5-1969

Solubility of Manganese and Iron in Impoundment Waters

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SOLUBILITY OF MANGANESE AND IRON IN IMPOUNDMENT WATERS

Presented to

Dr. Joe Nix

By

Jim Gilbert

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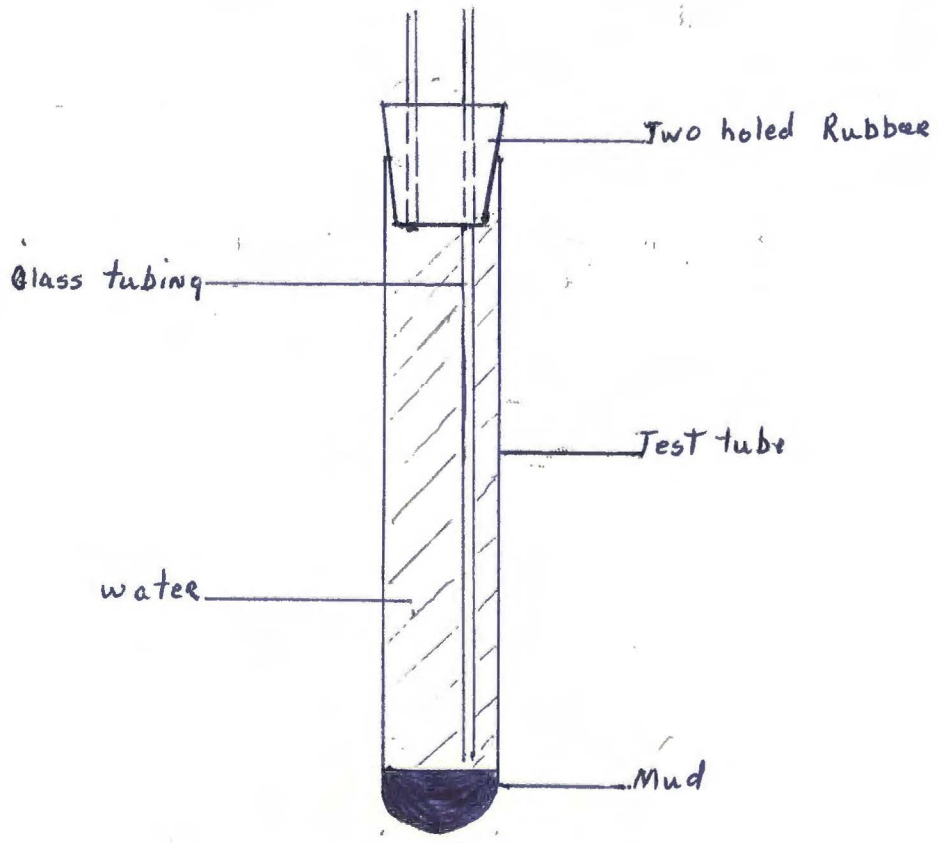
The purpose of this paper is to show the rate of solubility of certain elements (manganese and iron) in impoundment waters. The rate at which manganese and iron becomes soluble is important in determining if there is a change in the solubility of these elements in impoundment water and free running water.

The solubility of an element under impoundment waters represents a cycle. The mud on the bottom of impoundment waters contain the elements that are insoluble. At a certain stage the element becomes soluble, and it is released from the mud. The soluble element is much lighter than the insoluble one, and it therefore rises toward the surface. When it nears the top, there is a reaction; the particles become insoluble. They are heavier than the water particles and fall back down,

settling in the mud to start the cycle again. In impoundment waters, there is a higher degree of soluble particles near bottom than the top.

Test tubes were filled with about one centimeter of mud from a lake. Water was then placed over the mud — lake water was used. A rubber stopper, with glass tubing that almost reached the mud, was then inserted. The test tubes were then placed in a container of normal room temperature, where they stayed when not in use.



An atomic absorption spectrohotometer was used to find the amount (parts per million) of the element which was in the water. You could thus find the solubility of the element in the water. The atomic absorption spectrohotometer was connected to a recorder readout, which was connected to a recorder.

A standard was first run through the atomic absorption spectrohotometer. This was followed by the unknown. Using the standard as a base, the unknown (ppm) could be calculated. The time in which it took the unknown to be recorded was sperated into four intervals. Each interval being a fourth of the space taken up by the reading.

The experiment was started March 20, 1969 and was continued until May 22, 1969. Around twenty

readings were taken during that time period. More than one reading was taken on some days.

Iron was found to have a faster rate (ppm) than manganese did. The readings on iron were inconsistent, with iron fluctuating from a low ppm content to a higher ppm content, and back down to a low ppm content. The trend was a rise in ppm content and then a sharp drop down to zero. After two months of readings, the ppm content of iron dropped to zero or around zero on most of last readings.

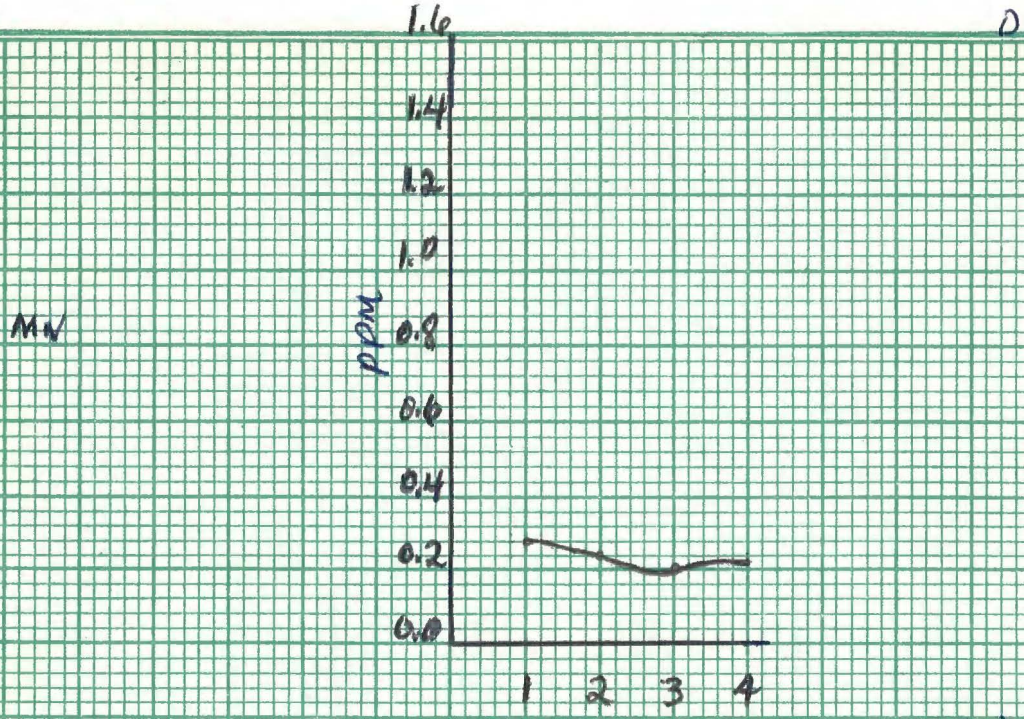
The manganese rate (ppm) was much slower and much more consistent. Manganese rose steadly from about 0.2 ppm to around 1.0 ppm. Manganese never exceeded 1.48 ppm and toward the end of the experiment was reading around 1.0 ppm.

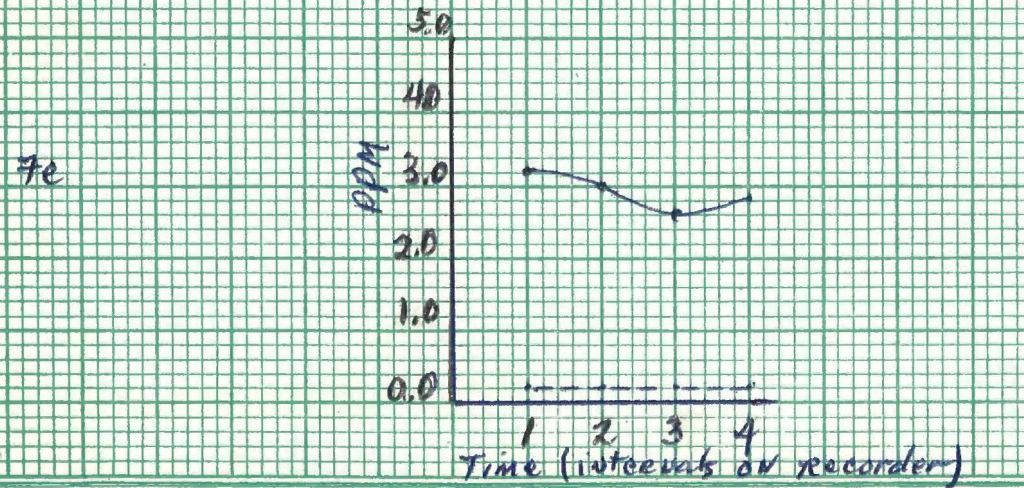
The results of the readings are on the graphs at end of this conclusion. They are in sequence of one

to seventeen.

There should have been a decline in ppm from the first interval to last interval. The reason that there was not a decline in ppm could be attributed to the rubber stopper, which might have contained manganese or iron. But this may not be the reason that the solubility is almost a constant throughout the test tube.

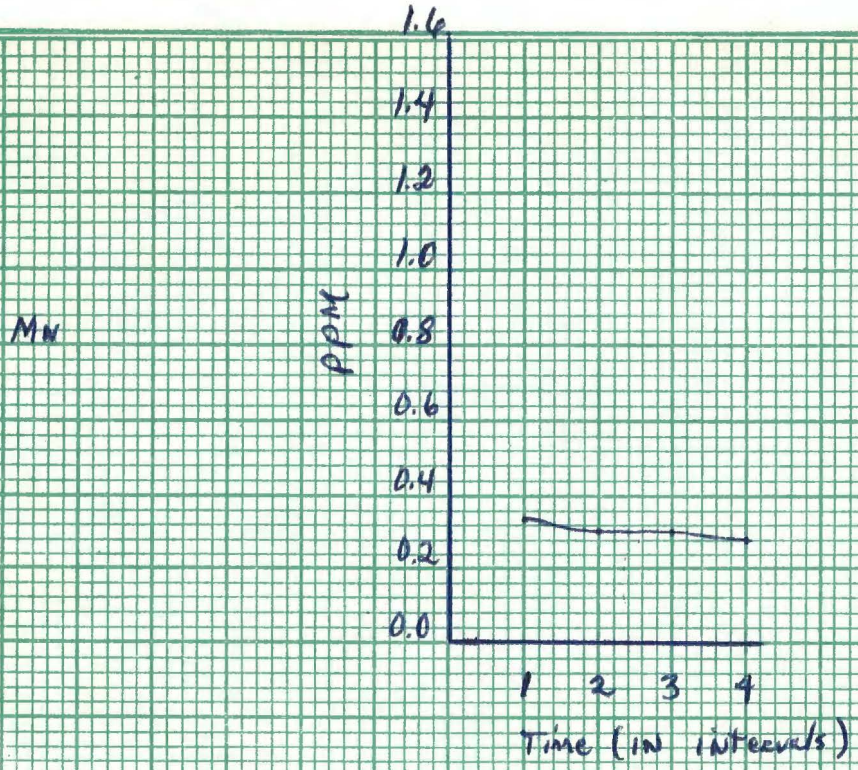
Date 3-20-69

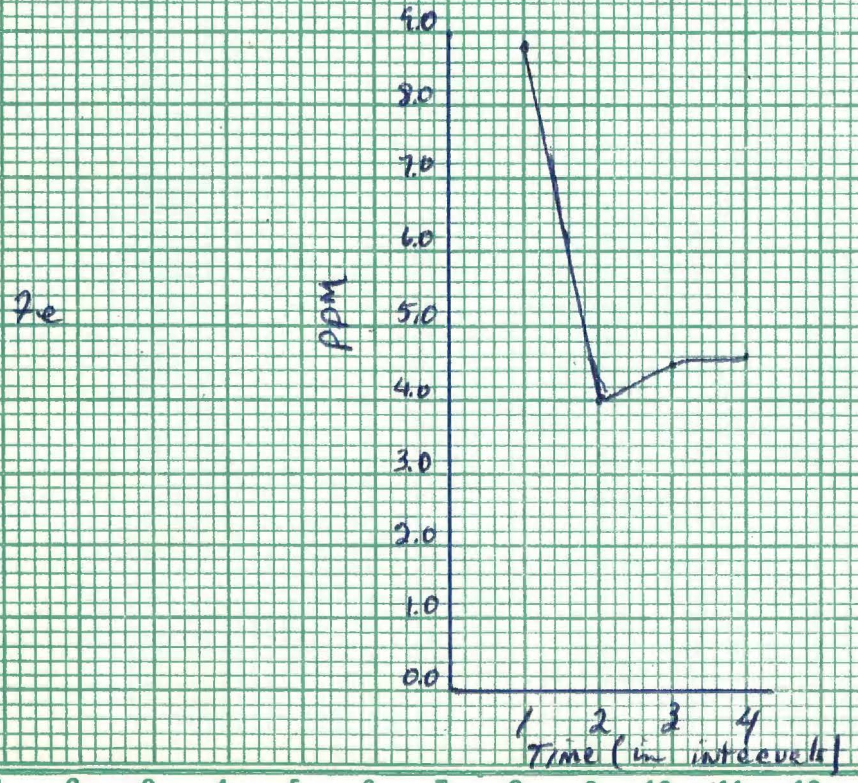




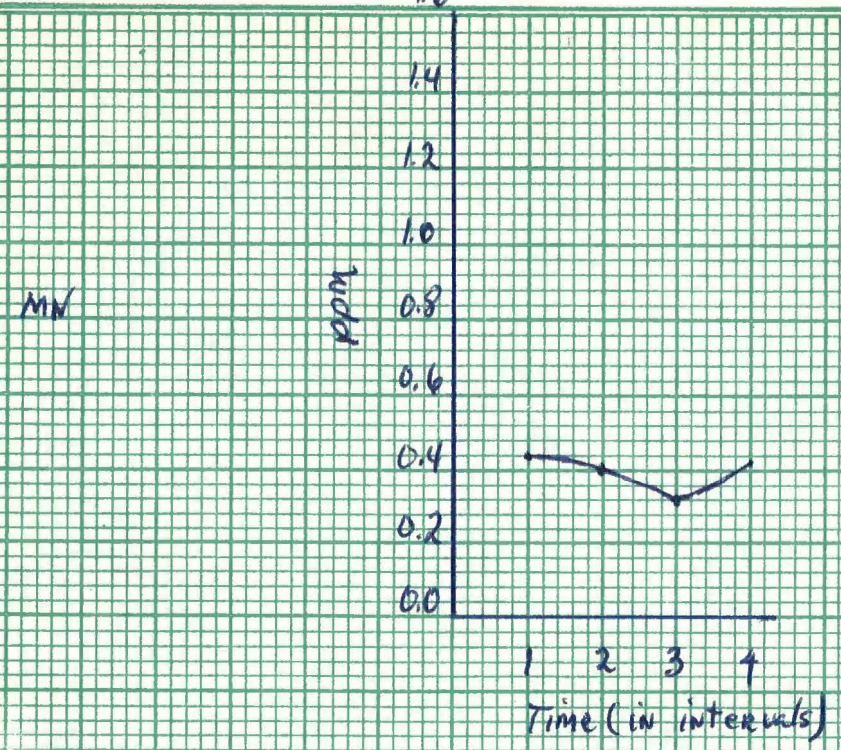
* Note: Sometimes more than one reading was taken of a element on one day. ∴ First reading ——— ∴ Second Reading - - - - -

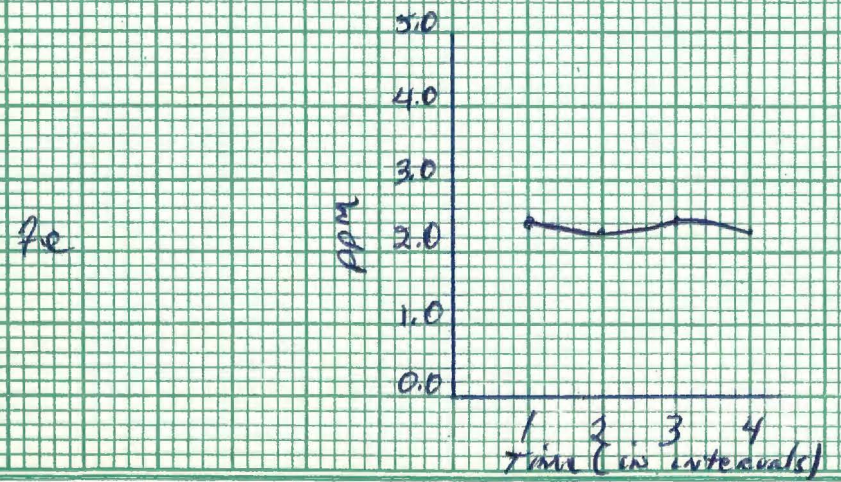
Date 3-22-69


Mn
PPM
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Time (in intervals)


Fe
PPM
4.0
3.0
2.0
1.0
0.0
1 2 3 4
Time (in intervals)

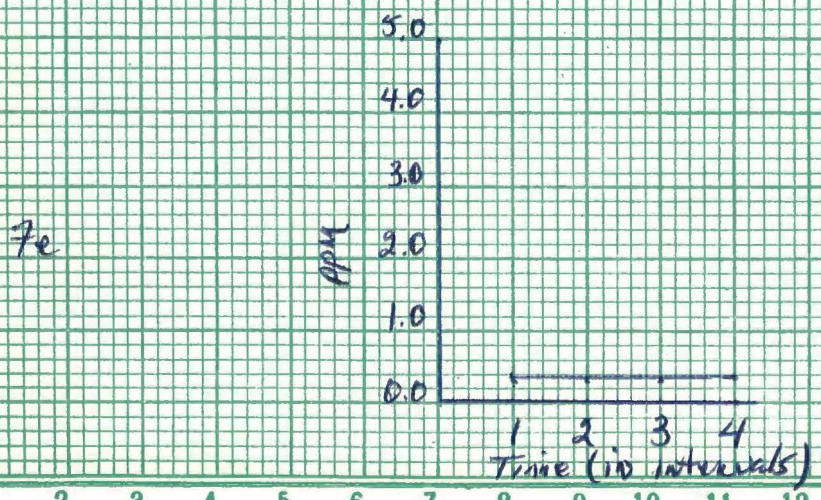
Date 3-24-69


MN
mgm
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Time (in intervals)


Fe
mgm
5.0
4.0
3.0
2.0
1.0
0.0
1 2 3 4
Time (in intervals)

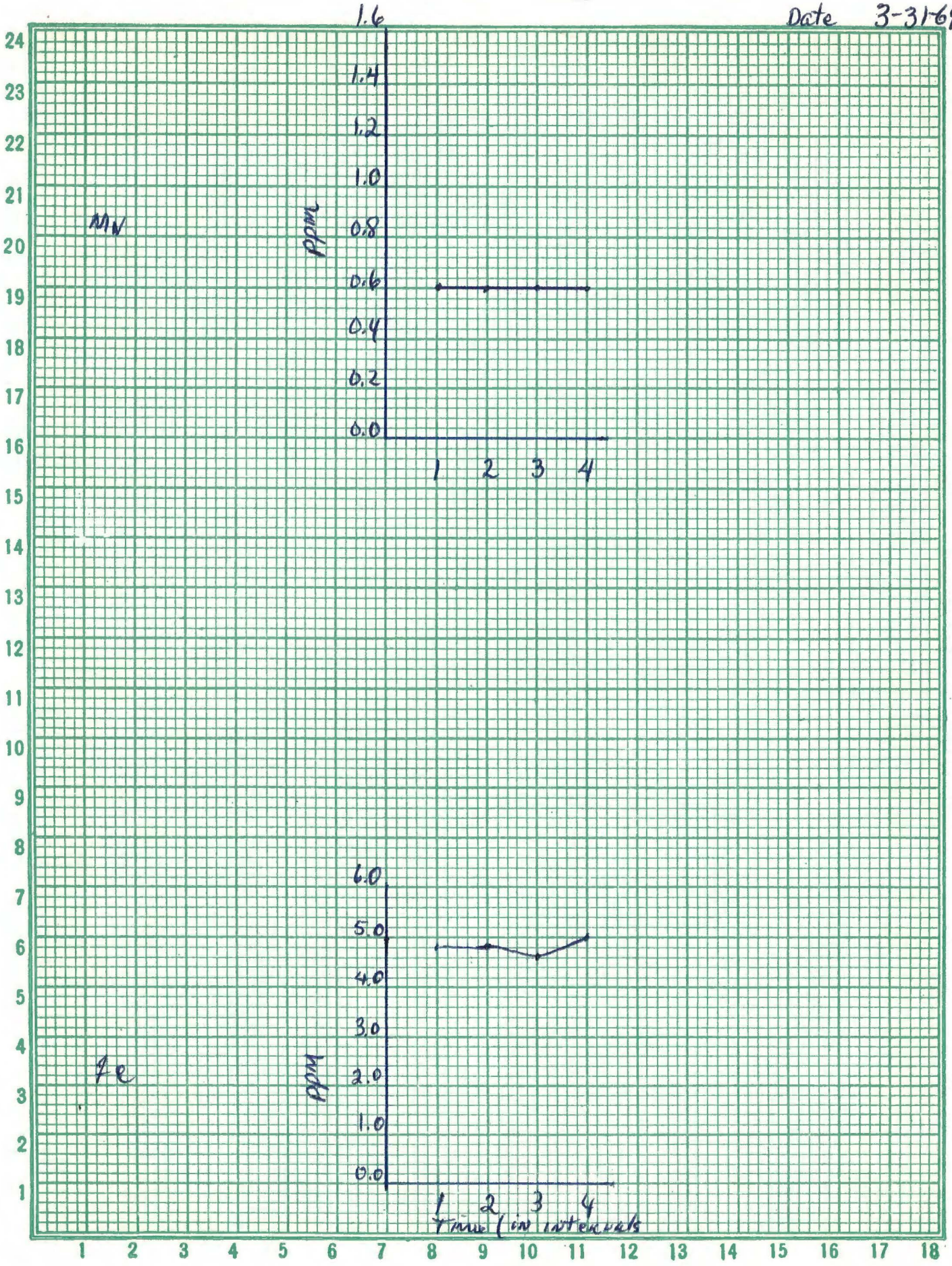
Date 3-25-69

MW → not recorded on this date



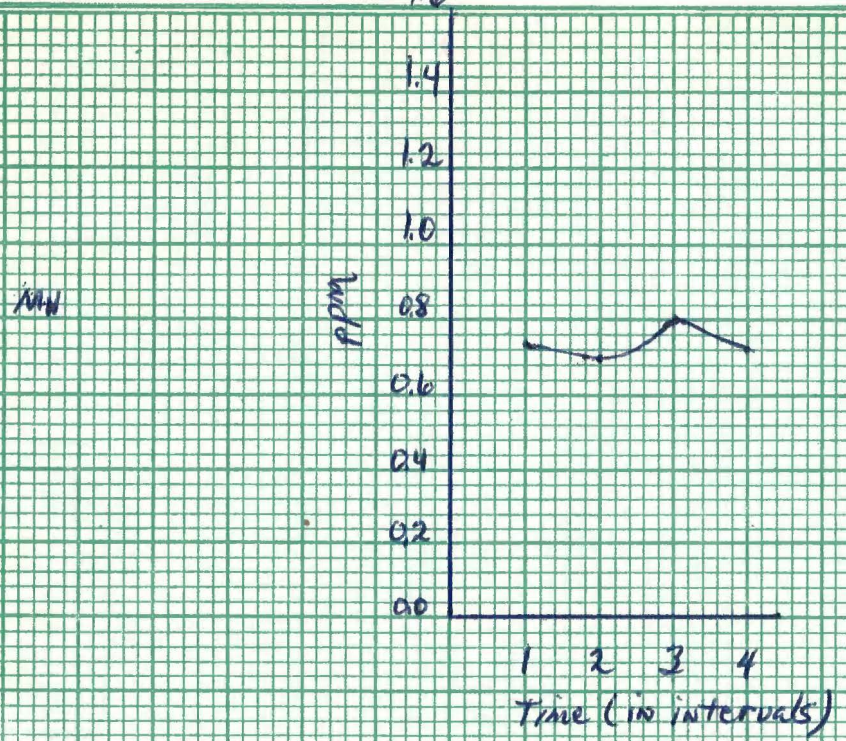
Fe

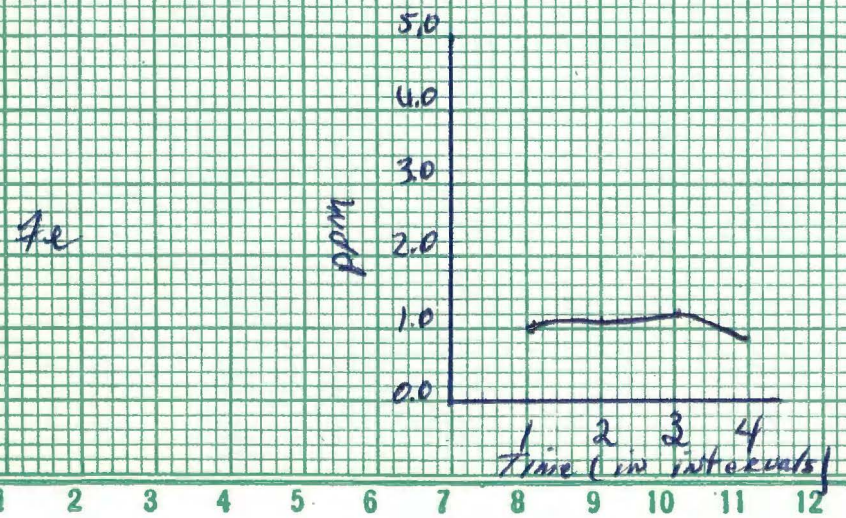
Date 3-31-69


Mn
ppm
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Fe
ppm
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1 2 3 4
Time (in intervals

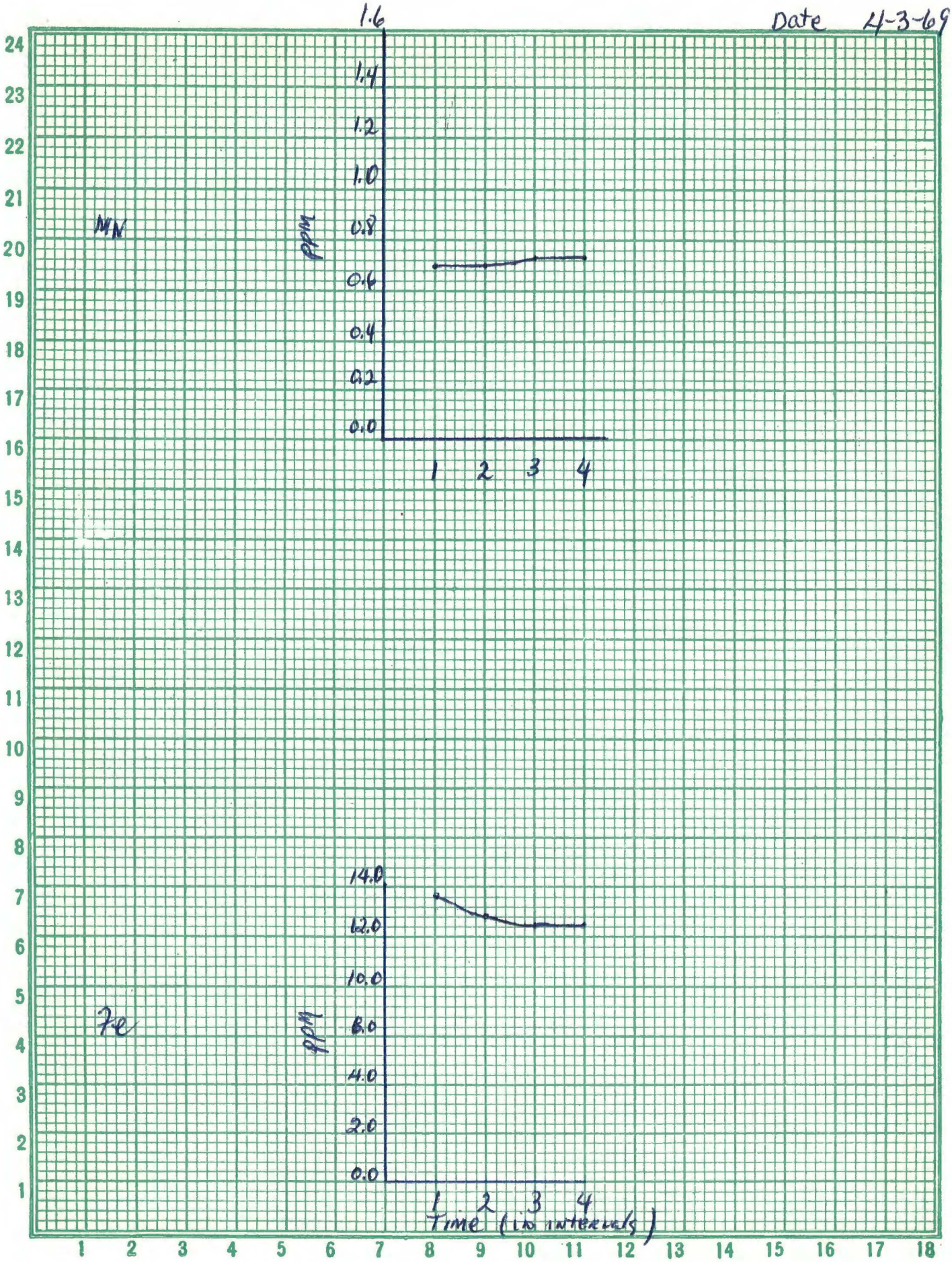
P.6

Date 4-2-69

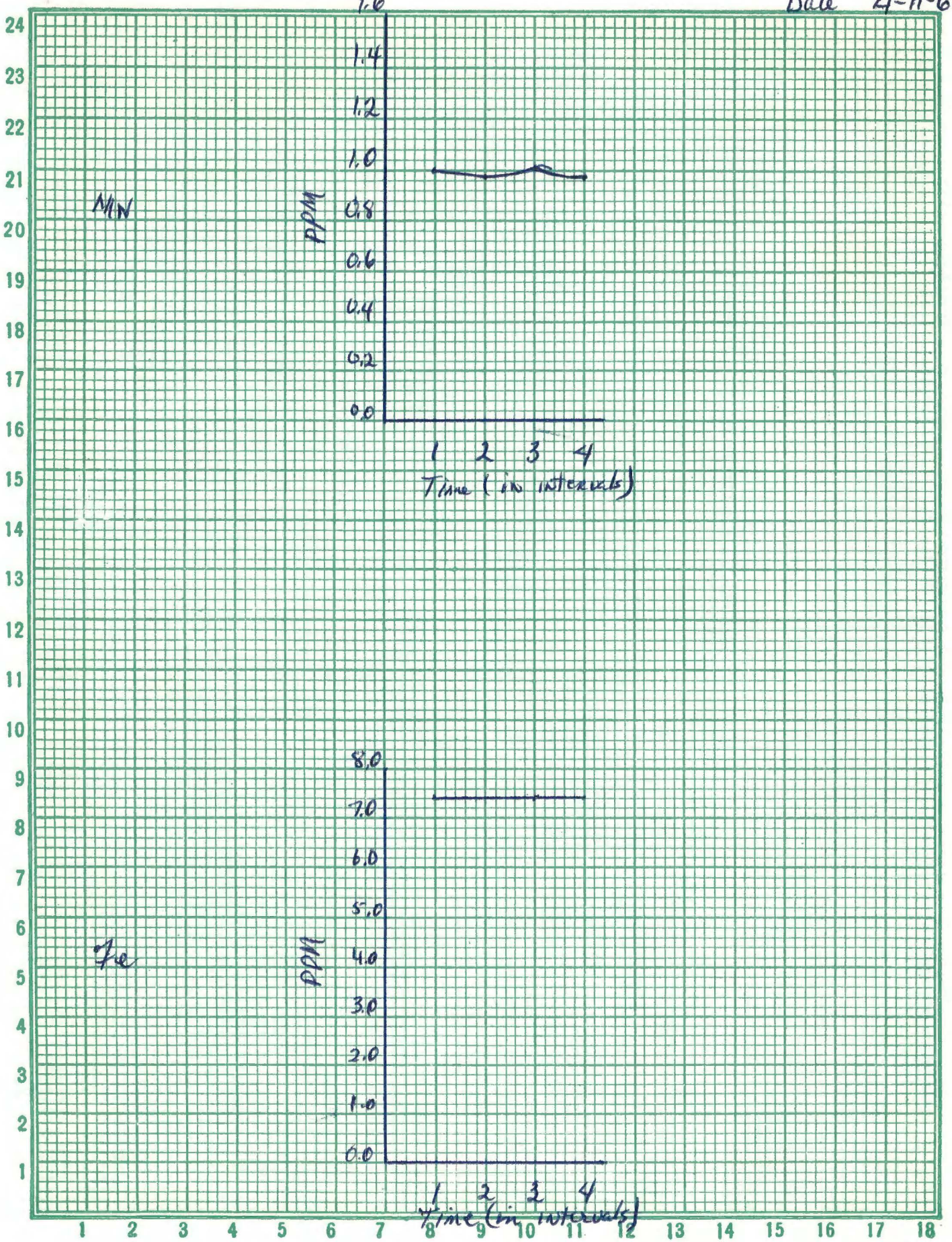

Mn
ppm
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Time (in intervals)


Fe
ppm
5.0
4.0
3.0
2.0
1.0
0.0
1 2 3 4
Time (in intervals)

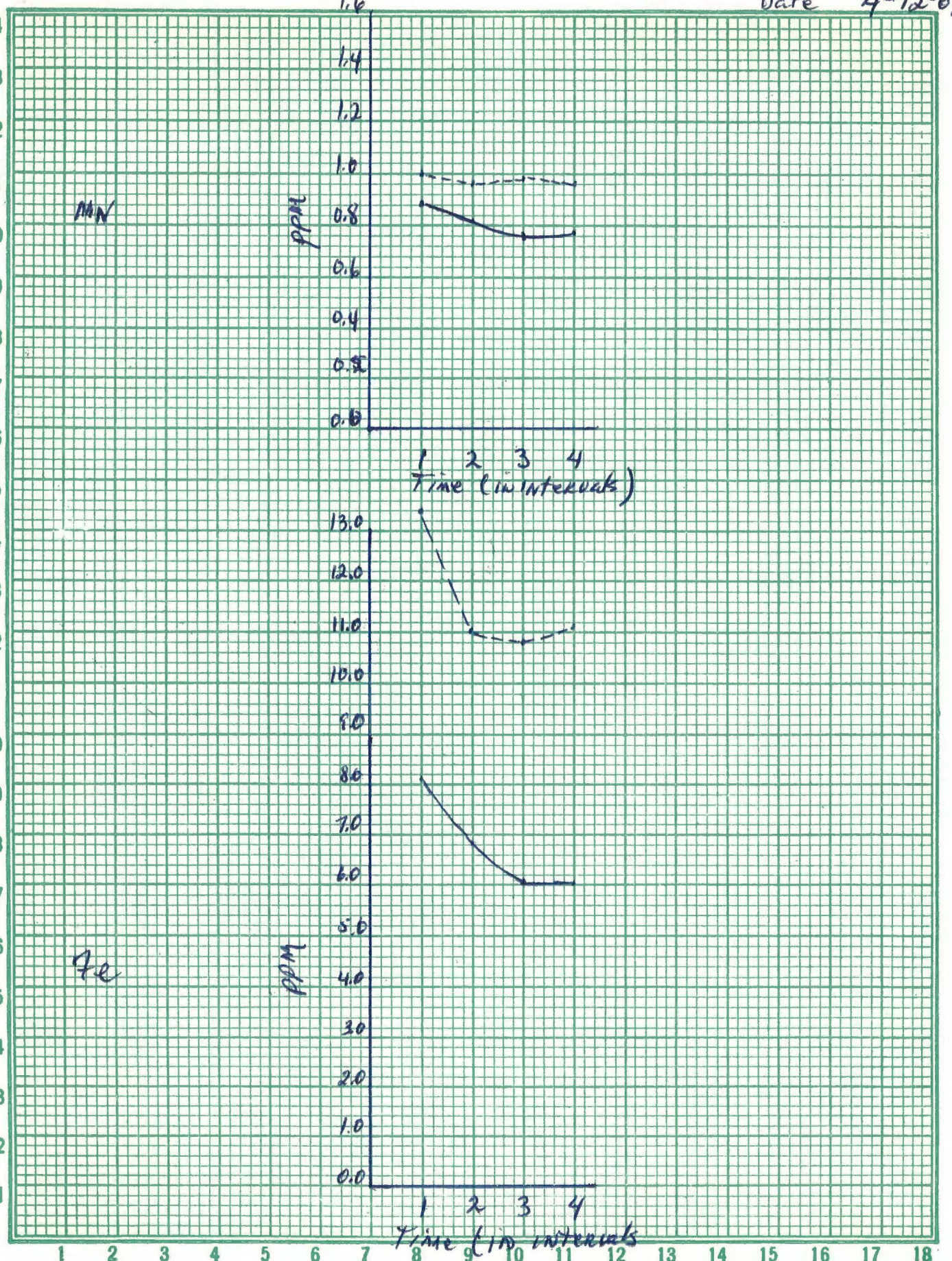
Date 4-3-69


1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
ppm
Mn
1 2 3 4
14.0
12.0
10.0
8.0
4.0
2.0
0.0
ppm
Fe
1 2 3 4
Time (in intervals)

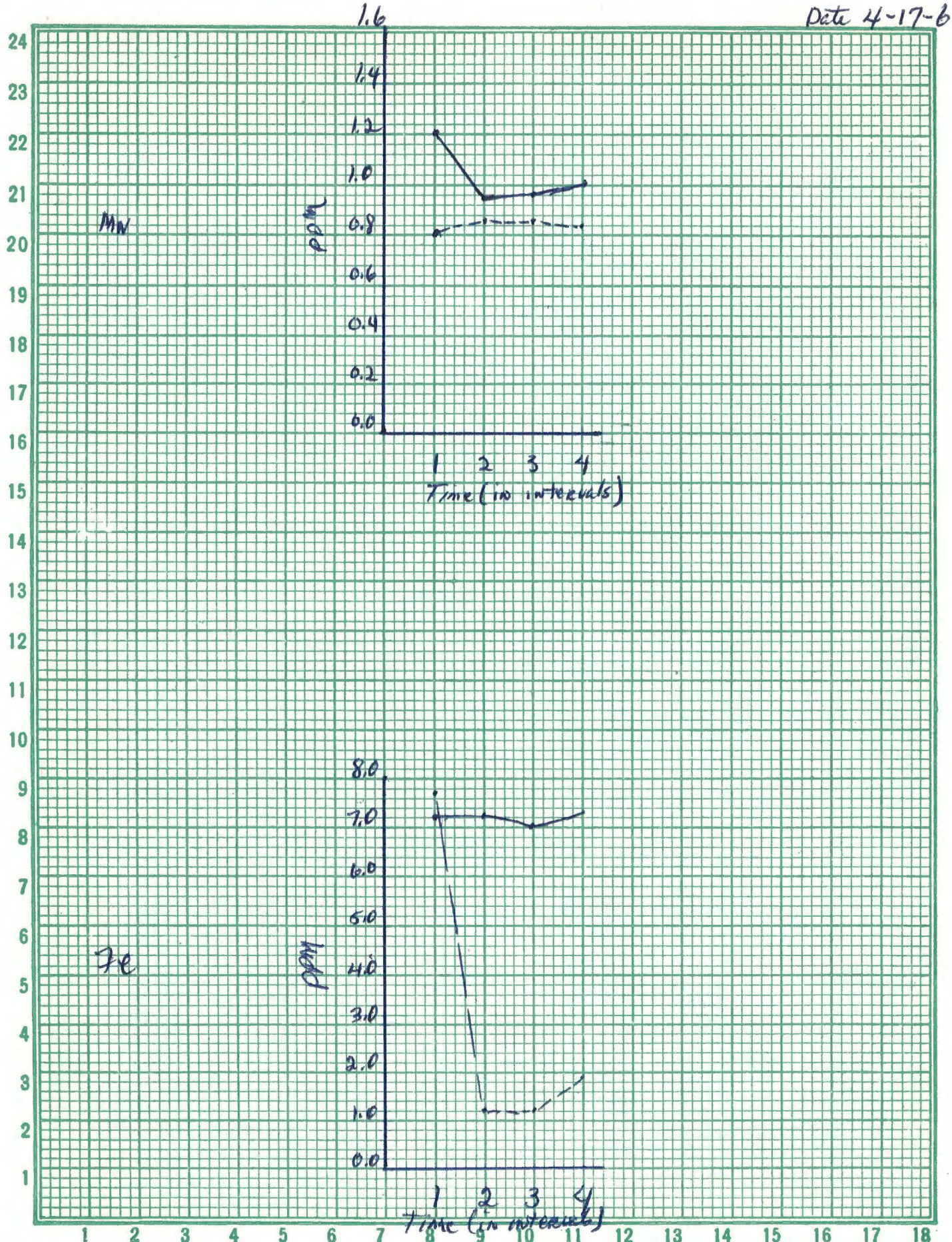
Date 4-11-69


Mn
ppm
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Time (in intervals)
Fe
ppm
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1 2 3 4
Time (in intervals)

Date 4-12-69


Mn
ppm
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Time (in intervals)
Fe
ppm
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1 2 3 4
Time (in intervals)

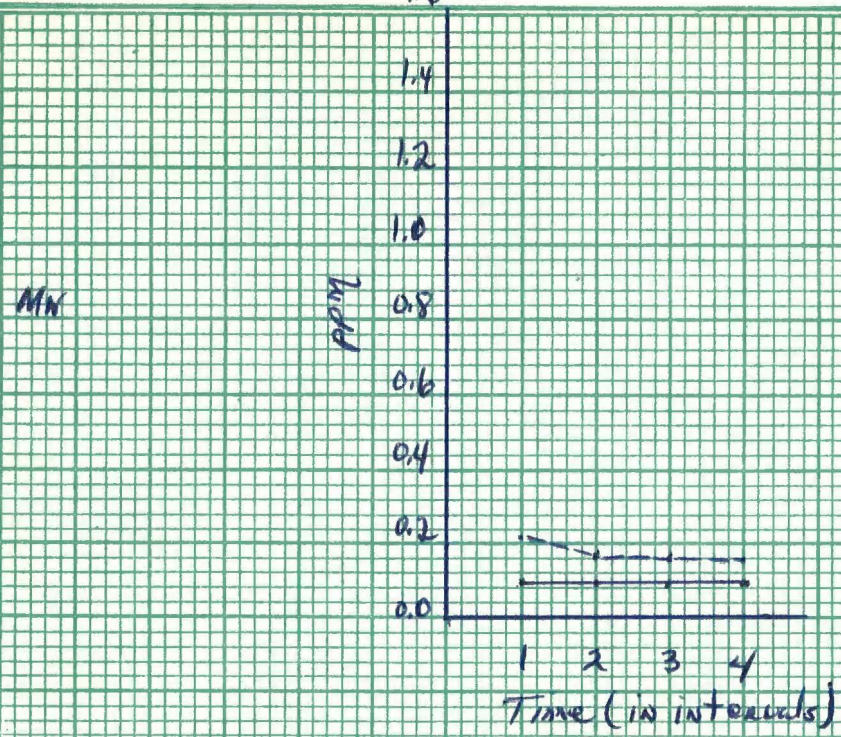
Date 4-17-69


1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
MW
1 2 3 4
Time (in intervals)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Fe
1 2 3 4
Time (in intervals)

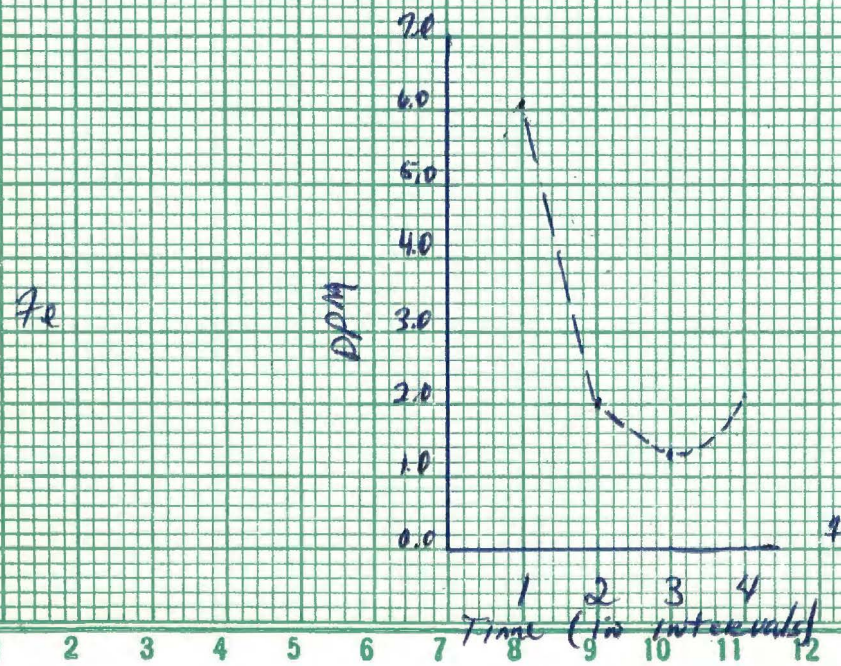
1.6

Date 4-18-69

Mn



Fe



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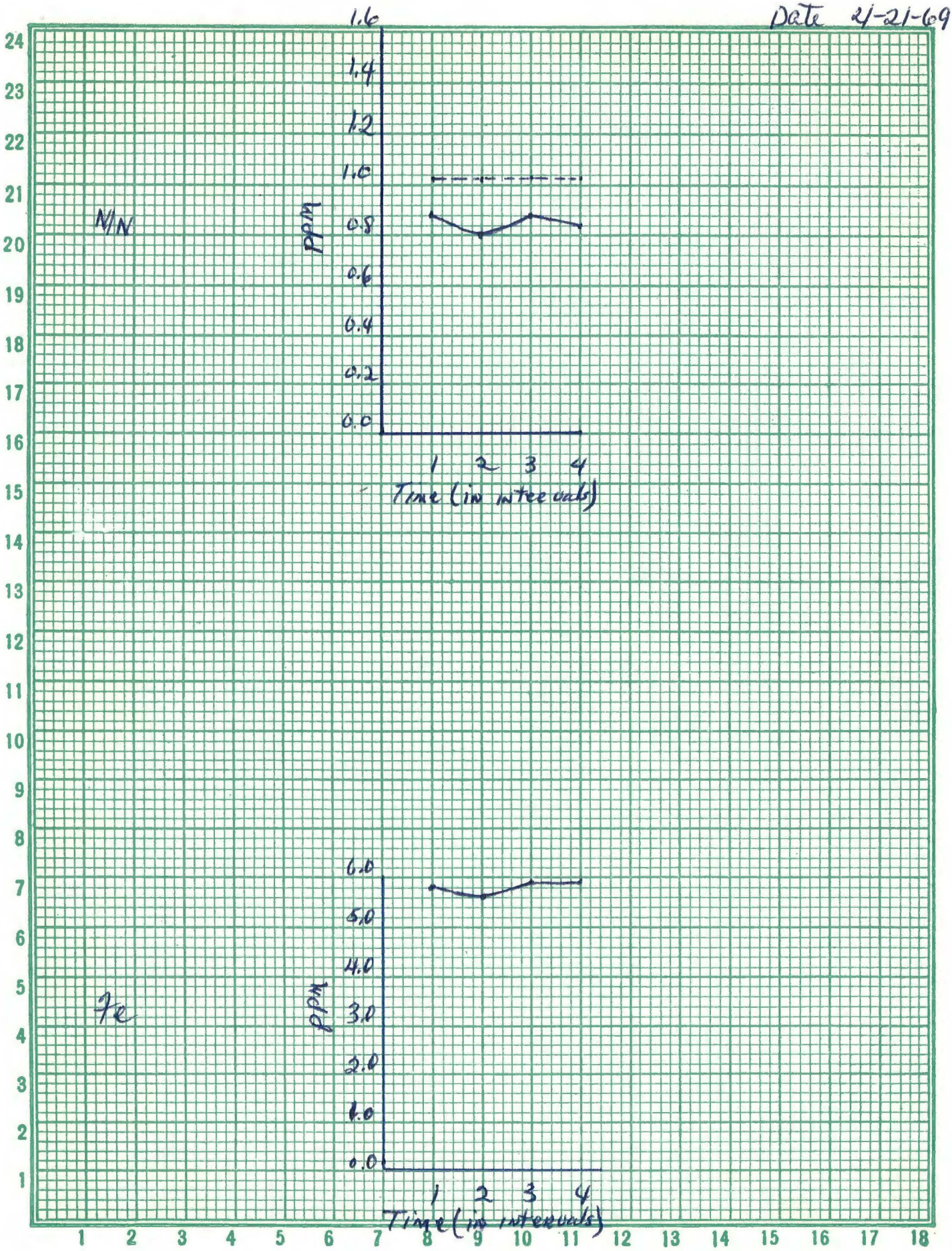
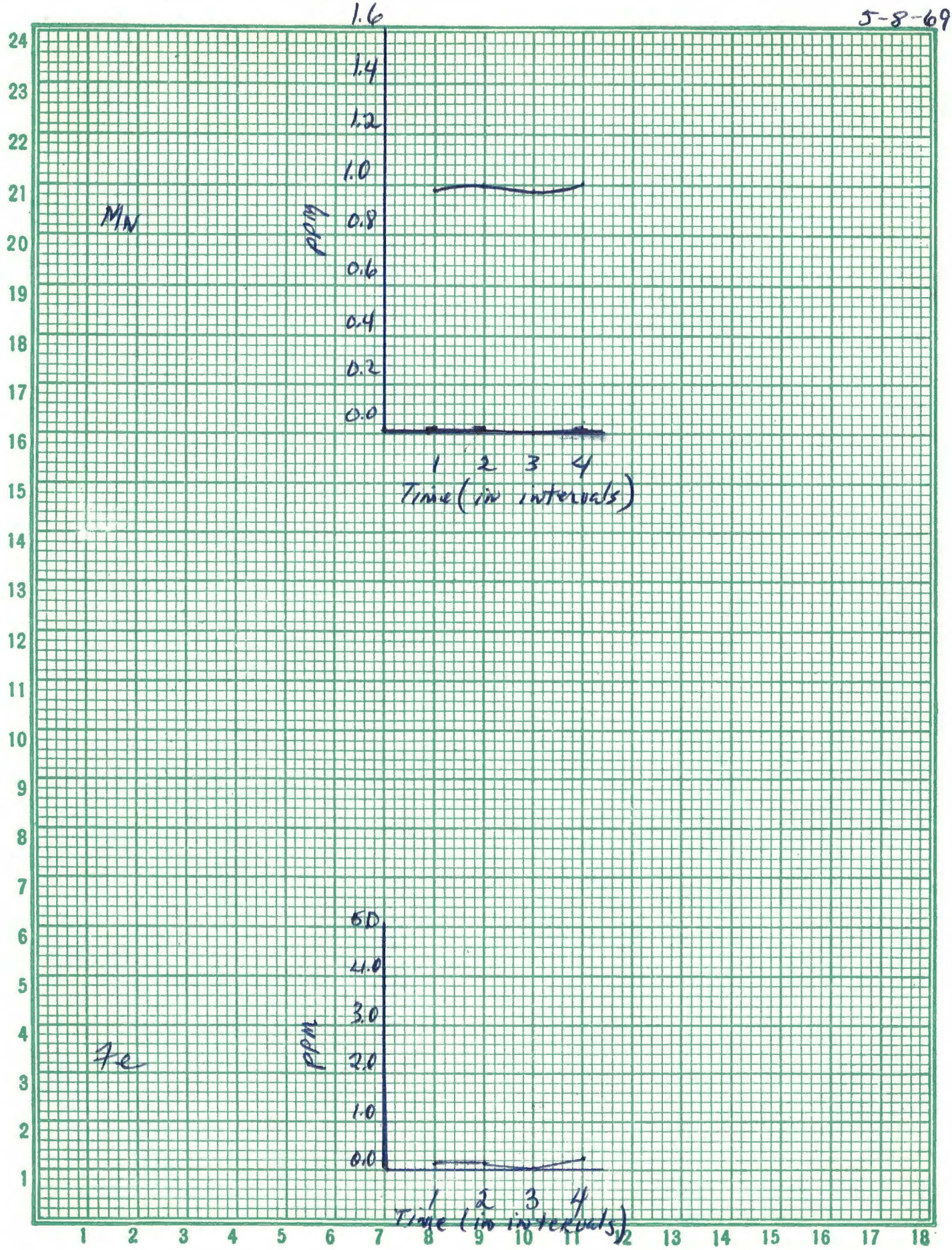
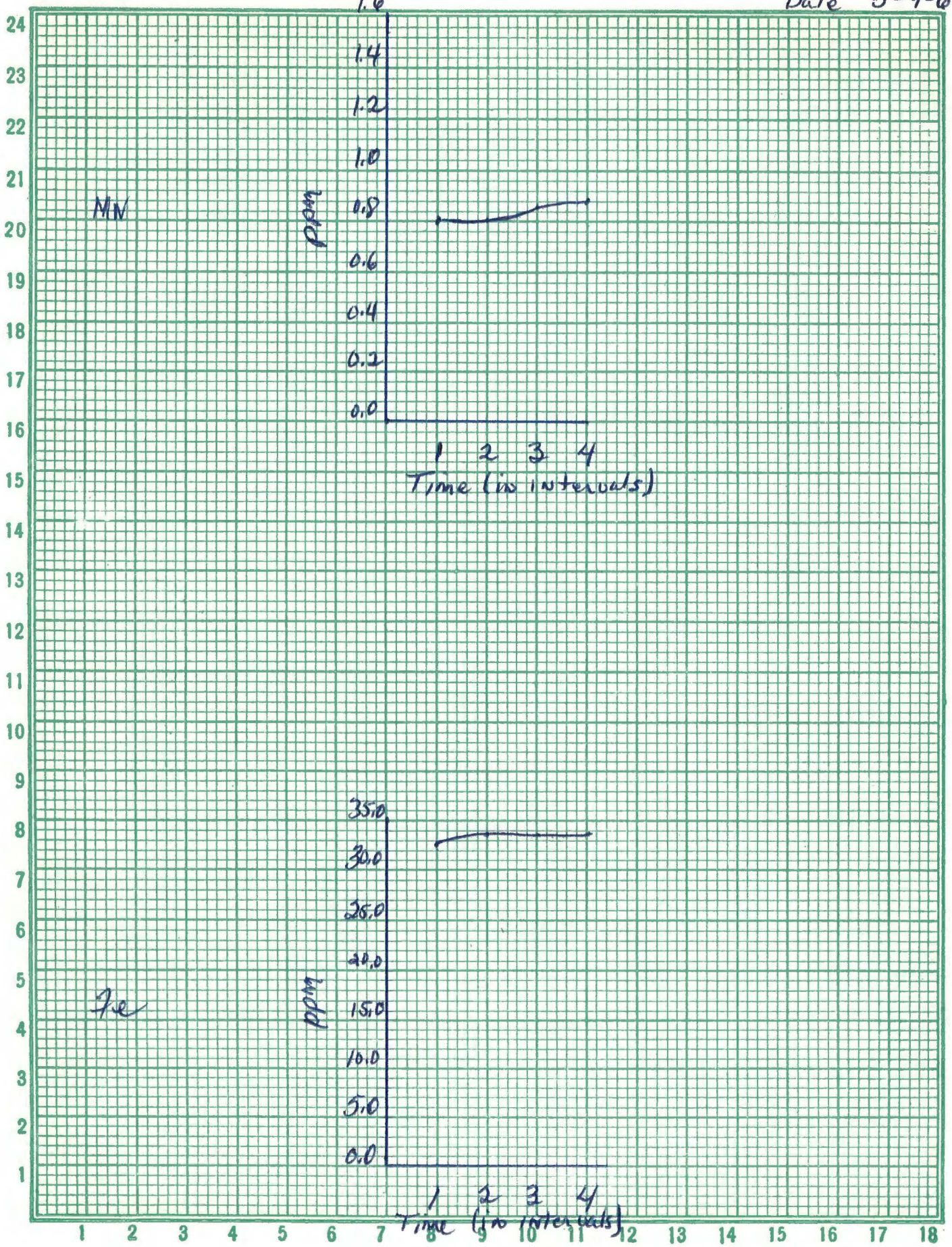
Date 4-21-69


Mn
Weld
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Time (in intervals)
Fe
Weld
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1 2 3 4
Time (in intervals)

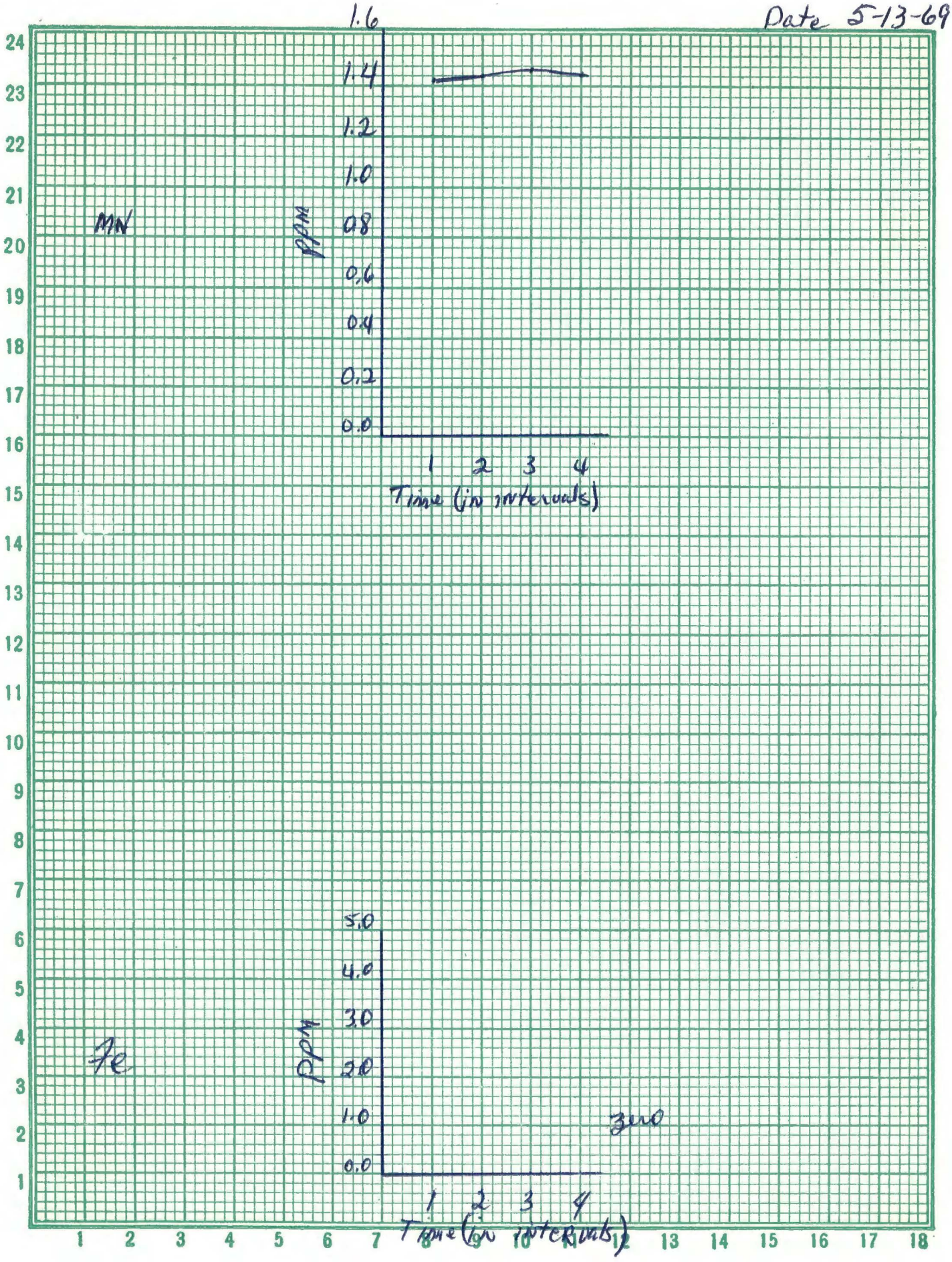
5-8-69


Mn
ppm
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Time (in intervals)
Fe
ppm
6.0
4.0
3.0
2.0
1.0
0.0
1 2 3 4
Time (in intervals)

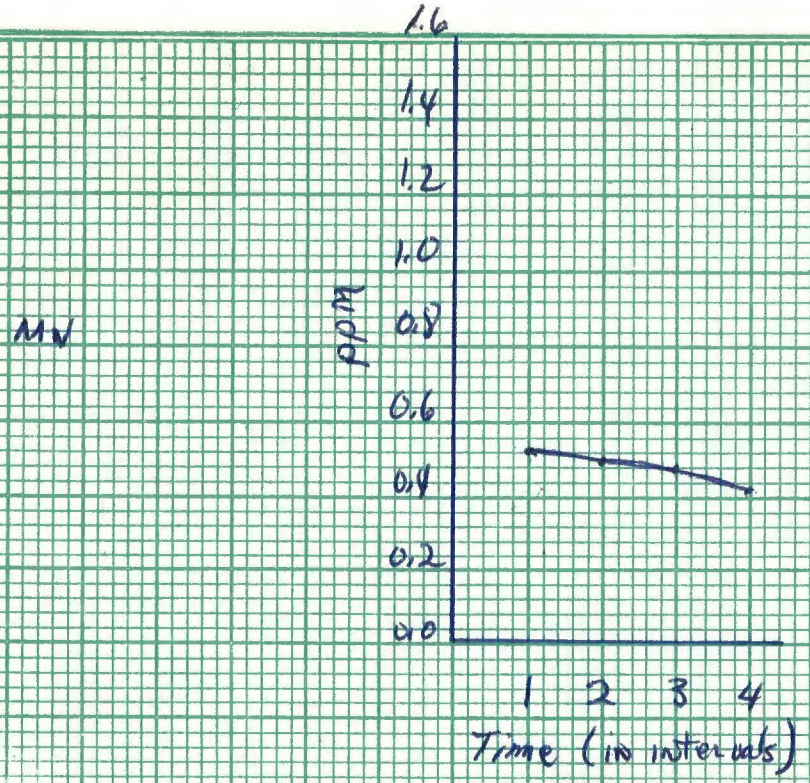
Date 5-9-69

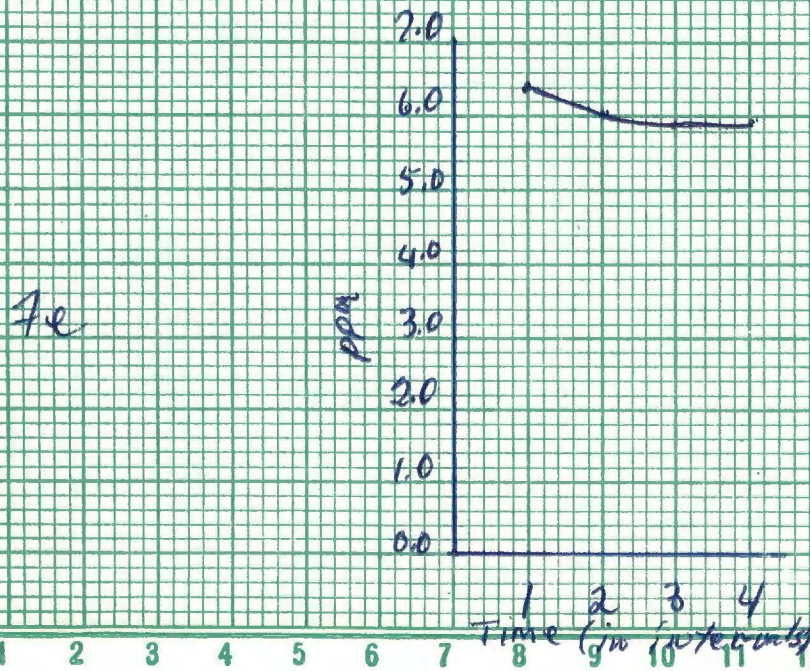

Mn
ppm
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Time (in intervals)
Fe
ppm
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4
Time (in intervals)

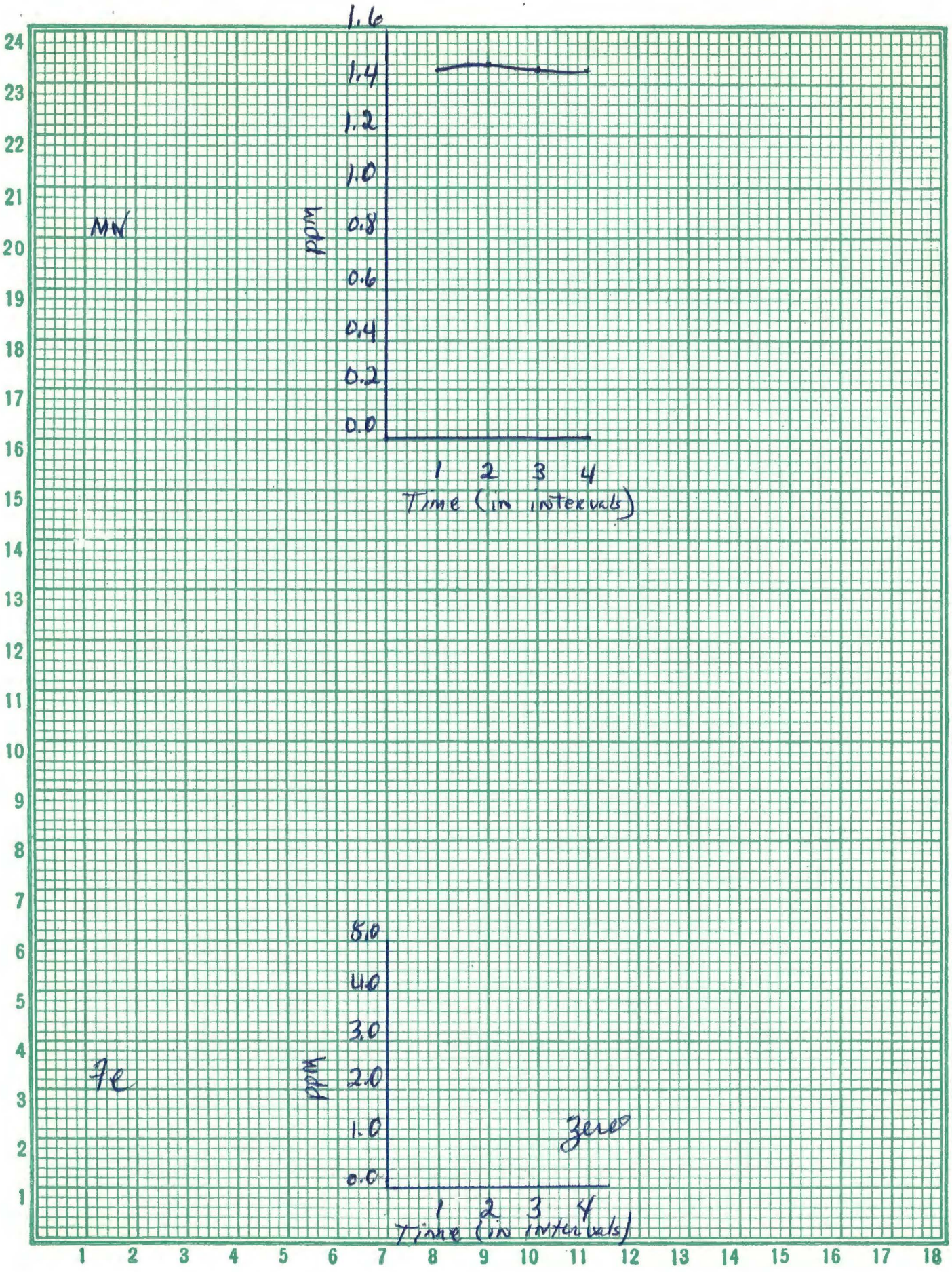
Date 5-13-69


1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
ppm
Mn
1 2 3 4
Time (in intervals)
5.0
4.0
3.0
2.0
1.0
0.0
ppm
Fe
Zero
1 2 3 4
Time (in intervals)

Date 5-19-69


1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
ppm
Mn
1 2 3 4
Time (in intervals)


2.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
ppm
Fe
1 2 3 4
Time (in intervals)


Mn
ppm
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4
Time (in intervals)
Fe
ppm
8.0
4.0
3.0
2.0
1.0
0.0
Zero
1 2 3 4
Time (in intervals)