RECORD #118

TITLE: Airflow Measurement and Control For Supplied-Air Respirators

FICHE: 38281-278

Greger 0904/82

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

AUG 16 1982

MEMORANDUM FOR: Facilities Radiation Protection Section Inspection Staff

FROM: L. R. Greger, Chief, Facilities Radiation Protection Section

SUBJECT: AIRFLOW MEASUREMENT AND CONTROL FOR SUPPLIED AIR RESPIRATORS - MEMORANDUM NO. F-28 (M-36)

Attached are memoranda concerning minimum airflow considerations when several air-line respirator users share a single air regulator manifold. Use this information as guidance in your inspections.

LRGreger

L. R. Greger, Chief
Facilities Radiation
Protection Section

Attachments:
1. Memo, Wigginton to Miller, dtd 8/5/82
2. Ltr, Hack to Hendricks, dtd 6/9/82

cc w/attachments:
J. R. Miller
C. E. Norelius

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

AUG 5 1982

MEMORANDUM FOR: J. H. Joyner, Chief, Technical Inspection Branch, Region I
A. F. Gibson, Chief, Technical Inspection Branch, Region II
J. R. Miller, Chief, Technical Inspection Branch, Region III
G. D. Brown, Chief, Technical Inspection Branch, Region IV
H. E. Book, Radiological Safety Branch, Region V

THRU: L. J. Cunningham, Section Chief, Section B, Engineering and Technical Support Branch, DEQA, IE

FROM: J. E. Wigginton, Section B, Engineering and Technical Support Branch, DEQA, IE

SUBJECT: AIRFLOW MEASUREMENT AND CONTROL FOR SUPPLIED-AIR RESPIRATORS

In response to a Regional inspector's request, RES asked Los Alamos to clarify how can we be assured that the required minimum airflow is being provided to each individual air-line respirator user when several users are sharing a standard air regulator/manifold supply. The enclosed Los Alamos National Laboratory memorandum answers this question and provides other suggestions for using supplied-air respirators. As mentioned in the Los Alamos letter, the standard industry practice of using a single air regulator serving several identical respirator/hose-length units will provide the required air flow to the individual users, assuming the proper (calibrated) regulated manifold pressure is maintained and the maximum hose length for each user is not exceeded.

However, if the individual users' (sharing the same air manifold) respirators or hose lengths are different, then required airflows cannot be assumed and must be measured.

IE is considering drafting an information notice on proper airline respirator use and would appreciate any Regional input concerning observed licensee problems/experiences in this area.

If you have any questions concerning this information, please contact RES's Lynette Hendricks (49-35970) or me (49-24907).

James E. Wigginton

James E. Wigginton, Section B
Engineering and Technical Support Branch
Division of Engineering and Quality Assurance
Office of Inspection and Enforcement

Enclosure: See Page 2

AUG 9 1982

Enclosure:
Letter, Los Alamos to Ms. L. Hendricks,
dated June 9, 1982

cc: R. Nimitz, Region I
N. DuBry, Region III Resident
L. Higginbotham, IE
W. Fisher, IE
L. Hendricks, RES
D. Collins, NRR

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

June 9, 1982
Ref: H-5R 82-65 (R972)

Ms. Lynnette Hendricks
Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Washington, DC 20555

Dear Lynnette:

This letter will suggest methods to measure and control airflows for supplied-air respirators. We will also discuss the problems of measuring airflow in the airline as compared to standard conditions.

The opinions expressed are a consensus of Chuck Fairchild, O. D. Bradley, Barbara Skaggs, and myself. We will discuss the airflow requirements for continuous-flow Type C respirators only. The airflow requirements of regulator-controlled airline respirators (such as pressure-demand) are so much less than continuous-flow devices, that adequate airflow is not usually a problem.

It is apparent from reading the several enclosures which you sent to us that there is a misunderstanding on what flow measurement is appropriate when adjusting the air pressure to an airline. It is the airflow about the head and face of the respirator wearer that largely determines the protection provided by the device. Therefore, we need to be concerned only with the airflow at ambient conditions. Furthermore, the temperature and pressure at most actual working conditions are sufficiently close to standard conditions that either may be used for the calculations. An exception would be for work at high altitude, such as above 6000 ft, where the atmospheric pressure is less than 80% of sea level, requiring corrections for the difference in flow.

Manufacturers of airline respirators include instructions specifying a range of air pressure required to produce the needed flow rates based on both the lengths of hose used and the number of sections connected together. Concern with the latter is because of the considerable pressure drop in the quick-connect fittings between each section of hose. If the appropriate pressure for the total length of hose is used, ample flow should be available.

Problems may develop when more than one user is connected to a breathing air manifold. Figure 1 shows a simple manifold, typical of what is in use in industry, but containing a single regulator and pressure gauge. This set-up should be limited to the case where all of the respirators connected are identical, as are hose lengths and the number of hose fittings.

Should each user have different hose lengths, or respirators with different air pressure requirements, then the manifold in Figure 1 should not be used. In this case it will be difficult to determine if each user is receiving the required airflow. A much better system is shown in Figure 2, where individual control is provided for each user, with a separate pressure gauge available for each.

In addition, or in place of the manifold shown in Figure 2, the user has the option of measuring the airflow at the respirator. This is most easily done during the set up of the system before work begins. The lengths of hose required for the job should be connected. In most systems there is a belt-mounted valve, orifice, or regulator. The high-pressure air hose plugs into this valve, and a low-pressure breathing tube runs to the facepiece or hood. The end of the breathing tube is the best point at which to take flow measurements. Disconnect the tube from the facepiece and insert into a calibrated rotameter or other convenient airflow measuring instrument. Then the line pressure may be adjusted to obtain the desired airflow. We recommend that any air supply system be designed to deliver greater than the minimum required (4 cfm for tight fitting facepieces and 6 cfm for hoods), but the flow should be adjusted so as not to be so high as to be uncomfortable for the wearer.

If the pressures required for each configuration of hose and respirator combination are recorded, future respirator set up of this type will be made considerably easier. Any question as to the adequacy of airflow can be easily answered by actually measuring it.

I would like to make a final point about the use of appropriate hose fittings. It is extremely important in a work place using a variety of different piped fluids, that the fitting used for breathing air be different and incompatible with any other in the plant. Supplied-air respirators may be ordered with one of several different quick-connect fittings, and, if any one of these is not already in use in the plant, there is no problem. However, in the event that all of the hose fittings available from the respirator manufacturer are already in use, then a different, unique fitting will have to be selected for breathing air. The user organization must then replace all of the fittings on the valves and hoses with the special fitting designated for breathing air. Since the resistance to airflow of the new fitting may not be known, the actual airflow of the respirator with various hose lengths should be measured as discussed above.

I hope that this letter will be helpful in clearing up the problem.

Sincerely,

Alan Hack for
Respiratory Protection Section
Industrial Hygiene Group

AH:sf

Attachment: Figures 1 and 2

Cy: Ching Bien
Sam Terry
Dan Lillian

Figure 1

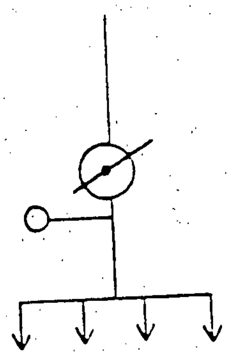
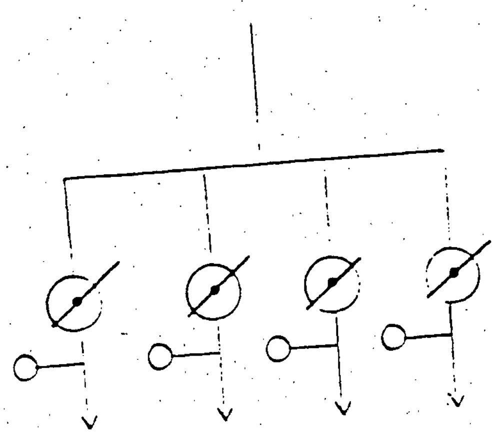
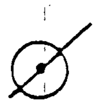


Figure 2



 Air Regulator

○ Pressure Gauge

↓ Air Hose Connection