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TECHNICAL NOTE

INTERIM REPORT

POLLUTION MONITORING SYSTEM

(NASA-CR-141662) POLLUTION MONITORING SYSTEM Interim Report (Technicolor Graphic Services, Inc.) CSCL 14B

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POLLUTION MONITORING SYSTEM

This report has been reviewed

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INTRODUCTION

At the request of the Photographic Technology Division chief, Mr. John R. Brinkmann, an investigation was undertaken to identify those Photographic Laboratory by-products which can produce harmful reactions if released untreated. After identification of these by-products, specific monitoring systems for each of the offending ions were investigated and recommendations for implementation have been made. Appropriate monitoring systems have been discussed and commercial suppliers of monitoring equipment have been contacted for further information.

SECTION I

Identification of Harmful Chemicals

In the mixed effluent from a processing laboratory, the following chemicals may occur and produce harmful results.

Ferrocyanide-	Bleach by-products produced by the reduction of ferricyanide in color bleaches. In the presence of sunlight and oxygen, free cyanide is produced from ferrocyanide.
Dichromate Compounds-	Hexavalent chromium is present when dichromate bleaches are utilized. This ion is harmful to fish in small concentrations.
Silver-	The free silver ion is toxic to micro-organisms. Most silver in photographic processing waste is in the form of a silver thiosulfate which can be readily recovered or converted to silver sulfide.
Phosphates and Nitrates-	These chemicals are plant nutrients which contribute to algae and weed growth.

Boron-	In high concentration, boron can be toxic to plants.

SECTION II

Measurement and Monitoring Methods

Ferrocyanide - Ferricyanide and ferrocyanide which are the main ions present in the effluent are not themselves especially toxic. It is the cyanide which is released when they decompose that is toxic. To monitor the cyanide on a continuous basis, a complicated and ingenious procedure and equipment have been devised. First, it is necessary to pretreat the effluent to release the metal-cyanide bonds before measurement. After a double-stage pretreatment, the free cyanide in the sample can be measured using a specific monitoring electrode for the cyanide ion.

This entire sampling procedure can be performed on a continuous basis by using commercially available monitoring devices such as the one described in the attached brochure. Such devices incorporate continuous strip chart recorders and alarm systems to signal when a preset level of cyanide is exceeded.

Silver - The measurement of silver can be complicated by hypo and other interferring ions. It may be possible to make the measurement directly or it may be necessary to pretreat with some reagent such as $KA_g(NO_3)$. However, these are both standard chemical procedures used for silver measurement and can be performed easily by the type of monitoring gear described in the attached brochure.

Phosphate - A possible method may be to treat the sample with lanthanum nitrate and then sodium fluoride. The measurement is then made on the remaining fluoride ions using a specific fluoride monitor.

Nitrate - Very little nitrate is expected in the effluent, but it can be measured after pretreatment with silver sulfate to remove interferring ions. Specific electrodes for nitrate can then be used.

Boron - This will be the most difficult ion to measure. The best method is to treat with hydrofluoric acid to form tetrofluoroborate, for which specific ion electrodes exist.

Chromates - Not much trouble is to be expected from the chromates, as they would quite likely be reduced to a less toxic form by the hypo, sulfate, and developing agent present. It is not expected that chromate monitoring will be required.

Monitoring of all of these ions is possible utilizing chemical pre-treatment and specific ion sensors. In practice, a small portion of the Building 8 effluent would be continuously diverted to run through a set of specific monitors to analyze and record the levels of the harmful chemicals. Integral alarm systems can be set to signal excessive ion levels. These same alarm systems could be utilized to trigger electronic circuits which could divert the flow into holding tanks or treatment facilities.

SECTION III

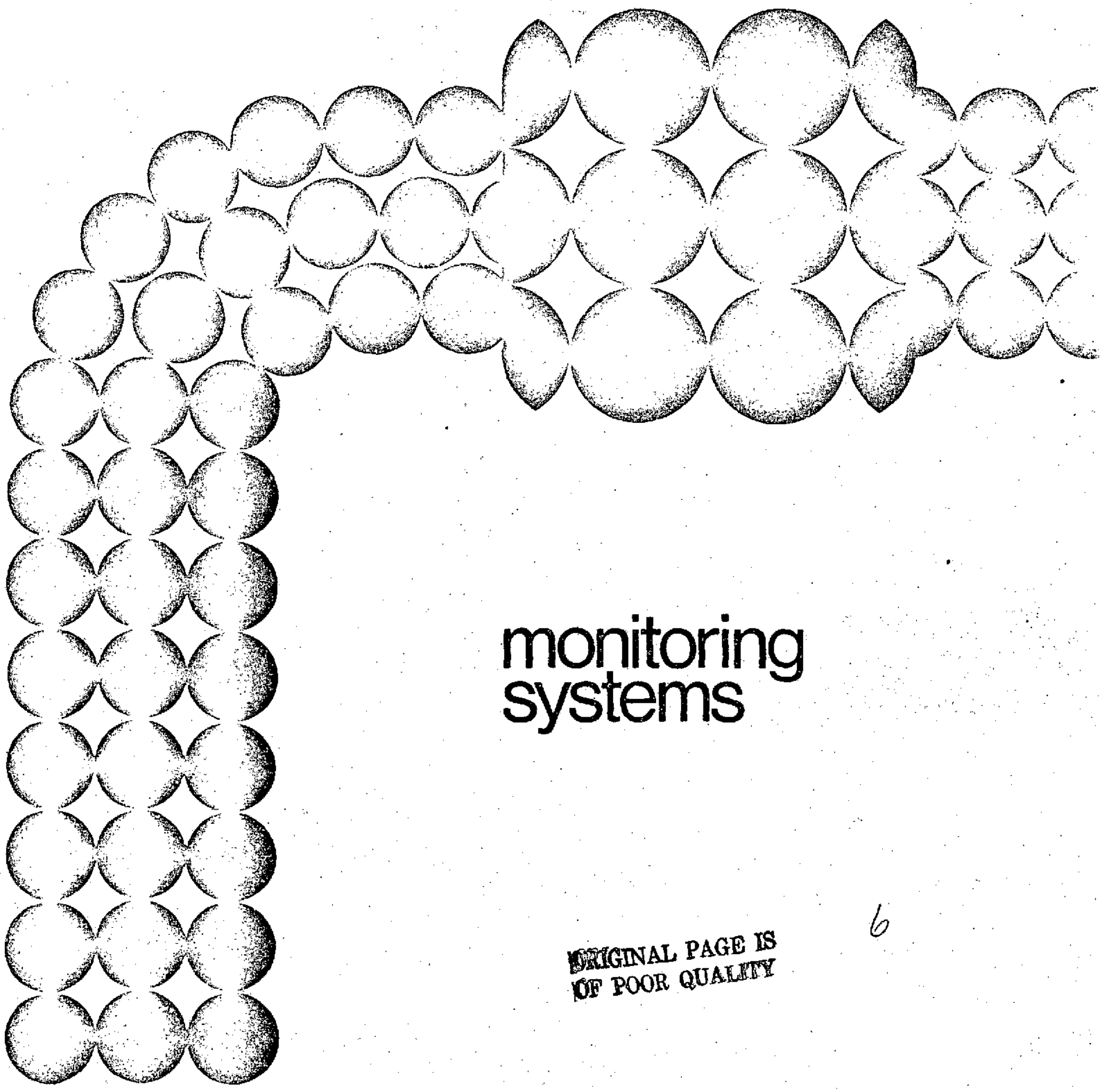
ACTION TAKEN

1. Arrangements are being made with Eastman Kodak Company to discuss monitoring equipment requirements, ion levels and monitoring techniques.

2. Contact has been made with the representatives of monitoring equipment manufacturers for discussions about available equipment, costs and effectiveness. Orion and Leeds and Northrup have both been contacted. They are working on the problem and will send representatives to visit our facility.

3. After the above requested information has been analyzed, specific recommendations for monitoring systems and automatic containment systems will be made.

ORION RESEARCH



monitoring systems

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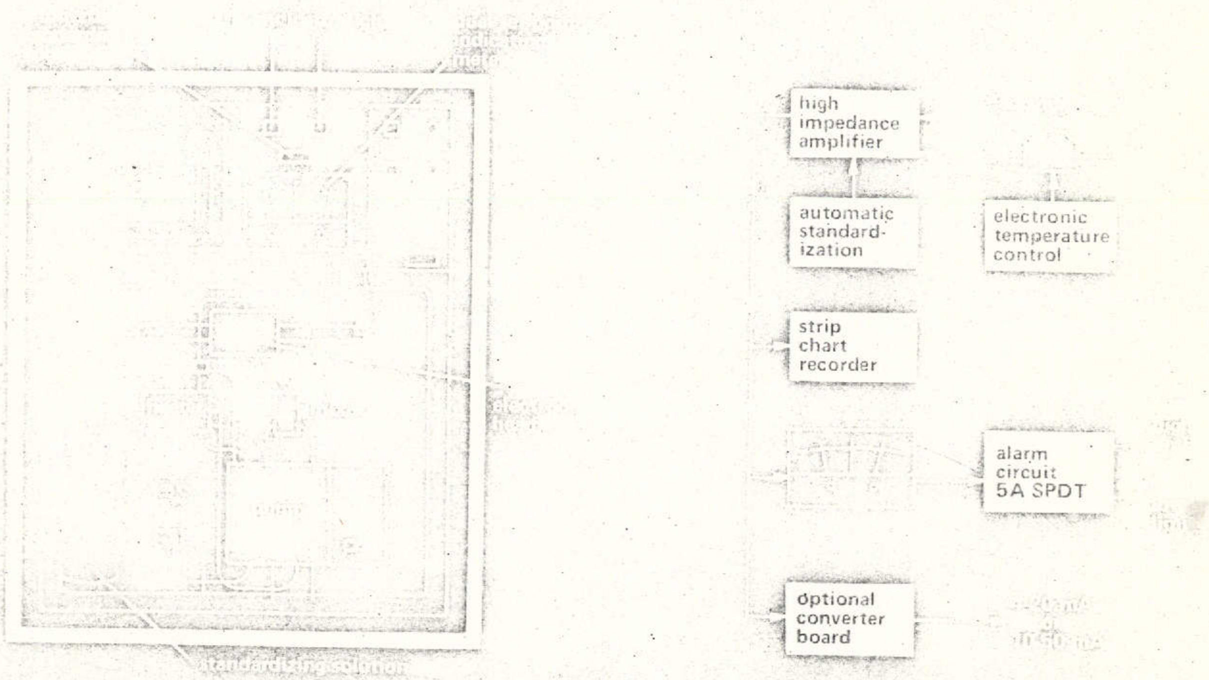
SERIES 1000 MONITORS
a major technical breakthrough in continuous measurement of chemical parameters



Series 1000 monitors are single parameter continuous analyzers built to perform in the rigorous environment of the industrial plant. The system is housed in a rugged NEMA 12 case, and the critical sensing assembly is electronically thermostatted to allow the actual measurement to be made under "laboratory conditions".

Clean sample for the monitor is provided by a by-pass filtration system which requires a minimum of attention.

Reduced operating costs result from low in-operation reagent consumption, and a stand-by mode keeps the monitor in complete operational readiness whenever the process stream is shut down.

The electronic and mechanical design is simple and modular – so that reliability is maximized and servicing can be done with little more than a screwdriver.

Each day the electronic package automatically checks the system calibration on a standard solution, corrects any error, and indicates proper operation.

The electronics package includes a 4-inch strip chart recorder and a dual set-point indicating meter for establishing high and low alarm limits. (The meter allows the level measured to be read at a glance, and shows where the limits have been set.) An optional current converter board can be plugged into the electronics package to interface the monitor to process control apparatus.

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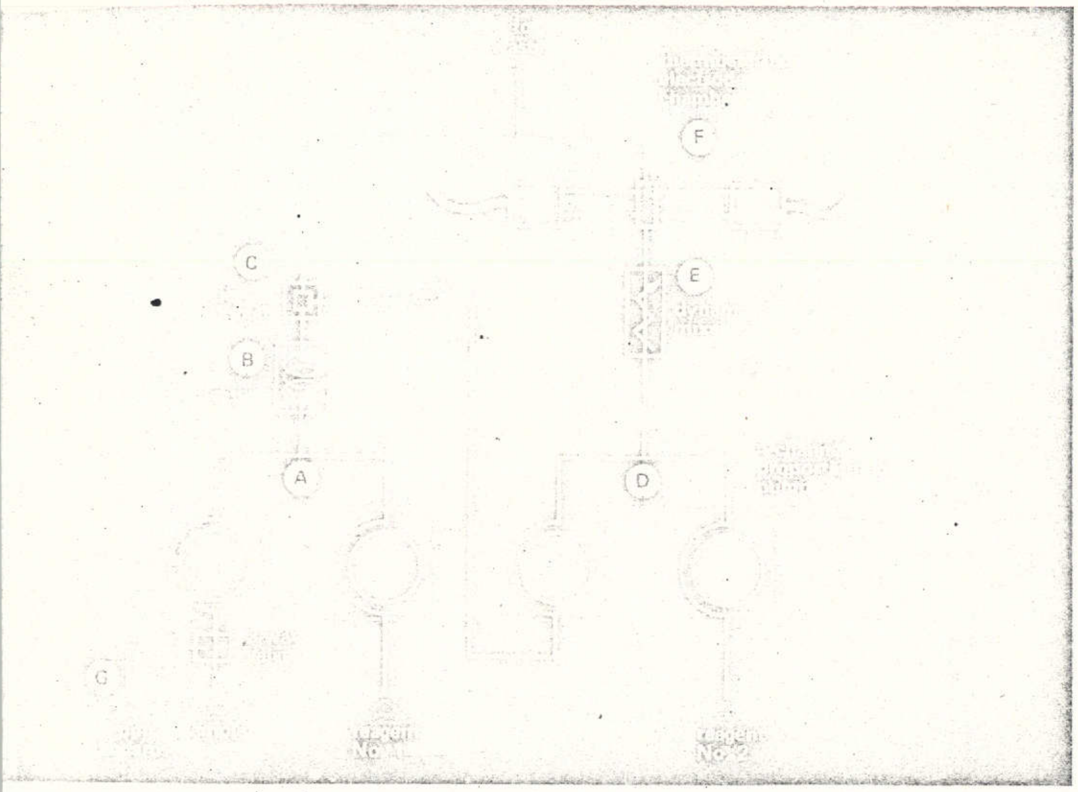
rugged, reliable hardware

electronics that do
a lot more than just measure



parameter measured	limit of detection (ppm)
ammonia	0.02
bromide	0.05
cadmium	0.02
chloride	1.00
chlorine	0.05
copper	0.05
cyanate	0.05
cyanide	0.06
fluoride	0.05
hardness	0.01
hypochlorite	0.05
iodide	0.10
lead	0.20
nitrate	0.60
nitrite	0.05
oxidizing agents	0.05
reducing agents	0.05
sodium	<0.01
silver	0.20
sulfide	0.10
sulfite	0.05
total acid	—
total base	—

The above list of parameters is representative of the wide capabilities of Series 1000 monitors. For a comprehensive, up-to-date survey of the state of the art of chemical analysis by electrode, see the ORION ANALYTICAL METHODS GUIDE.

Because of their many advantages over older analytical techniques, methods using Orion chemical sensing electrodes are in daily use in thousands of laboratories throughout the world. These proven electrode methods are automated in Series 1000 monitors, making possible precision and sensitivity never before available in continuous monitoring systems. The logarithmically-responding electrodes are both sensitive and accurate over a tremendous concentration range — important information need not be lost because of off-scale readings. Time response is excellent, sample color and turbidity do not interfere, and fouling is less of a problem than with other types of detection.

The electrode methods employed in the Series 1000 monitors are easily run in parallel on the bench-top, greatly simplifying the verification of results.

The block diagram above shows the chemistry section of the Model 1206 cyanide monitor; two reagents are used in the sample pre-treatment. Acidified EDTA is added to the sample (A). The stream is heated to 80°C to release metal-bound cyanide (B). Air bubbles are removed (C). A basic indicator reagent is added to the stream (D) and mixed (E) before entering the electrode measuring chamber (F). A three-way valve (G) allows a standardizing solution to be introduced into the system automatically to verify correct system operation.

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SERIES 1000 MONITORS

Designed to meet the needs of the chemist or chemical engineer responsible for maintaining the quality of a chemical process or keeping plant effluent free of pollutants.

ORION
RESEARCH

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