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HEALTH SAFE ALARM EVALUATION. (U)
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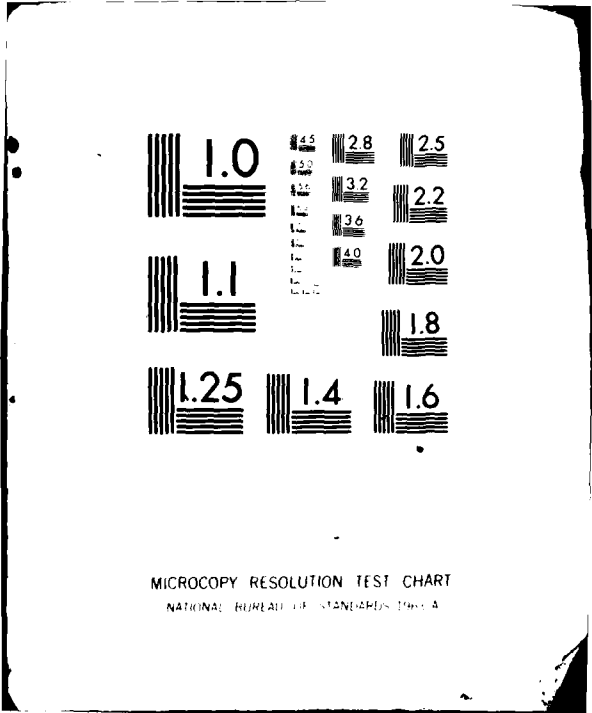
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HEALTH SAFE ALARM EVALUATION

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USAF Occupational and Environmental Health Laboratory
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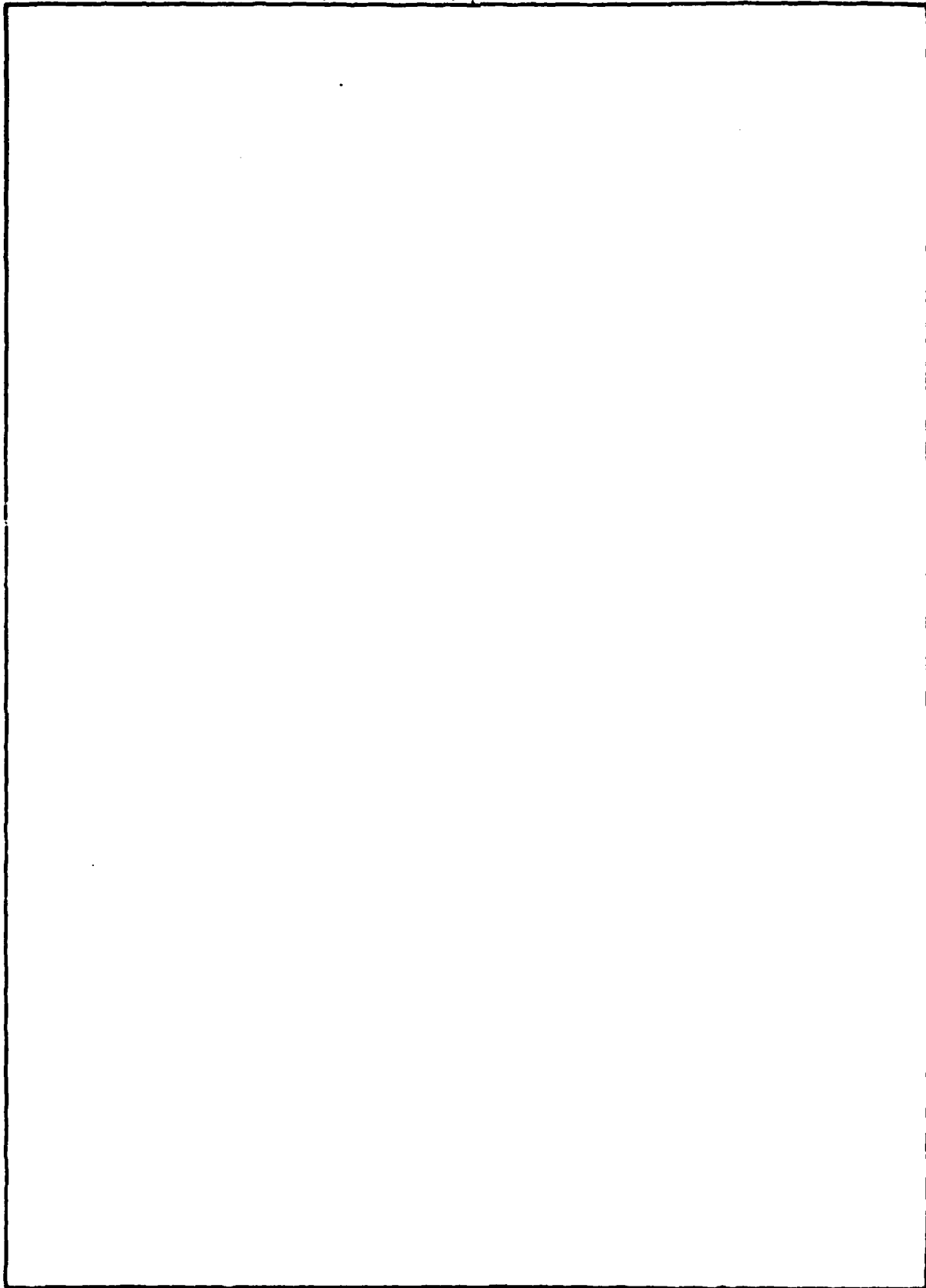
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This technical report has been reviewed and is approved for publication.


WILLIAM E. MABSON, Colonel, USAF, BSC
Commander

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USAF OCCUPATIONAL AND ENVIRONMENTAL

HEALTH LABORATORY

Brooks AFB, Texas 78235

HEALTH SAFE ALARM EVALUATION

December 1981

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I. INTRODUCTION

The USAF Occupational and Environmental Health Laboratory (USAF OEHL) conducted an evaluation of the National Mine Service Company, Model MX 241, Combination Combustible Gas/Oxygen Deficiency Alarm under the USAF OEHL Special Project CH810011, "Health Safe Alarm Evaluation." Although several new instruments have been recently introduced, only the Model MX 241 met our requirements:

- a. ability to set the %LEL alarm at or below 5% LEL,
- b. ability to set the oxygen alarm at or below 19.5% oxygen, and
- c. very compact.

An example of this instrument was supplied by Vallen Corporation of Houston TX for our laboratory evaluation.

II. DESCRIPTION OF THE INSTRUMENT

The MX 241 (Figure 1) is a light weight (18.2 oz), continuous duty, oxygen and combustible gas monitor. It has a digital, liquid crystal display (LCD), an audio indicator (alarm buzzer), solid-state circuitry, and rechargeable, nickel-cadmium battery pack in a stainless steel case. Combustible gas atmospheres are measured with a catalytic diffusion-type sensor. The combustible gas concentration, as a percent of the LEL, is shown on the display when the push button read switch is pressed. An integral audible alarm, independent of the display, sounds if the concentration of the combustible gases exceeds the set point. The alarm is factory set at 20% LEL, hexane and is adjustable between 0% LEL and 55% LEL. Oxygen concentration is monitored using a micro fuel cell (galvanic electrochemical cell) that provides a current proportional to the concentration of oxygen in the air. The LCD displays the concentration of oxygen as a percent of the total atmospheric volume and the alarm sounds if the oxygen concentration falls below the preset level. The alarm is factory set at 19.5% of oxygen and is adjustable between 17% and 55% oxygen. The MX 241 will accept a headphone driver unit that provides an output for an earphone or headset whenever noise in an area to be tested could mask the audible signal from the wearer. The MX 241 has been submitted to Factory Mutual Research Corporation (FM) for intrinsic safety certification.

III. TEST RESULTS AND DISCUSSION

The factory calibration of hexane on the Combustible Measuring Range was checked and the test results are shown in Table I and Figure 2. The linearity of response to hexane was excellent. The alarm set point at 20% LEL of hexane was also checked. The buzzer sounds at or above 20% LEL and stops at or below 20% LEL of hexane. When the alarm set point was adjusted to 5% LEL of hexane, the alarm sounded at or above 5% LEL and stopped below 5%. The test results are shown in Table II. A 3% LEL hexane alarm set point was also tested and found to be accurate.



FIGURE 1. PHOTOGRAPH OF THE COMBUSTIBLE/OXYGEN MONITOR, MX241

TABLE I

MX 241 Response to Hexane

Sample Concentration (% LEL Hexane)	Meter Readings
1.0	1, 1, 0, 1, 1
2.0	2, 2, 2, 2, 2
3.0	3, 3, 3, 3, 2
4.0	4, 4, 4, 4, 5
5.0	5, 5, 6, 5, 5
10.0	10, 11, 11, 12, 11
20.0	22, 22, 23, 20, 21

TABLE II

5% LEL Hexane Alarm Set-Point Testing

Sample Conc. (% LEL Hexane)	Alarm Start	Meter Reading	Alarm Stop
10.0	at or above 5 same	12 12	at or below 5 same
6.0	at or above 5 same same	5-6 5 5	at or below 5 same same
4.0	No alarm No alarm	4 4	- -
2.0	No alarm No alarm	2 2	- -

MX 241 RESPONSE TO HEXANE

SCALE: COMBUSTIBLE

METHOD OF VAPOR GENERATION: STATIC

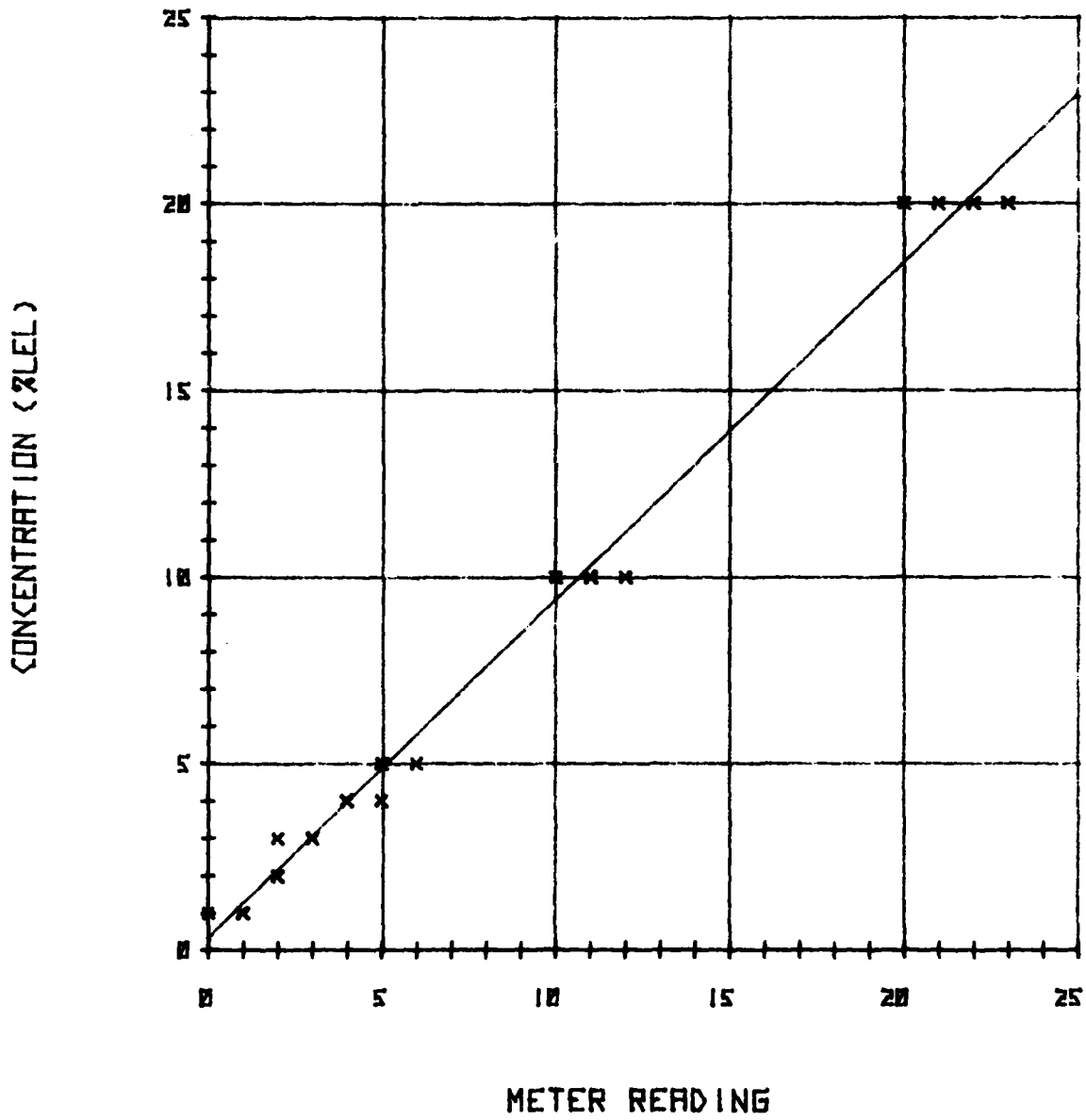


FIGURE 2. MX241 RESPONSE TO HEXANE

The factory calibration of oxygen on the Oxygen Measuring Range was checked and the test results are shown in Table III. The instrument's response to oxygen was excellent. The buzzer sounds at or below 19.4% and stops at or above 19.5% of oxygen.

TABLE III

MX 241 Response to Oxygen

% Oxygen	Meter Readings
17.0	17.1, 17.0, 17.0
19.6	19.7, 19.6, 19.7
20.1	20.2, 20.1, 20.2

IV. RECOMMENDATION

The overall performance of the instrument was excellent. The instrument can be used below 5% LEL with an accuracy of $\pm 1\%$ LEL. It is very easy to use and all controls and adjustments are easily accessible. We recommend the MX 241 for use during fuel cell maintenance operations after a certificate of intrinsic safety has been awarded by Factory Mutual Research Corporation.

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