MFIRE Version 1.22 contains three major improvements and more than 24 bug type fixes. These fixes involve data checking and reading operations and intermediate results checking to avoid runtime errors which can be vague and do not help locate the problem. For a specific list, contact the Bureau of Mines. 612-725-4500

MFIRE now allows negative heat flows to simulate air cooling stations by giving the appropriate value for the data item HEAT on the contamination lines. If air temperature drops below -70 deg. F. or raises above 3,000 deg. F., a WARNING message is issued. If temperature drops below -200 deg. F. or raises above 5,000 deg. F. an ERROR message is issued and the program terminates.

MFIRE now flags air recirculation paths. In previous versions, recirculations were calculated but not brought to the user's attention.

MFIRE now allows the user to select a reference density for the mine air. In previous versions, this value was 0.074 lbs/ft^3. This is new input and is the 15th data item on control line 1, DR. If the value is 50 pct larger or smaller than air density calculated at 1 atmospheric pressure and the reference temperature, a WARNING message is issued. If the value is more or less than 70 pct of the calculated value, an ERROR message is issued and the program terminates.

This version requires a math co-processor.

MFIRE 1.25 allows ITN and MADJ to range up to 200. 500 iterations are allowed in the network balancing section (CFM balancing). The criteria for "fume" advancement from a junction was set at 0.1% in previous versions. MFIRE 1.25 now advances "fumes" from a junction when the concentration reaches 0.0001%.

MFIRE 1.26 increases allowable airway dimensions for:

variable	1.25 max value	1.26 max value
LA - length of airway	1000	100000
A - cross section area	1000	100000
O - perimeter	1000	10000

These new limits apply for the stated variables and stated average values. The limit on the CRITSM variable was decreased to 0.00001%.

Some of the FORMAT statements were altered to clean up the ********* message and to accommodate the new input and output variable sizes. This version does not require a math co-processor.

MFIRE 1.28 contains several important fixes. One user's data set produced unusual behavior of the fan curve fitting procedure. Investigations revealed that spline curve fitting method as implemented, although correct, did cause problems with some fan curve data. This has been corrected with a new version the spline curve fitting subroutine.

A convergence problem reported with a MFIRE data set and was examined. A term in the Hardy Cross correction (first derivative of the fan pressure curve) normally is insignificant, however when the fan curve becomes near vertical it becomes significant. This term is supposed to be multiplied by 100,000 to keep the units consistent but was inadvertently left at unity. Because fans seldom operate in this region, the problem was slow to surface.

Another reported problem was examined and found to result from the parameters of O (airway perimeter and A (airway cross section area). When O and A do not reflect a realistic airway geometry, the unrealistic area available for heat transfer can cause airflow instability along with reversals. These parameters are now checked and modified if they do not reflect realistic geometries. The modified parameters are reported. Jan 1992

MFIRE 1.29. There were many improvements to MFIRE during the past 18 months. Unfortunatly, old source code crept back into the revised version 1.28 source code during this process. The effect was to reset the maximum values of the airway dimensionvariables back to those of MFIRE version 1.25. If the maximumvalues are exceedeed in the data file, the program resets these variables to default values.

	1.28 maximum value	1.29 maximum value
length of airway	1000	100000
cross section area	1000	100000
perimeter	1000	10000

Some users may be affected by these old limits, thus, MFIRE 1.29 which expands these dimensions to accomodate large airways, is being to all known users.

Internal and MSHA testing of MFIRE 1.29 resulted in increasing several array dimensions to accomodate cases where an entire large mine becomes contaminated. These arrays were limeted for the PC implimentation. In rare cases this could cause problems depending upon how the compiler handled the potential overflow. This could result in overwriting adjacent memory locations, usually scrambling a list of network junctions. Additional error checking for airway perimiter and cross section area were also incorporated. May 1992

The version 2.20 of MFIRE is upgraded from the version 1.29 for the state simulation in dry condition. The modification in MFIRE v2.20 is as follows:

1. More flexible selection for the fan curve fitting and the handling of the boundary region of the fan curve

For the slection of fan curve fitting, the cubic spline and least squares methods are available. For the handling of the boundary region of the fan curve, there are three choices: a.the slopes of the both right and left boundary region of fan curve are same as that of most right and left data points of input fan characteristic curve. b. the slope of the right boundary region of fan curve is sent to zero. c. the slopes of right and left boundary region of fan curve are sent to zero. The flexible choices for fan curve fitting method and the handling of boundary region of fan curve improve the common suitability and calculation convergence of program MFIRE for various input data sets.

2. The wrong airflow, fume distribution after airflow reversal happens

If airflow reverses in an airway, it is necessary to change the airflow direction and make the mutual exchange of the starting and ending junctions in the airway. In quasi-equilibrium state simulation part, if one cycle of data preparation,the outer iteration for natural ventilation calculation, can achieveconv ergence, the former version of MFIRE v1.29 cannot change the corresponding airway parameters in time when airflow reversal happens. It gives a wrong airflow, temperature, and fume concentration distribution. The modification in new version v2.20 make the single iteration doubled and achieve the airway parameters, such as the starting and ending junctions, change in time.

3. Wrong fan characteristic assignment

If stopping a fan for state control in a certain time after mine fire breaks out, the arrays for storing relative parameters of that stopped fan, such as NOF, MPTS, and NSKP, should be replaced by that of the fan with higher successive sequential number in array NOF. The parameter transfer will continue one by one through the fans with higher sequential numbers. The former version1.29 misses the replacement for some parameters of the stopped fan, such as the input data point of fan characteristic PF,QF, and the coefficient of fan equation array FKQ. The changed arrays NOF, MPTS, and NSKP conflict with unchanged arrays PF, QF, and FKQ. The fan NOF(n), pick up the input data points of fan characteristic of fan NOF(n-1). The parameter transfer of arrays PF, QF, and FKQ is added in the subroutine CDCH of new version 2.20.

4. The iteration divergence of dynamic state simulation part.

If the ventilation system condition is changed, the state distribution will change also. The mesh pattern formed from former airflow distribution is not suitable to the new state distribution,It causes the divergence of Hardy Cross method in the former version 1.29. The modification is applied on the new version of MFIRE 2.20. If the ventilation system condition changes, the new mesh pattern will be reformed for iteration calculation in subroutine ITR.

5. Wrong fume concentration for the end junction of an airway with fire source

The fume concentration of the ending junction of an airway with fire source should not be zero after mine fire breaks out. The former version of MFIRE did not make fume concentration calculation in time so that the fume concentration is delayed on one time interval. In subroutine DTTR of new version 2.20, the modification corrects the fume concentration calculation.

6. The determination of the average airflow rate in the time interval of airflow reversal

The formula in subroutine DISP of the former version v1.29 offers the average airflow rate in the time interval of airflow reversal by the algebraic time interval. The former formula offers a lower average airflow rate and causes larger error on the state simulation because of the offsetting influence of positive and negative value when airflow reversal happens in the time interval. The new formula in version 2.20 offers the absolute average value of the beginning and ending airflow rates in the time interval.

7. In the subroutine SPLINE of version 1.29, the variable MFA, the number of the fan curve segments, is directly replaced by MF-1 so that it is not assigned a va lue. The MFA, however, still exist in statement

M=MFA

to assign zero to the variable M which is the m-th segment of fan curve and cause problem.

8. The output error for the airways in which airflow reverses

In the dynamic state simulation part, when airflow reverses, the starting and ending junctions should be mulually exchanged and airflow direction should be corrected in time. The output of some data set shows that the airflow direction has been corrected but the airflow rates in some airways are still keep negative value. The modified version makes the correction of airflow direction and airflow rate in time.

9. remove over 20 varibles which are assigned some values or defined but never used.

June 8 1995

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