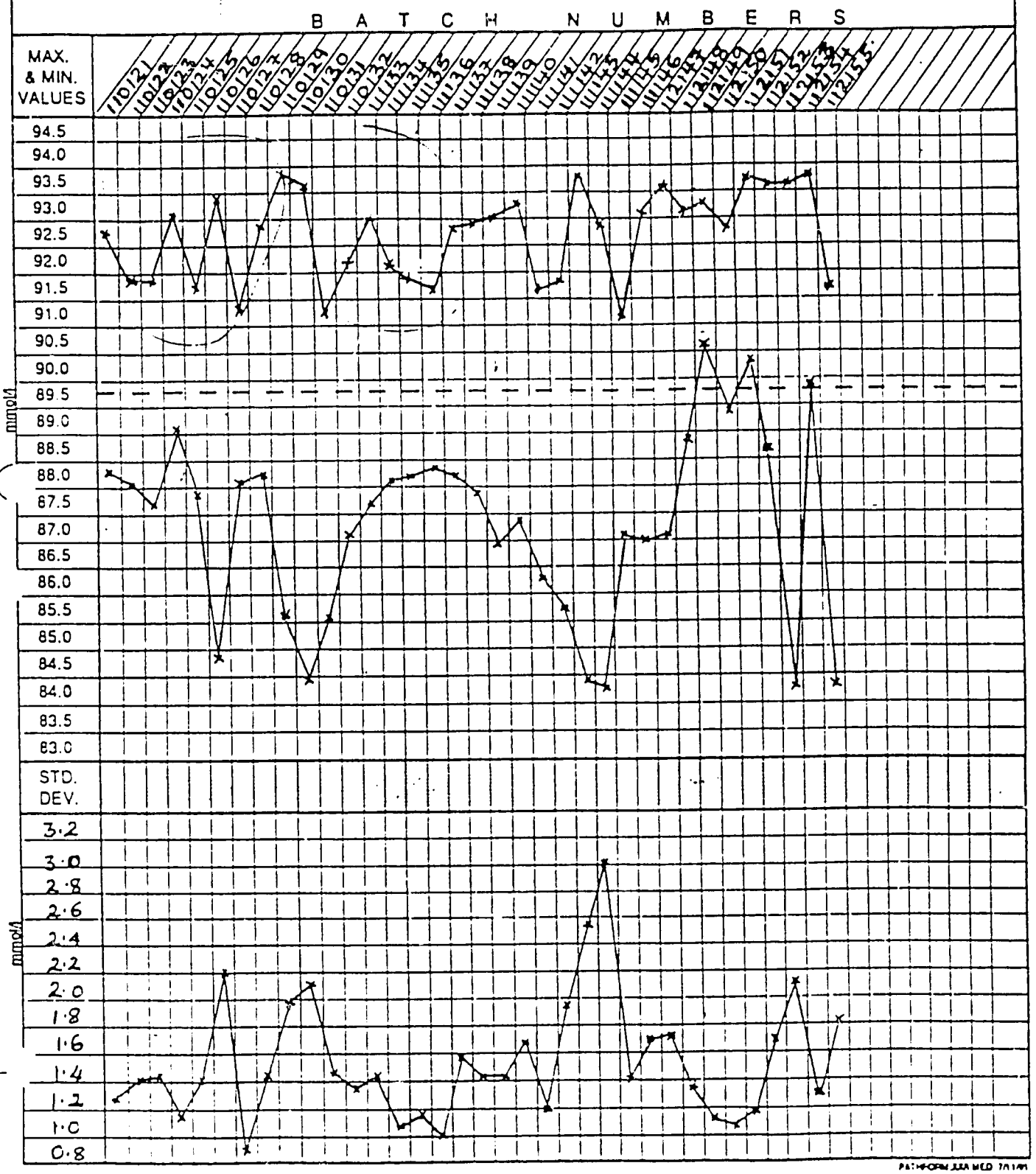
CONTROL ATTRIBUTES: MAXIMUM VALUE, MINIMUM VALUE, STANDARD DEVIATION



MEDIPHARM INDUSTRIES, E. A.
ORS QUALITY GRAPHS
CONTROL CHART FOR SODIUM ASSAY

SPECIFICATIONS: U = 94.0 mmol/l L = 83.2 mmol/l
Theory = 89.6 mmol/l

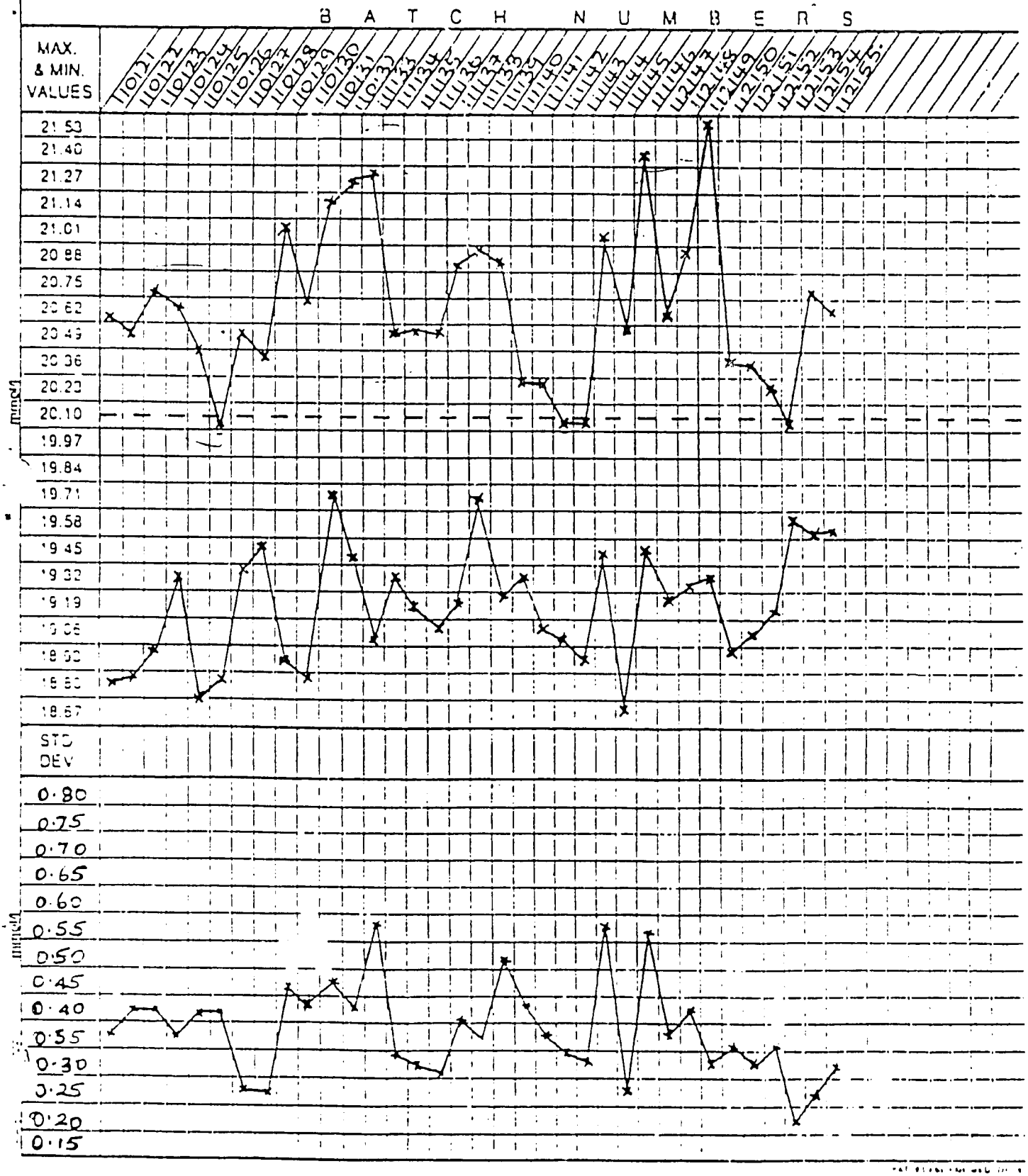
CONTROL ATTRIBUTES: MAXIMUM VALUE, MINIMUM VALUE, STANDARD DEVIATION



MEDIPHARM INDUSTRIES, E. A.
ORS QUALITY GRAPHS
CONTROL CHART FOR POTASSIUM ASSAY

SPECIFICATIONS: U = 21.5 mmol/l L = 18.7 mmol/l
Theory = 20.1 mmol/l

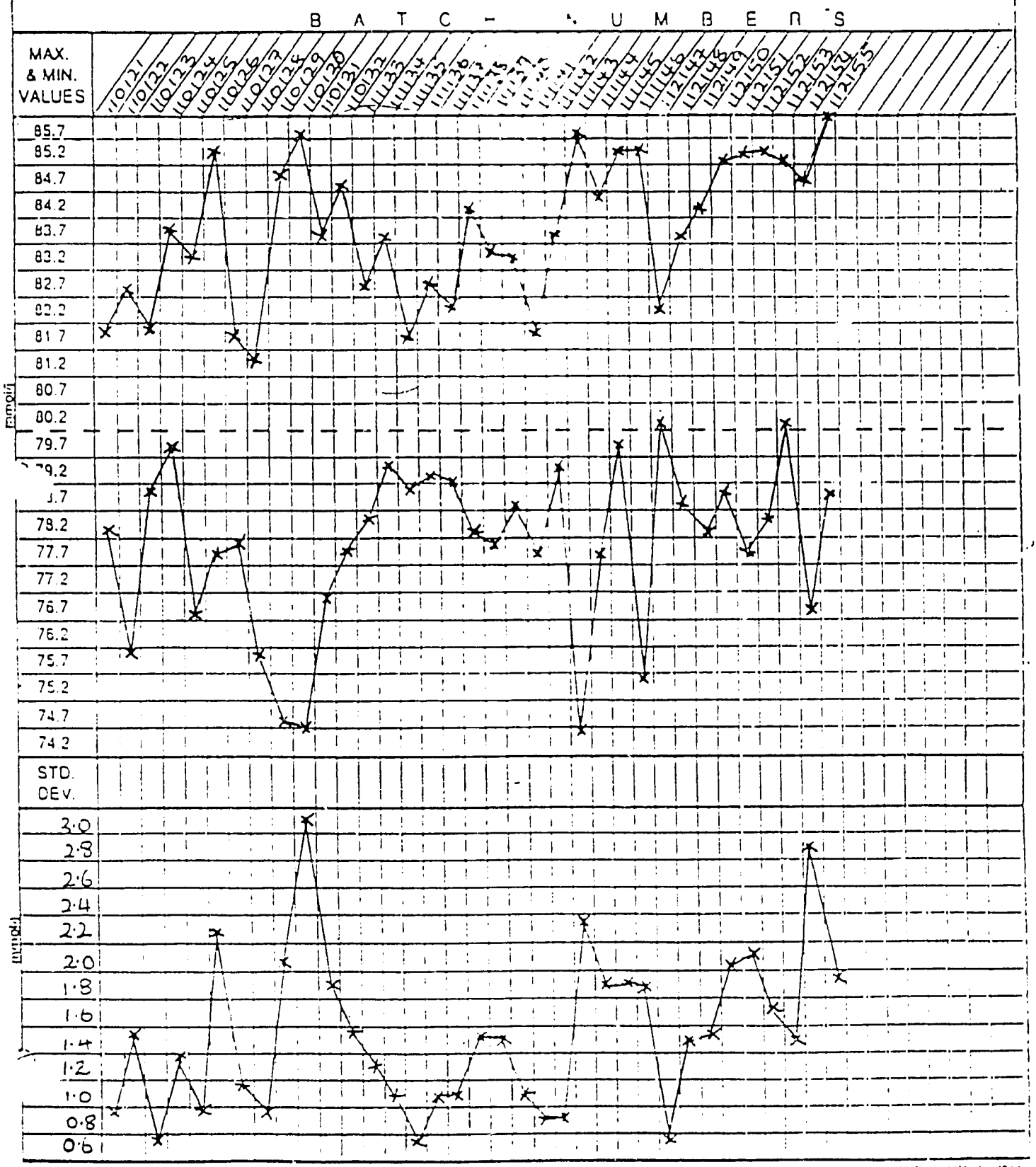
CONTROL ATTRIBUTES: MAXIMUM VALUE, MINIMUM VALUE, STANDARD DEVIATION



MEDIPHARM INDUSTRIES, E. A.
ORS QUALITY GRAPHS
CONTROL CHART FOR CHLORIDE ASSAY

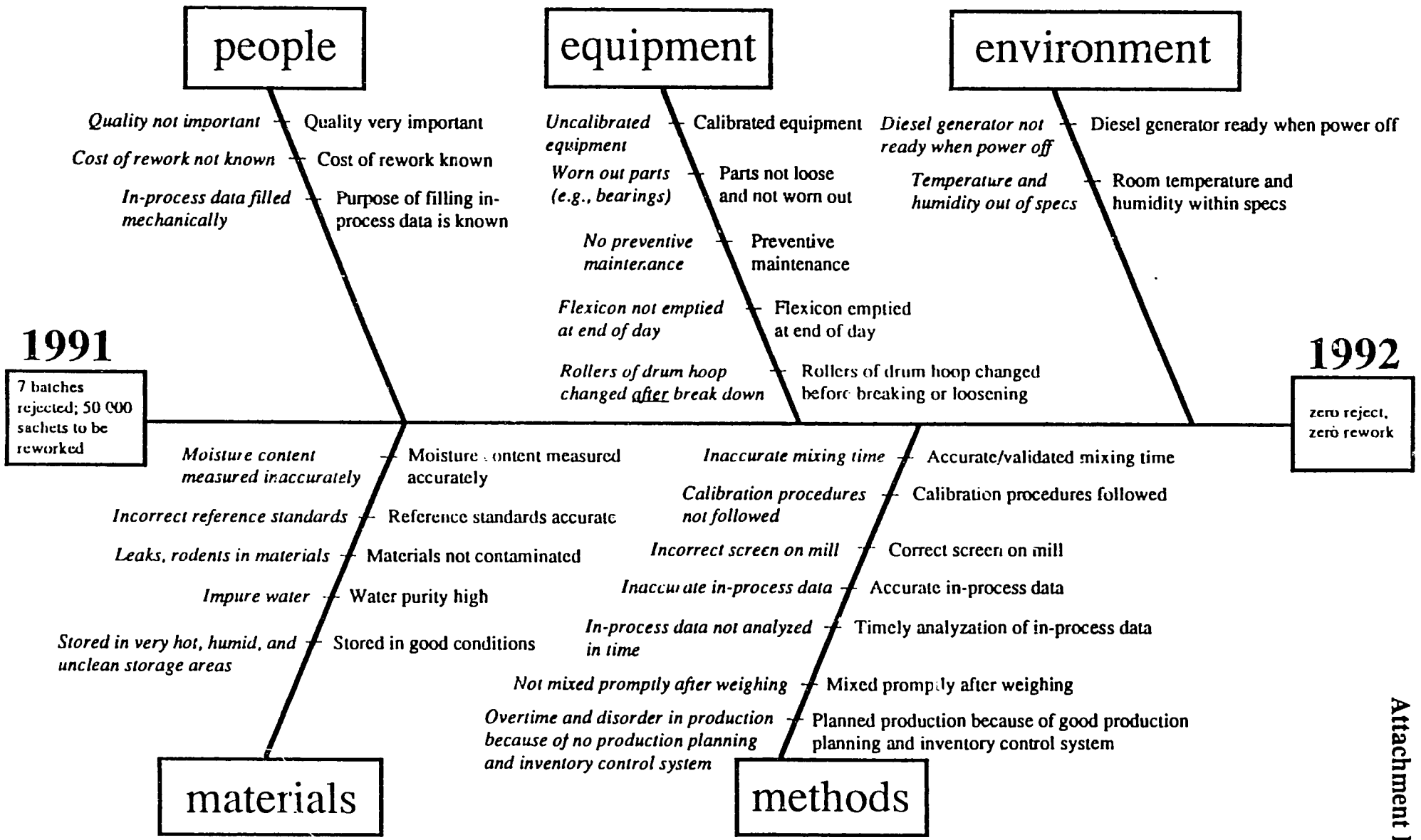
SPECIFICATIONS: U = 85.6 mmol/l L = 74.4 mmol/l
Theory = 80.0 mmol/l

CONTROL ATTRIBUTES: MAXIMUM VALUE, MINIMUM VALUE, STANDARD DEVIATION



26

Cause-Effect Analysis
(Fishbone Diagram)
Reject and Rework/Reprocess



Cause effect/abscissa 3/31/92
CSutter5

Attachment E

List of New Equipment

11/11/91
ORS/Uganda
Additional Equipment

Item	Qty	Description	Supplier	PO No.	Unit price	PO Amount	Est. avail	FOB Point
01	1	Dust collecter VS-1200	Donaldson Company	91-0141	$4,792.66	$4,792.66	11/25/91	Nicholasville, KY
01A	1	Stainless steel ventilation hood	Donaldson Company	91-0141	$678.00	$678.00	10/18/91	Seattle, WA
02	2	SS process drums (52.8 gal) w/cover	Alpha Stainless	91-0139	$725.00	$1,450.00	10/28/91	East Coast
03	1	Perforated screen for above drums	Alpha Stainless	91-0139	$585.00	$585.00	10/28/91	Santa Ana, CA
04	1	Voltage regulator - 3KVA 220voltz/50Hz/1 phase	Sola Electric	91-0134	$1,321.00	$1,321.00	Stock	Oak Grove Village, IL
05	1	Hygrometer/thermometer	Fisher Scientific	91-0137	$242.90	$242.90	12/03/91	Springfield, NJ
06	2	Immersion heaters for water still	Fisher Scientific	91-0137	$149.75	$299.50	12/03/91	Springfield, NJ
07	1	Lot glassware	Fisher Scientific	91-0137	$1,230.12	$1,230.12	12/03/91	Springfield, NJ
08	1	Timer	Industrial Controls	91-0143	$94.90	$94.90	11/4/91	Seattle, WA
09	1	Air compressor for flame photometer	Dalon Scientific	91-0138	$1,118.70	$1,118.70	11/11/91	London, UK
10	1	Spare parts for flame photometer	Dalon Scientific	91-0138	$407.90	$407.90	11/11/91	London, UK
11	1	Air compressor for packaging equipment	Sablecross Trading Co.	91-0136	$3,756.12	$3,756.12	11/28/91	Surrey, UK

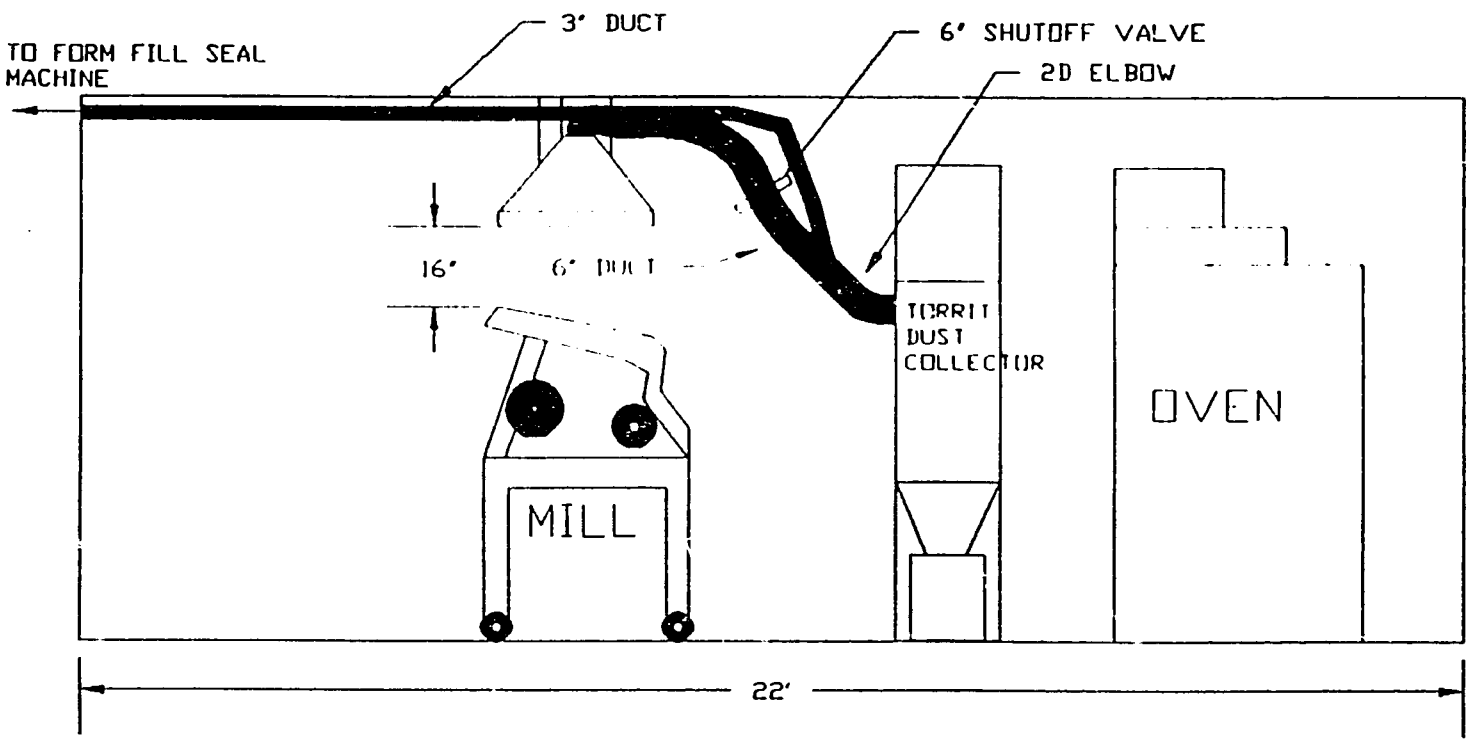
TOTAL PRICE FOB FACTORY US OR UK	$15,976.80
Est. freight & related expenses	$7,950.00
ESTIMATED TOTAL CIF KAMPALA/ENTEBBE	$23,926.80

Notes:
- o Does not include any import duties into Uganda
- o Does not include any installation assistance

Attachment F

28

LAYOUT OF TORRIT DUST COLLECTOR
DRYING/MILLING/SIEVING ROOM
FRONT VIEW



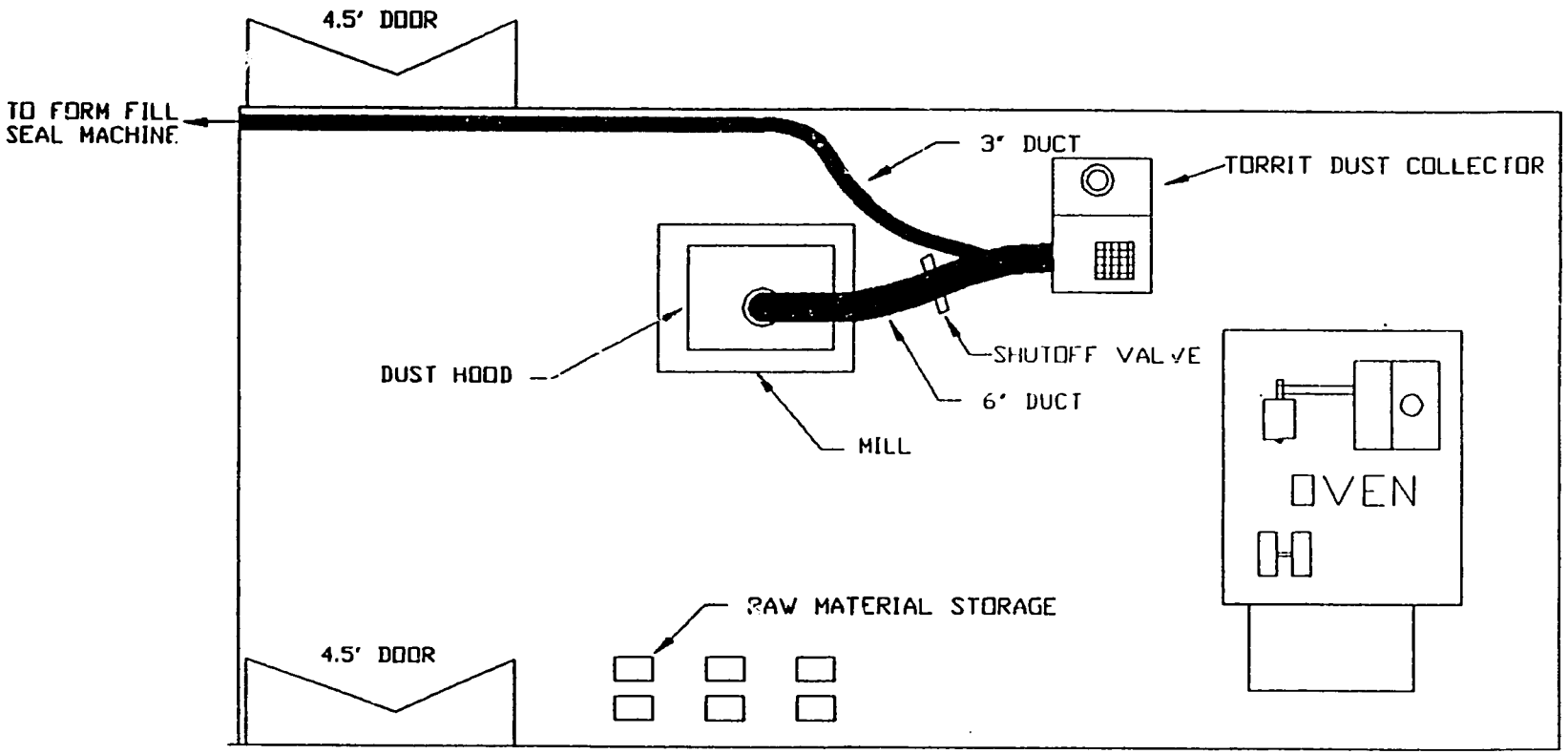
SCALE:
1"=3'

path
4 Nickerson Street, Seattle, WA 98109

Project: MEDIPHARM INDUSTRIES LTD
File: TORRIT.DWG
Drawn by: TJS date: 3/31/92

Attachment G

LAYOUT OF TORRIT DUST COLLECTOR
DRYING/MILLING/SIEVING ROOM
TOP VIEW

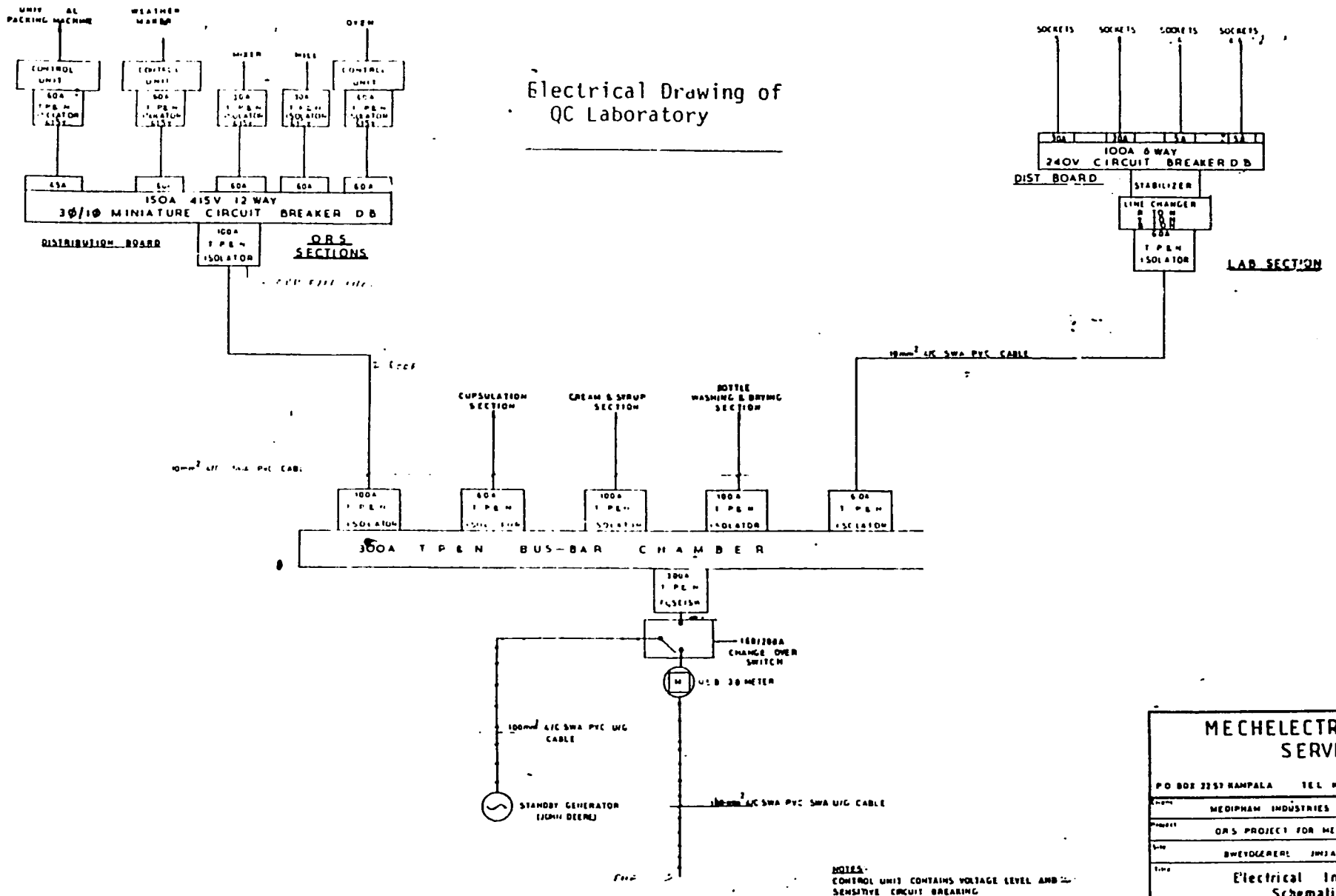


SCALE:
1" = 3'

path
4 Nickerson Street, Seattle, WA 98109

Project: MEDIPHARM INDUSTRIES LTD
File: TORRIT DWG
Drawn by: TJS date: 3/31/92

Electrical Drawing of QC Laboratory



MECHELECTRO ENGINEERING SERVICES

P O BOX 2257 KAMPALA TEL No. PLOT 17A WILLIA

MEDIPHAM INDUSTRIES (E A) LTD BWEYOGERERE

ORS PROJECT FOR MEDIPHAM INDUSTRIES

BWEYOGERERE JINJA ROAD

Electrical Installations Schematic.

N T S. DATE 31 12 91

Attachment H

31

MEDIPHARM (EA) LIMITED - UGANDA
PRODUCTION AND INVENTORY PLAN

1 ORADEX

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
SALES FORECAST	21,000	27,000	34,000	40,000	45,000	41,000	41,000	41,000	41,000	41,000	41,000
ACTUAL SALES	21,000	27,000	34,000	40,000	45,000	41,000	41,000	41,000	41,000	41,000	41,000
MAX INVT (60dd) FINAL	61,000	74,000	85,000	86,000	82,000	82,000	82,000	82,000	82,000	82,000	91,000
INVT BEG MONTH	241,338	220,338	193,338	159,338	119,338	74,338	204,338	163,338	122,338	81,338	211,338
WORK-IN-PROCESS	0	0	0	0	0	0	0	0	0	0	0
BALANCE	220,338	193,338	159,338	119,338	74,338	33,338	163,338	122,338	81,338	40,338	170,338
TO BE PRODUCED DURING	0	0	0	0	0	171,000	0	0	0	171,000	0
ACTUAL PRODUCTION	0	0	0	0	0	171,000	0	0	0	171,000	0
ESTIM. INVT END MONTH	220,338	193,338	159,338	119,338	74,338	204,338	163,338	122,338	81,338	211,338	170,338

2. ORS - MOH

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
SALES FORECAST	75,000	111,000	111,000	111,000	111,000	111,000	111,000	111,000	111,000	111,000	111,000
ACTUAL SALES	75,000	225,470	111,000	111,000	111,000	111,000	111,000	111,000	111,000	111,000	111,000
MAX INVT (60DD) FINAL	222,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000	230,000
INVT BEG MONTH	114,470	299,720	216,750	305,250	329,625	332,625	221,625	310,125	334,500	330,375	219,375
WORK-IN-PROCESS	75,000	0	0	0	0	0	0	0	0	0	0
BALANCE	114,470	188,720	105,750	194,250	218,625	221,625	110,625	199,125	223,500	219,375	108,375
TO BE PRODUCED DURING	185,250	142,500	199,500	135,375	114,000	0	199,500	135,375	106,875	0	199,500
ACTUAL PRODUCTION	185,250	142,500	199,500	135,375	114,000	0	199,500	135,375	106,875	0	199,500
ESTIM INVT END MONTH	299,720	216,750	305,250	329,625	332,625	221,625	310,125	334,500	330,375	219,375	307,875

3 METRIN CO-TRIMOXAZOLE SUSPENSION

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
SALES FORECAST	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
ACTUAL SALES	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
MAX INVT (60dd) FINAL	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,750
INVT BEG MONTH	3,000	10,000	7,000	9,000	6,000	8,000	10,000	7,000	9,000	6,000	8,000
WORK-IN-PROCESS	0	0	0	0	0	0	0	0	0	0	0
BALANCE	0	7,000	4,000	6,000	3,000	5,000	7,000	4,000	6,000	3,000	5,000
TO BE PRODUCED DURING	10,000	0	5,000	0	5,000	5,000	0	5,000	0	5,000	5,000
ACTUAL PRODUCTION	10,000	0	5,000	0	5,000	5,000	0	5,000	0	5,000	5,000
ESTIM. INVT END MONTH	10,000	7,000	9,000	6,000	8,000	10,000	7,000	9,000	6,000	8,000	10,000

28-Jan-92

Attachment I

22

MEDIPHARM (EA) LIMITED - UGANDA
PRODUCTION AND INVENTORY PLAN

1. ORADEX

MONTH	Jan-93	Feb-93	Mar-93	Apr-93	May-93	Jun-93	Jul-93	Aug-93	Sep-93	Oct-93	Nov-93	Dec-93	Jan-94	
SALES FORECAST	41,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	LOT SIZE
ACTUAL SALES	41,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	171,000
MAX INVT (60dd) FINAL	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000			
INVT BEG MONTH	170,338	129,338	79,338	200,338	150,338	100,338	221,338	171,338	121,338	242,338	192,338			
WORK-IN-PROCESS	0	0	0	0	0	0	0	0	0	0	0			
BALANCE	129,338	79,338	29,338	150,338	100,338	50,338	171,338	121,338	71,338	192,338	142,338			
TO BE PRODUCED DURING	0	0	171,000	0	0	171,000	0	0	171,000	0	0			
ACTUAL PRODUCTION	0	0	171,000	0	0	171,000	0	0	171,000	0	0			
ESTIM. INVT END MONTH	129,338	79,338	200,338	150,338	100,338	221,338	171,338	121,338	242,338	192,338	142,338			

2. ORS - MOH

MONTH	Jan-93	Feb-93	Mar 93	Apr-93	May-93	Jun-93	Jul-93	Aug-93	Sep-93	Oct-93	Nov-93	Dec-93	Jan-94	
SALES FORECAST	111 000	119,000	119 000	119 000	119,000	119,000	119,000	119,000	119,000	119,000	119,000	119,000	119,000	28
ACTUAL SALES	111 000	119 000	119 000	119,000	119 000	119,000	119,000	119,000	119,000	119,000	119,000	119,000	119,000	7,125
MAX INVT (60DD) FINAL	238 000	238 000	238 000	238 000	238 000	238,000	238 000	238,000	238,000	238,000	238,000			
INVT BEG MONTH	307 875	346 500	355 750	236 750	317 250	355,000	236 000	316 500	354 250	235,250	315,750			
WORK IN PROCESS	0	0	0	0	0	0	0	0	0	0	0			
BALANCE	196 875	227,500	236 750	117 750	198,250	236,000	117 000	197 500	235,250	116,250	196,750			
TO BE PRODUCED DURING	149,625	128,250	0	199,500	156,750	0	199,500	156,750	0	199,500	156,750			
ACTUAL PRODUCTION	149,625	128,250	0	199,500	156,750	0	199,500	156,750	0	199,500	156,750			
ESTIM INVT END MONTH	346,500	355,750	236,750	317,250	355,000	236,000	316,500	354,250	235,250	315,750	353,500			

3 METRIN CO-TRIMOXAZOLE

MONTH	Jan-93	Feb-93	Mar-93	Apr-93	May-93	Jun-93	Jul-93	Aug 93	Sep-93	Oct-93	Nov-93	Dec-93	Jan-94	
SALES FORECAST	3,000	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	4,083	LOT SIZE
ACTUAL SALES	3,000	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	5,000
MAX INVT (60dd) FINAL	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,833			
INVT BEG MONTH	10,000	12,000	8,250	9,500	10,750	12,000	8,250	9,500	10,750	12,000	8,250			
WORK-IN-PROCESS	0	0	0	0	0	0	0	0	0	0	0			
BALANCE	7,000	8,250	4,500	5,750	7,000	8,250	4,500	5,750	7,000	8,250	4,500			
TO BE PRODUCED DURING	5,000	0	5,000	5,000	5,000	0	5,000	5,000	5,000	0	5,000			
ACTUAL PRODUCTION	5,000	0	5,000	5,000	5,000	0	5,000	5,000	5,000	0	5,000			
ESTIM INVT END MONTH	12,000	8,250	9,500	10,750	12,000	8,250	9,500	10,750	12,000	8,250	9,500			

28-Jan-92

MEDIPHARM (EA) LIMITED - UGANDA
PRODUCTION AND INVENTORY PLAN

MANAGERIAL INDICATORS: (FOR ORS ONLY)

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
3. TOTAL PRODUCTION FCST	185,250	142,500	199,500	135,375	114,000	171,000	199,500	135,375	106,875	171,000	199,500
4. TOTAL PRODUCTION ACTUAL	185,250	142,500	199,500	135,375	114,000	171,000	199,500	135,375	106,875	171,000	199,500
5. MFG COST P/SACHET $	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200
6. VALUE OF F.G. INVT $	62,407	49,211	55,751	53,876	48,836	51,116	56,816	54,821	49,406	51,686	57,386
7. VALUE OF RAW MAT INVT	131,615	127,032	120,615	116,261	112,594	103,539	97,122	99,166	109,228	101,373	94,956
TOTAL INVT VALUE $	194,022	176,242	176,365	170,136	161,429	154,655	153,938	153,986	158,634	153,059	152,342
8. AVG NET SALES PRICE $	0.12600	0.12600	0.12600	0.14000	0.14000	0.14000	0.14000	0.14000	0.14000	0.14000	0.14000
9. SALES INCOME $	2,646	3,402	4,284	5,600	6,300	5,740	5,740	5,740	5,740	5,740	5,740
CUM SALES INCOME $	2,646	6,048	10,332	15,932	22,232	27,972	33,712	39,452	45,192	50,932	56,672
10. CONTRIBUTION (+ OH)	126	162	204	800	900	820	820	820	820	820	820
11. RAW MAT PURCHASES $	50	0	0	0	0	0	0	6,398	13,500	1,200	0

28-Jan-92

MEDIPHARM (EA) LIMITED - UGANDA
PRODUCTION AND INVENTORY PLAN

MANAGERIAL INDICATORS: MONTH	Jan-93	Feb-93	Mar-93	Apr-93	May-93	Jun-93	Jul-93	Aug-93	Sep-93	Oct-93	Nov-93	Dec-93	Jan-94	TOTAL FOR THE PERIOD 22 MONTHS
3 TOTAL PRODUCTION FCST	149,625	128,250	171,000	199,500	156,750	171,000	199,500	156,750	171,000	199,500	156,750			3,619,500
4. TOTAL PRODUCTION ACTU	149,625	128,250	171,000	199,500	156,750	171,000	199,500	156,750	171,000	199,500	156,750			3,619,500
5 MFG COST P/SACHET $	0.1200	0.1206	0.1206	0.1206	0.1206	0.1206	0.1206	0.1206	0.1206	0.1206	0.1206			
6. VALUE OF F.G. INVT $	57,101	52 459	52,700	56,377	54,900	55,141	58,819	57,342	57,583	61,260	59,783			
7. VALUE OF RAW MAT INVT	99,452	96,634	96,888	100,953	97,218	97,472	91,055	86,013	0	0	0			
TOTAL INVT VALUE $	156,553	149,093	149,587	157,330	152,118	152,613	149,874	143,355	57,583	61,260	59,783			
8 AVG NET SALES PRICE $	0.14000	0.16800	0.16800	0.16800	0.16800	0.16800	0.16800	0.16800	0.16800	0.16800	0.16800			
9. SALES INCOME $	5,740	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400			62,412
CUM SALES INCOME $	62,412	70,812	79,212	87,612	96,012	104,412	112,812	121,212	129,612	138,012	146,412			
10 CONTRIBUTION (+ OH)	820	2,372	2,372	2,372	2,372	2,372	2,372	2,372	2,372	2,372	2,372			7,932
11 RAW MAT PURCHASES $	9,308	1,307	9,308	10,482	1,307	9,308	0	0	0	0	0			30,456

28 Jan-92

MEDIPHARM (EA) LIMITED - UGANDA
PRODUCTION AND INVENTORY PLAN

ASSUMPTIONS FOR THE INVENTORY MODEL:

1. In any given month, production can take place either for ORS-MOH or for Oradex.
2. Safety inventory for final products is 60 days.
3. Safety inventory for raw materials is 120 days.
4. Lead time for raw materials is 6 months.
5. Batch size for ORS is 7,500, sachets. Yield is assumed at 95%.
6. Batch size for Oradex is in multiples of 8 batches of 7,500 sachets each. This is because colored Trisodium citrate is produced in multiples of 8 batches. Yield is assumed at 95%.
7. The cost of raw materials is the actual average CIF price paid.

MEDIPHARM INDUSTRIES (EA) LIMITED - UGANDA
PRODUCTION AND INVENTORY PLAN
RAW AND PACKAGING MATERIALS INVENTORY PLANNING

Sodium Chloride

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
USAGE FORECAST g	682,500	525,000	735,000	498,750	420,000	630,000	735,000	498,750	393,750	630,000	735,000
ACTUAL CONSUMPTION g	682,500	525,000	735,000	498,750	420,000	630,000	735,000	498,750	393,750	630,000	735,000
MIN INVT (90DD) END g	1,758,750	1,653,750	1,548,750	1,785,000	1,863,750	1,627,500	1,522,500	1,758,750	1,916,250	1,758,750	1,653,750
INVT BEG MONTH g	6,597,000	5,914,500	5,389,500	4,654,500	4,155,750	3,735,750	3,105,750	2,370,750	1,872,000	5,478,250	4,848,250
BALANCE g	5,914,500	5,389,500	4,654,500	4,155,750	3,735,750	3,105,750	2,370,750	1,872,000	1,478,250	4,848,250	4,113,250
TO BE ORDERED g	0	0	0	4,000,000	0	0	0	0	0	4,000,000	0
RECEIVED ACTUAL g	0	0	0	0	0	0	0	0	4,000,000	0	0
ESTIM INVT END MONTH g	5,914,500	5,389,500	4,654,500	4,155,750	3,735,750	3,105,750	2,370,750	1,872,000	5,478,250	4,848,250	4,113,250
INVT COST $	4,265	3,887	3,357	2,997	2,694	2,240	1,710	1,350	3,951	3,496	2,966
END MO. EQUIV SACHETS	1,689,857	1,539,857	1,329,857	1,187,357	1,067,357	887,357	677,357	534,857	1,565,214	1,385,214	1,175,214

Trisodium citrate, dihydrate

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
USAGE FORECAST g	565,500	435,000	609,000	413,250	348,000	522,000	609,000	413,250	326,250	522,000	609,000
ACTUAL CONSUMPTION g	565,500	435,000	609,000	413,250	348,000	522,000	609,000	413,250	326,250	522,000	609,000
MIN INVT (90DD) END g	1,457,250	1,370,250	1,283,250	1,479,000	1,544,250	1,348,500	1,261,500	1,457,250	1,587,750	1,457,250	1,370,250
INVT BEG MONTH g	5,314,000	4,748,500	4,313,500	3,704,500	3,291,250	2,943,250	2,421,250	1,812,250	4,799,000	4,472,750	3,950,750
BALANCE g	4,748,500	4,313,500	3,704,500	3,291,250	2,943,250	2,421,250	1,812,250	1,399,000	4,472,750	3,950,750	3,341,750
TO BE ORDERED g	0	0	3,400,000	0	0	0	0	0	0	3,400,000	0
RECEIVED ACTUAL g	0	0	0	0	0	0	0	3,400,000	0	0	0
ESTIM INVT END MONTH g	4,748,500	4,313,500	3,704,500	3,291,250	2,943,250	2,421,250	1,812,250	4,799,000	4,472,750	3,950,750	3,341,750
INVT COST $	8,935	8,116	8,971	6,193	5,538	4,556	3,410	9,030	8,416	7,434	6,288
END MO. EQUIV SACHETS	1,637,414	1,487,414	1,277,414	1,134,914	1,014,914	834,914	624,914	1,654,828	1,542,328	1,362,328	1,152,328

Potassium Chloride

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
USAGE FORECAST g	292,500	225,000	315,000	213,750	180,000	270,000	315,000	213,750	168,750	270,000	315,000
ACTUAL CONSUMPTION g	292,500	225,000	315,000	213,750	180,000	270,000	315,000	213,750	168,750	270,000	315,000
MIN INVT (90DD) END g	753,750	708,750	663,750	765,000	798,750	697,500	652,500	753,750	821,250	753,750	708,750
INVT BEG MONTH g	2,831,000	2,538,500	2,313,500	1,998,500	1,784,750	1,604,750	1,334,750	1,019,750	806,000	1,637,250	1,367,250
BALANCE g	2,538,500	2,313,500	1,998,500	1,784,750	1,604,750	1,334,750	1,019,750	806,000	637,250	1,367,250	1,052,250
TO BE ORDERED g	0	0	0	0	0	0	1,000,000	0	0	0	1,000,000
RECEIVED ACTUAL g	0	0	0	0	0	0	0	0	1,000,000	0	0
ESTIM INVT END MONTH g	2,538,500	2,313,500	1,998,500	1,784,750	1,604,750	1,334,750	1,019,750	806,000	1,637,250	1,367,250	1,052,250
INVT COST $	3,318	3,024	2,612	2,333	2,098	1,745	1,333	1,054	2,140	1,787	1,375
END MO EQUIV SACHETS	1,692,333	1,542,333	1,332,333	1,189,833	1,069,833	889,833	679,833	537,333	1,091,500	911,500	701,500

MEDIPHARM INDUSTRIES (EA) LIMITED - UGANDA
PRODUCTION AND INVENTORY PLAN
RAW AND PACKAGING MATERIALS INVENTORY PLANNING

Sodium Chloride

MONTH	Jan-93	Feb-93	Mar-93	Apr-93	May-93	Jun-93	Jul-93	Aug-93	Sep-93	Oct-93	Nov-93	Dec-93	MIN ORDER
USAGE FORECAST g	551,250	472,500	630,000	735,000	577,500	630,000	735,000	577,500	630,000	735,000	577,500	0	4,000,000 g
ACTUAL CONSUMPTION g	551,250	472,500	630,000	735,000	577,500	630,000	735,000	577,500	630,000	735,000	577,500	0	
MIN INVT (90DD) END g	1,837,500	1,942,500	1,942,500	1,942,500	1,942,500	1,942,500	1,942,500	1,942,500					PRICE $/g
INVT BEG MONTH g	4,113,250	3,562,000	3,089,500	2,459,500	5,724,500	5,147,000	4,517,000	3,782,000					0.00072116
BALANCE g	3,562,000	3,089,500	2,459,500	1,724,500	5,147,000	4,517,000	3,782,000	3,204,500					
TO BE ORDERED g	0	0	0	0	0	0	0	ERR					
RECEIVED ACTUAL g	0	0	0	4,000,000	0	0	0	0					
ESTIM INVT END MONTH	3,562,000	3,089,500	2,459,500	5,724,500	5,147,000	4,517,000	3,782,000	3,204,500					
INVT COST $	2,569	2,228	1,774	4,128	3,712	3,257	2,727	2,311					
END MO. EQUIV SACHETS	1,017,714	882,714	702,714	1,635,571	1,470,571	1,290,571	1,080,571	915,571					

Trisodium citrate, dihydrate

MONTH	Jan-93	Feb-93	Mar 93	Apr 93	May 93	Jun 93	Jul 93	Aug 93	Sep-93	Oct 93	Nov 93	Dec 93	MIN ORDER
USAGE FORECAST g	456,750	391,500	522,000	609 000	478 500	522,000	609 000	478 500	522 000	609 000	478 500	0	3 400 000 g
ACTUAL CONSUMPTION g	456,750	391,500	522 000	609 000	478 500	522 000	609 000	478 500	522 000	609 000	478 500	0	
MIN INVT (90DD) END g	1,522,500	1,609,500	1,609,500	1 609 500	1 609 500	1 609,500	1 609 500	1 609 500					PRICE $/g
INVT BEG MONTH g	3,341,750	2,885,000	2,493,500	1 971 500	4 762 500	4,284 000	3,762 000	3 153 000					0 00188165
BALANCE g	2,885,000	2 493,500	1,971,500	1 362,500	4 284 000	3 762,000	3,153 000	2 674,500					
TO BE ORDERED g	0	0	0	0	0	0	0	ERR					
RECEIVED ACTUAL g	0	0	0	3,400,000	0	0	0	0					
ESTIM INVT END MONTH	2,885,000	2,4[illegible],500	1,971,500	4,762,500	4,284,000	3,762,000	3,153,000	2,674,500					
INVT COST $	5,429	4,692	3,710	8,961	8,061	7,079	5,933	5,032					
END MO. EQUIV SACHETS	994,828	859,828	679,828	1,642,241	1,477,241	1,297,241	1,087,241	922,241					

Potassium Chloride

MONTH	Jan-93	Feb-93	Mar-93	Apr-93	May-93	Jun-93	Jul-93	Aug-93	Sep-93	Oct-93	Nov-93	Dec-93	MIN ORDER
USAGE FORECAST g	236,250	202,500	270,000	315,000	247,500	270,000	315,000	247,500	270,000	315,000	247,500	0	1,000,000 g
ACTUAL CONSUMPTION g	236,250	202,500	270,000	315,000	247,500	270,000	315,000	247,500	270,000	315,000	247,500	0	
MIN INVT (90DD) END g	787,500	832,500	832,500	632,500	832,500	832,500	832,500	832,500					PRICE $/g
INVT BEG MONTH g	1,052,250	816,000	1,613,500	1,343,500	1,028,500	1,781,000	1,511,000	1,196,000					0.00130716
BALANCE g	816,000	613,500	1,343,500	1,028,500	781,000	1,511,000	1,196,000	948,500					
TO BE ORDERED g	0	0	1,000,000	0	0	0	0	0					
RECEIVED ACTUAL g	0	1,000,000	0	0	1,000,000	0	0	0					
ESTIM INVT END MONTH	816,000	1,613,500	1,343,500	1,028,500	1,781,000	1,511,000	1,196,000	948,500					
INVT COST $	1,067	2,109	1,756	1,344	2,328	1,975	1,563	1,240					
END MO. EQUIV SACHETS	544,000	1,075,667	895,667	685,667	1,187,333	1,007,333	797,333	632,333					

MEDIPHARM INDUSTRIES (EA) LIMITED - UGANDA
PRODUCTION AND INVENTORY PLAN
RAW AND PACKAGING MATERIALS INVENTORY PLANNING

Dispensing box @ 50

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
USAGE FORECAST unit	0	0	0	0	0	3,600	0	0	0	3,600	0
ACTUAL CONSUMPTION un	0	0	0	0	0	3,600	0	0	0	3,600	0
MIN INVT (90DD) END un	0	0	3,600	3,600	3,600	0	3,600	3,600	3,600	0	3,600
INVT BEG MONTH unit	60,000	60,000	60,000	60,000	60,000	60,000	56,400	56,400	56,400	56,400	52,800
BALANCE unit	60,000	60,000	60,000	60,000	60,000	56,400	56,400	56,400	56,400	52,800	52,800
TO BE ORDERED unit	0	0	0	0	0	0	0	0	0	0	0
RECEIVED ACTUAL unit	0	0	0	0	0	0	0	0	0	0	0
ESTIM INVT END MONTH un	60,000	60,000	60,000	60,000	60,000	56,400	56,400	56,400	56,400	52,800	52,800
INVT COST $	4,995	4,995	4,995	4,995	4,995	4,695	4,695	4,695	4,695	4,396	4,396
END MO. EQUIV SACHETS	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	2,820,000	2,820,000	2,820,000	2,820,000	2,640,000	2,640,000

Shipper @ 1,000

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
USAGE FORECAST unit	195	150	210	143	120	180	210	143	113	180	210
ACTUAL CONSUMPTION un	195	150	210	143	120	180	210	143	113	180	210
MIN INVT (90DD) END un	503	473	443	510	533	465	435	503	548	503	473
INVT BEG MONTH unit	2,043	1,848	1,698	1,488	1,346	1,226	1,046	836	693	581	1,401
BALANCE unit	1,848	1,698	1,488	1,346	1,226	1,046	836	693	581	401	1,191
TO BE ORDERED unit	0	0	0	0	0	0	0	1,000	0	0	0
RECEIVED ACTUAL unit	0	0	0	0	0	0	0	0	0	1,000	0
ESTIM INVT END MONTH un	1,848	1,698	1,488	1,346	1,226	1,046	836	693	581	1,401	1,191
INVT COST $	2,218	2,038	1,786	1,615	1,471	1,255	1,003	832	697	1,681	1,429
END MO. EQUIV SACHETS	1,848,000	1,698,000	1,488,000	1,345,500	1,225,500	1,045,500	835,500	693,000	580,500	1,400,500	1,190,500

Foil ORS - MOH

MONTH	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jul-92	Aug-92	Sep-92	Oct-92	Nov-92	Dec-92
USAGE FORECAST g	19,013	14,625	20,475	13,894	11,700	0	20,475	13,894	10,969	0	20,475
ACTUAL CONSUMPTION g	19,013	14,625	20,475	13,894	11,700	0	20,475	13,894	10,969	0	20,475
MIN INVT (90DD) END g	48,994	46,069	25,594	32,175	34,369	45,338	24,863	31,444	35,831	48,994	28,519
INVT BEG MONTH g	4,147,500	4,128,488	4,113,863	4,093,388	4,079,494	4,067,794	4,067,794	4,047,319	4,033,425	4,022,456	4,022,456
BALANCE g	4,128,488	4,113,863	4,093,388	4,079,494	4,067,794	4,067,794	4,047,319	4,033,425	4,022,456	4,022,456	4,001,981
TO BE ORDERED g	0	0	0	0	0	0	0	0	0	0	0
RECEIVED ACTUAL g	0	0	0	0	0	0	0	0	0	0	0
ESTIM INVT END MONTH g	4,128,488	4,113,863	4,093,388	4,079,494	4,067,794	4,067,794	4,047,319	4,033,425	4,022,456	4,022,456	4,001,981
INVT COST $	33,312	33,194	33,029	32,917	32,823	32,823	32,657	32,545	32,457	32,457	32,292
END MO. EQUIV SACHETS	1,764,311	1,758,061	1,749,311	1,743,373	1,738,373	1,738,373	1,729,623	1,723,686	1,718,998	1,718,998	1,710,248

MEDIPHARM INDUSTRIES (EA) LIMITED - UGANDA
PRODUCTION AND INVENTORY PLAN
RAW AND PACKAGING MATERIALS INVENTORY PLANNING

Glucose, anhydrous

MONTH	Jan-93	Feb-93	Mar-93	Apr-93	May-93	Jun-93	Jul-93	Aug-93	Sep-93	Oct-93	Nov 93	Dec-93	MIN ORDER
USAGE FORECAST g	3,150,000	2,700,000	3,600,000	4,200,000	3,300,000	3,600,000	4,200,000	3,300,000	3,600,000	4,200,000	3,300,000	0	10,000,000 g
ACTUAL CONSUMPTION g	3,150,000	2,700,000	3,600,000	4,200,000	3,300,000	3,600,000	4,200,000	3,300,000	3,600,000	4,200,000	3,300,000	0	
MIN INVT (90DD) END g	10,500,000	11,100,000	11,100,000	11,100,000	11,100,000	11,100,000	11,100,000	11,100,000					PRICE $/g
INVT BEG MONTH g	10,115,000	16,965,000	14,265,000	20,665,000	16,465,000	13,165,000	19,565,000	15,365,000					0.00093082
BALANCE g	6,965,000	14,265,000	10,665,000	16,465,000	13,165,000	9,565,000	15,365,000	12,065,000					
TO BE ORDERED g	10,000,000	0	0	10,000,000	0	0	0	0					
RECEIVED ACTUAL g	10,000,000	0	10,000,000	0	0	10,000,000	0	0					
ESTIM INVT END MONTH	16,965,000	14,265,000	20,665,000	16,465,000	13,165,000	19,565,000	15,365,000	12,065,000					
INVT COST $	15,791	13,278	19,235	15,326	12,254	18,211	14,302	11,230					
END MO. EQUIV SACHETS	848,250	713,250	1,033,250	823,250	658,250	978,250	768,250	603,250					

Foil Oradex

MONTH	Jan-93	Feb-93	Mar-93	Apr-93	May-93	Jun-93	Jul-93	Aug-93	Sep-93	Oct-93	Nov-93	Dec-93	MIN ORDER
USAGE FORECAST g	368,550	315,900	421,200	491,400	386,100	421,200	491,400	386,100	421,200	491,400	386,100	0	1,000,000 g
ACTUAL CONSUMPTION g	0	0	421,200	0	0	421,200	0	0	421,200	0	0	0	
MIN INVT (90DD) END g	1,228,500	1,298,700	1,298,700	1,298,700	1,298,700	1,298,700	1,298,700	1,298,700					PRICE $/unit
INVT BEG MONTH g	4,490,100	4,490,100	4,490,100	4,068,900	4,068,900	4,068,900	3,647,700	3,647,700					0.00806880
BALANCE g	4,121,550	4,174,200	4,068,900	3,577,500	3,682,800	3,647,700	3,156,300	3,261,600					
TO BE ORDERED g	0	0	0	0	0	0	0	0					
RECEIVED ACTUAL g	0	0	0	0	0	0	0	0					
ESTIM INVT END MONTH	4,490,100	4,490,100	4,068,900	4,068,900	4,068,900	3,647,700	3,647,700	3,647,700					
INVT COST $	36,230	36,230	32,831	32,831	32,831	29,433	29,433	29,433					
END MO. EQUIV SACHETS	1,918,846	1,918,846	1,738,846	1,738,846	1,738,846	1,558,846	1,558,846	1,558,846					

PE bag MOH @ 25

MONTH	Jan-93	Feb-93	Mar-93	Apr-93	May-93	Jun-93	Jul-93	Aug-93	Sep-93	Oct-93	Nov-93	Dec-93	MIN ORDER
USAGE FORECAST unit	263	225	0	350	275	0	350	275	0	350	275	0	200,000 un
ACTUAL CONSUMPTION u	263	225	0	350	275	0	350	275	0	350	275	0	PRICE $/unit
MIN INVT (90DD) END un	575	625	625	625	625	625	625	625					0.00600
INVT BEG MONTH unit	86,413	86,150	85,925	85,925	85,575	85,300	85,300	84,950					
BALANCE unit	86,150	85,925	85,925	85,575	85,300	85,300	84,950	84,675					
TO BE ORDERED unit	0	0	0	0	0	0	0	0					
RECEIVED ACTUAL unit	0	0	0	0	0	0	0	0					
ESTIM INVT END MONTH	86,150	85,925	85,925	85,575	85,300	85,300	84,950	84,675					
INVT COST $	517	516	516	513	512	512	510	508					
END MO. EQUIV SACHETS	2,153,750	2,148,125	2,148,125	2,139,375	2,132,500	2,132,500	2,123,750	2,116,875					

CRITERIA FOR REWORK/REPROCESSING

Rework/reprocess the sachets only if all of the following conditions exist:

1. Fully trained workers are idle and are being paid, no work is available and machine time is available, and production can be scheduled without disrupting the regular production plan.

2. The reprocess mixing time is validated.

3. The protocol and manufacturing records for rework/reprocessing is written and is approved by QC.

4. The cost/benefit analysis for rework/reprocessing has a positive balance.

Example

The cost to rework/reprocess 50,000 sachets will be US$2,977, and the savings achieved from the recovery of chemicals will be US$1,428. This will provide a loss of US$1,549.

	US$/sachet	For 50,000 sachets
BENEFIT:		
Material saved:		
Cost of chemicals	0.02856	1,428
TOTAL MATERIAL SAVED		US$1,428
COST:		
Cost to reprocess:		
Direct labor	0.00827	414
Indirect labor	0.02847	1,424
Testing cost: US$105.58/batch		739
Approximate validation cost		400
TOTAL COST TO REPROCESS		US$2,977
TOTAL SAVINGS		(US$1,549)

ATTACHMENT K

PHARMACEUTICAL STORAGE CLEANING AND MAINTENANCE

The following procedures are recommended as the typical cleaning and maintenance procedures for pharmaceutical storage areas:

- Periodically (every six months) remove all product cartons from storage shelves, particularly cartons that have been on the shelf for a long period.
- Visually inspect each carton for the presence of insects or their eggs or feces.
- Visually inspect the storage shelves, floors, walls, and ceiling for the presence of insects and physical damage to the structure such as holes in the walls and ceiling and cracks in the floors and walls that lead to the outside environment.
- Plug any holes and cracks to prevent the intrusion of small insects.
- Vacuum the storage area including the ceiling.
- Treat the area with a commercially available insecticide Diazinon (brand name: KNOX OUT 2FM; technical specifications are attached).

Warehouse managers also may want to consider installing an electronic device by the entrance to keep rodents and other insects away (see attached brochure).

...Crickets, Fleas, Silverfish and Ticks

Apply a 0.5% to 1% KNOX OUT 2FM spray to exterior surfaces of buildings, porches, screens, window frames, eaves, patios, garages and other areas where these pests congregate or enter premises.

To help prevent infestations of buildings by the above pests, treat a band of soil 6 to 10 feet wide around and adjacent to the building. Also treat the building foundation to a height of 2 to 3 feet where pests are active and may find entrance. KNOX OUT 2FM may be applied in compressed air equipment or power spray equipment. Apply as a coarse spray to thoroughly and uniformly wet the band area. A rate of 4 to 6 ounces of KNOX OUT 2FM per 1,000 square feet is desirable.

Food Handling Establishments—Places other than private residences in which food is held, processed, prepared, packaged or served. Applications are limited to spot and/or crack and crevice treatments only.

Make spot and/or crack and crevice applications of KNOX OUT 2FM using a 0.5% to 1% spray in and around both food and non-food locations treating localized areas where cockroaches, silverfish, ants, and flies have been seen or are suspected of hiding or entering. Do not use as a space spray or allow spray to contact food, food processing surfaces, or utensils. Make applications using low pressure.

Crack and crevice applications should be made using equipment capable of delivering a pin stream or of applying small amounts of insecticide directly into or between equipment and floors, openings leading to voids in walls, floors, and ceilings, and similar locations where these pests may hide or enter.

Spot treatments should not cover areas of more than 2 square feet and not more than 20% of the floor surface should be treated.

> This product is authorized for use in inedible product areas of Federally Inspected Meat and Poultry Plants.

Stored Product Pests—*For control of exposed stages of Sawtoothed Grain Beetle, Confused Flour Beetle, Red Flour Beetle, Rice Weevil, Granary Weevil, Warehouse Beetle*

Make spot and/or crack and crevice treatment of 0.5% to 1% KNOX OUT 2FM to localized areas including shelves, cupboards, walls and floors where food products suspected of being infested are stored. Food should be removed or covered during treatment. This treatment is supplemental to good housekeeping, since it will have no effect on insects breeding inside packaging. Infested food packaging should be destroyed.

Use in Greenhouses—*For control of Aphids, Fungus Gnat Larvae, Leafminers, Mealybugs, (Citrus, Stem and Root), Mites, Scale insects and Thrips*

Apply KNOX OUT 2FM to the ornamentals listed below at a rate of 0.5 to 1.0 fl. oz. per gallon of water (3-6 pints/100 gallons).

Treat when insects appear. Use higher rate for heavy insect infestations. Repeat applications as necessary.

ORNAMENTALS

African Violets	Flat Topped Sedum	Petunia
Aglaonemas	Floss Flower	Photinia
Ageratum	Friendship Plant	Pineapple Guava
Aluminum Plant	Gardenia	Pittosporum
Alyssum	Gazania	Podocarpus
Arrowhead	Geranium	Primrose
Azalea	Goldust	Privet
Begonia	Honeysuckle	Pyracantha
Bird's Nest Fern	Hydrangea	Raphiolepis
Boston Fern	Ilex	Rhododendron
Bottlebrush	Impatiens	Rose
Cactus	Ivy	Salvia
Calendula	Jade Plant (Crassula)	Sansevieria
Camellia	Japanese Aralia	Scarlet Sage
Coleus Jewel Box	Juniper	Snake Plant
Chrysanthemum	Leucothoe	Snapdragon
Cockscomb	Lilac	Spider Plant
Coleus	Mahonia	Star Jasmine
Cotoneaster	Maranta	Strawflower
Crape Myrtle	Marigold	Taiwan Ondal Vel
Croton	Nandina	Velvet Plant (Gynura)
Daisy	Oleander	Verbena
Dianthus	Orchid	Vinca
Dogwood	Osmanthus	Wandering Jew
Escallonia	Pachysandra	Wax Plant
Euonymus	Peperomia	Zinnia

Do not use on Bella Palm, Dracaena, Hoya, Maidenhair Fern, Nephthytis, Poinsettia, and Prayer Plant.

KNOX OUT 2FM has demonstrated excellent plant safety; however, all varieties of the plants listed above have not been tested. When treating large numbers of plants of a single variety, spray a few plants and observe for phytotoxicity prior to full scale application.

KNOX OUT 2FM may not control some organophosphate resistant ornamental plant pests.

Use In and Around Livestock Housing—*For control of Flies in Barns and Animal Sleeping Quarters (except Dairy Barns, Milk Rooms and Poultry Houses):*

Apply a 1% KNOX OUT 2FM spray to ceilings and walls of livestock sheds, calf barns, hog barns, loafing sheds, and other farm buildings except dairy barns, milkrooms and poultry houses. Areas where flies congregate, such as garbage dumps and corrals, should be sprayed thoroughly. Repeat applications as fly populations warrant.

Remove animals from buildings prior to treatment and keep animals out until spray has dried.

Do not contaminate milk, feed, drinking water, or apply to animals or poultry.

Yellowjackets—Use in Baits for Control of Scavenger Yellowjackets (*Vespula pensylvanica, V. vulgaris*) in the 11 Contiguous Western States Only.

Consult the Supplemental Label available in these states.

WARRANTY AND DISCLAIMER

Pennwalt Corporation warrants that this material conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the Directions for Use, subject to the risks referred to therein. PENNWALT MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. IN NO CASE SHALL PENNWALT OR SELLER BE LIABLE FOR CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT INCLUDING, BUT NOT LIMITED TO LOSS OF PROFITS, BUSINESS REPUTATION OR CUSTOMERS, LABOR COST OR OTHER EXPENSES INCURRED IN PLANTING OR HARVESTING.

KNOX OUT 2FM

Flowable Microencapsulated Insecticide

EPA Registration No. 4581-335

GENERAL INFORMATION

KNOX OUT 2FM is a flowable microencapsulated formulation containing 2 pounds Diazinon per gallon.

It is to be used for residual pest control in and around buildings including, but not limited to, homes, apartments, stores, hospitals, nursing homes, manufacturing plants, warehouses, schools, restaurants, hotels, motels, food processing plants, and on vessels, aircraft, boats, ships, rail cars, buses, trucks, and trailers.

KNOX OUT 2FM can be sprayed on any surface which will not be damaged or stained by water. Under conditions of proper application, KNOX OUT 2FM will not leave a visible deposit. However, if unevenly applied or sprayed to run-off, a visible deposit may occur on some dark surfaces and may be wiped off with a wet cloth or sponge.

Due to its controlled-release nature, KNOX OUT 2FM gives excellent residual kill of the pests listed below; however, effective knockdown may take up to 24 hours after application.

DIRECTIONS FOR USE
GENERAL CLASSIFICATION

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Thoroughly wash out spray equipment before using KNOX OUT 2FM. Shake concentrate well before diluting. When diluting, first add approximately half of the water to the spray tank, then add the required quantity of KNOX OUT 2FM and finally add the rest of the water. Occasionally agitate sprayer during use to assure even coverage. Shake or re-agitate sprayer before use if application is interrupted.

Do not use this formulation with oil.

IF SPRAY SCREENS ARE USED, THEY SHOULD BE 50 MESH OR LARGER.

Unless otherwise directed, dilute KNOX OUT 2FM with water to make a 0.5% to 1% spray** as indicated below:

Amount of Finished Spray	Amount* of KNOX OUT 2FM to use for: 0.5% Spray**	1% Spray**
1 Pint	0.3 fl. oz.	0.6 fl. oz.
2 Pints	0.6 fl. oz.	1.2 fl. oz.
4 Pints	1.2 fl. oz.	2.5 fl. oz.
1 Gallon	2.5 fl. oz.	5.0 fl. oz.
2 Gallons	5.0 fl. oz.	10.0 fl. oz.
3 Gallons	7.5 fl. oz.	15.0 fl. oz.
10 Gallons	25.0 fl. oz. (1.6 pints)	50.0 fl. oz. (1.6 quarts)

*1 Tablespoon = 0.5 fl. oz.
**Active ingredient basis

Cockroaches and Silverfish—Make spot applications of KNOX OUT 2FM as a 0.5% to 1% fine spray or by paint brush to drawers, shelves, around water pipes, storage areas, closets, behind and under cabinets, refrigerators, sinks, stoves and in similar areas where these insects hide.

Repeat treatments of KNOX OUT 2FM should be made as needed, but generally will not be necessary more than once every 60 days. Use the low rate for light infestations or monthly maintenance sprays, and the higher concentration for heavy infestations, initial clean out, or where insecticide resistance is suspected.

Ants—Make spot applications of 0.5% to 1% KNOX OUT 2FM as a spray to baseboards, window frames, wall voids, crawl spaces, cracks and crevices, and similar hiding or harborage areas. Apply to trails, around doors and windows, and other areas where these pests may crawl or enter the premises. Repeat application as necessary.

Carpenter Ants—Make spot applications of 0.5% to 1% KNOX OUT 2FM to ant trails, around doors and windows, wall voids, crawl spaces, and other places where ants enter premises. Where possible, treat ant nest or infested wood directly. Repeat application as necessary.

Carpet Beetles—Make applications of 0.5% to 1% KNOX OUT 2FM as a spray on and under edges of floor coverings, under carpets and furniture, and in closets or other localities where these insects are found. Entire carpets may be treated. When treating entire carpets use directions under Fleas and Ticks. Repeat application as necessary.

Crickets—Make spot applications of 0.5% to 1% of KNOX OUT 2FM as a spray to baseboards, behind and under cabinets and appliances, and other hiding places. Areas around doors and water pipes should be treated to help prevent crickets from entering the premises. Repeat application as necessary.

Flies—Make spot applications of 1% KNOX OUT 2FM as a spray to window frames, screens, dumpsters, trash cans, and similar areas where these pests may congregate. Repeat application as necessary.

Fleas and Ticks—Thoroughly apply KNOX OUT 2FM as a 1% fine spray to pet beds and resting quarters, adjacent cracks and crevices, baseboards, carpets and floor coverings, between and under cushions of upholstered furniture, and other areas where these pests may be present. Entire carpets may be treated. Applications to most surfaces should be as light as possible, approximately 2 quarts finished spray per 800 square feet. It may be necessary to use a higher volume of spray, approximately 3 to 4 quarts per 800 square feet, on long, dense shag carpets. Old bedding of pets should be replaced with clean, fresh bedding after treatment. Animals should not be sprayed with this product.

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SHIP TO:

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9434 ARTESIA

BELLFLOWER CA 90706

ORDER NO: 519578784
PROD NO: 05286170

VAN WATERS & ROGERS INC. 1600 NORTON BLDG. SEATTLE, WA 98104-1566

EMERGENCY ASSISTANCE

FOR EMERGENCY ASSISTANCE INVOLVING CHEMICALS CALL CHEMTREC (800) 424-9300.

FOR PRODUCT AND SALES INFORMATION

CONTACT YOUR LOCAL VAN WATERS & ROGERS BRANCH OFFICE

PRODUCT IDENTIFICATION

PRODUCT NAME: KNOX OUT(R) 2FM INSECTICIDE
EPA REG. NO. 4581-335-499

CAS NO.: UNASSIGNED

COMMON NAMES/SYNONYMS: DIAZINON

VW&R CODE: P4559

FORMULA: MIXTURE

DATE ISSUED: 08/88
SUPERCEDES: NONE

HAZARD RATING (NFPA 704 CRITERIA)
HEALTH: 1
FIRE: 0
REACTIVITY: 0
SPECIAL: NONE

HAZARD RATING SCALE:
0=MINIMAL 3=SERIOUS
1=SLIGHT 4=SEVERE
2=MODERATE

HAZARDOUS INGREDIENTS

COMPONENT	CAS NO.	%	EXPOSURE LIMITS, MG/M3 OSHA PEL	ACGIH TLV	OTHER LIMIT	HAZARD
DIAZINON	333-41-5	23	NONE	0.1	NONE	TOXIC
WATER	7732-18-5	UNK	NONE	NONE	NONE	NONE
OTHERS	TRADE SECRET	UNK	NONE	NONE	NONE	NONE

(R) TRADEMARK OF WHITMIRE RESEARCH LABORATORIES, INC.

PHYSICAL PROPERTIES

BOILING POINT, DEG F: 212
MELTING POINT, DEG F: NOT APPLICABLE
SPECIFIC GRAVITY (WATER=1): 1.036
APPEARANCE AND ODOR:
BEIGE LIQUID: CHARACTERISTIC ODOR

VAPOR PRESSURE, MM HG/20 DEG C: N/D
VAPOR DENSITY (AIR=1): N/D
WATER SOLUBILITY, %: DISPERSES
EVAPORATION RATE (BUTYL ACETATE=1): 1

FIRST AID MEASURES

IF INHALED: REMOVE TO FRESH AIR. GIVE ARTIFICIAL RESPIRATION IF NOT BREATHING. GET IMMEDIATE MEDICAL ATTENTION.

IN CASE OF EYE CONTACT: IMMEDIATELY FLUSH EYES WITH LOTS OF RUNNING WATER FOR 15 MINUTES. LIFTING THE UPPER AND LOWER EYELIDS OCCASIONALLY. GET IMMEDIATE MEDICAL ATTENTION.

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IN CASE OF SKIN CONTACT: IMMEDIATELY WASH SKIN WITH LOTS OF SOAP AND WATER. REMOVE CONTAMINATED CLOTHING AND SHOES; WASH BEFORE REUSE. GET MEDICAL ATTENTION IF IRRITATION PERSISTS AFTER WASHING.

IF SWALLOWED: IF CONSCIOUS, IMMEDIATELY INDUCE VOMITING BY GIVING 2 GLASSES OF WATER AND STICKING A FINGER DOWN THE THROAT. GET IMMEDIATE MEDICAL ATTENTION. DO NOT GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS OR CONVULSING PERSON.

HEALTH HAZARD INFORMATION

PRIMARY ROUTES OF EXPOSURE: INHALATION, SWALLOWED, SKIN OR EYE CONTACT.

SIGNS AND SYMPTOMS OF EXPOSURE

INHALATION: VAPORS AND MISTS IRRITATE THE NOSE AND THROAT. INHALATION OF HIGHER CONCENTRATIONS MAY CAUSE HEADACHES, NAUSEA, VOMITING, AND COMA. INHALATION OF VERY HIGH CONCENTRATIONS OR PROLONGED EXPOSURE MAY CAUSE UNCONSCIOUSNESS OR DEATH.

EYE CONTACT: LIQUID AND MIST MAY IRRITATE THE EYES.

SKIN CONTACT: NO IRRITATION IS LIKELY AFTER BRIEF CONTACT BUT MAY BE IRRITATING AFTER PROLONGED CONTACT.

SWALLOWED: SWALLOWING LARGE QUANTITIES CAUSES DIZZINESS, WEAKNESS, INCOORDINATION, MUSCLE TWITCHING, TREMOR, ABDOMINAL CRAMPS, DIARRHEA, SWEATING, HEADACHES, NAUSEA, VOMITING, AND PERHAPS UNCONSCIOUSNESS.

CHRONIC EFFECTS OF EXPOSURE: NO SPECIFIC INFORMATION AVAILABLE.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: NONE REPORTED.

TOXICITY DATA

ORAL: RAT LD50 > 21 G/KG

DERMAL: RABBIT LD50 > 10 G/KG

INHALATION: RAT LC50 > 22.42 MG/L/1 HR

CARCINOGENICITY: THIS MATERIAL IS NOT CONSIDERED TO BE A CARCINOGEN BY THE NATIONAL TOXICOLOGY PROGRAM, THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER, OR THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

OTHER DATA: NONE

PERSONAL PROTECTION

VENTILATION: LOCAL MECHANICAL EXHAUST VENTILATION CAPABLE OF MAINTAINING EMISSIONS AT THE POINT OF USE BELOW THE TLV.

RESPIRATORY PROTECTION: WEAR A NIOSH-APPROVED RESPIRATOR APPROPRIATE FOR THE VAPOR OR MIST CONCENTRATION AT THE POINT OF USE. APPROPRIATE RESPIRATORS MAY BE A FULL FACEPIECE OR A HALF MASK AIR-PURIFYING CARTRIDGE RESPIRATOR EQUIPPED FOR ORGANIC VAPORS/MISTS, A SELF-CONTAINED BREATHING APPARATUS IN THE PRESSURE DEMAND MODE, OR A SUPPLIED-AIR RESPIRATOR.

EYE PROTECTION: CHEMICAL GOGGLES UNLESS A FULL FACEPIECE RESPIRATOR IS ALSO WORN. IT IS GENERALLY RECOGNIZED THAT CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING WITH CHEMICALS BECAUSE CONTACT LENSES MAY CONTRIBUTE TO THE SEVERITY OF AN EYE INJURY.

PROTECTIVE CLOTHING: LONG-SLEEVED SHIRT, TROUSERS, SAFETY SHOES, RUBBER GLOVES, AND RUBBER APRON.

OTHER PROTECTIVE MEASURES: AN EYEWASH AND SAFETY SHOWER SHOULD BE NEARBY AND READY FOR USE.

FIRE AND EXPLOSION INFORMATION

OR IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN.**

ALL INFORMATION APPEARING HEREIN IS BASED UPON DATA OBTAINED FROM THE MANUFACTURER AND/OR RECOGNIZED TECHNICAL SOURCES. WHILE THE INFORMATION IS BELIEVED TO BE ACCURATE, VWGR MAKES NO REPRESENTATIONS AS TO ITS ACCURACY OR SUFFICIENCY. CONDITIONS OF USE ARE BEYOND VWGR'S CONTROL AND THEREFORE USERS ARE RESPONSIBLE TO VERIFY THIS DATA UNDER THEIR OWN OPERATING CONDITIONS TO DETERMINE WHETHER THE PRODUCT IS SUITABLE FOR THEIR PARTICULAR PURPOSES AND THEY ASSUME ALL RISKS OF THEIR USE, HANDLING, AND DISPOSAL OF THE PRODUCT, OR FROM THE PUBLICATION OR USE OF, OR RELIANCE UPON, INFORMATION CONTAINED HEREIN. THIS INFORMATION RELATES ONLY TO THE PRODUCT DESIGNATED HEREIN, AND DOES NOT RELATE TO ITS USE IN COMBINATION WITH ANY OTHER MATERIAL OR IN ANY OTHER PROCESS.

**** E N D O F M S D S ****

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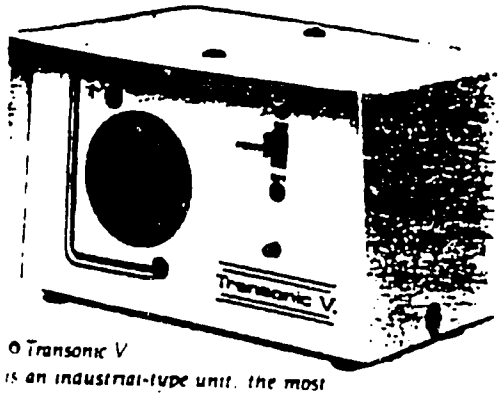
Mice, rats, roaches, bats, fleas, spiders and other pests make life miserable at home or at the plant. Old fashioned poisons get rid of them — but only temporarily, and they are a hazard to you and to your pets. *Transonic V* works on a different principle: It delivers a tremendous blast of ultrasound that is inaudible to humans and pets, but that sounds like an onrushing 747 jet to pests. It so totally disrupts their nervous system that they'll leave your home within a few weeks — never to return. There is nothing to prepare, nothing to set up — no poison and no mess. Pests just disappear.

Transonic V is an industrial-type unit that protects up to 10,000 sq. ft. (70,000 cu. ft.) It has six variable pitch and "loudness" settings. You can even adjust it to keep larger pests, such as raccoons, pigeons or rabbits at bay. Since it's clad in a steel housing, you can even use it outdoors.



Transonic V is an industrial-type unit, the most powerful you can get. It's a humane, clean, and effective system to get rid of your pests—once and for all

Transonic V has been designed to work in restaurants, factories and food processing plants. It's that powerful. We offer this top-of-the-line industrial unit for just $69.95. But here's an even better deal: ***Buy two for just $139.90, and we'll send you a third one, with our compliments — absolutely FREE!*** Get rid of those nasty pests once and for all. Get the best — get *Transonic V* today!

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Please give order #1802A174. If you prefer, mail check or card authorization and expiration. We need daytime phone for all orders and issuing bank for charge orders. We cannot ship without this. UPS/insurance: $6.95 for one *Transonic*, $8.95 for three. Add sales tax for CA delivery. You have 30-day return and one year warranty.

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