VENTILATION ACTIVITIES AND PROGRAMS AT ARGONNE NATIONAL LABORATORY

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The ventilation program at Argonne may be considered as having progressed through three periods, the first being the design and construction period, the second being an operating period of several years, and the third being a transition period in which modifications to the present systems are necessary in order to meet the new requirements and demands of the scientific staff. Changes and additions have been made during the operating period but the capacity limit of the present supply systems has been reached. More supply and exhaust air is particularly needed throughout the Chemistry Building 200 while the Physics Building 203 and the Chemical Engineering Building 205 have only a limited number of laboratories which require additional ventilation. With this increased ventilation problem there also is the attendant provision for increased air conditioning facilities. A preliminary proposal has recently been submitted to the AEC for making the required changes to the present ventilation systems.

The ventilation systems in all three of the above mentioned buildings are not identical. However, the Chemistry Building 200 may be considered representative of all three and a brief resume of the ventilation facilities in this building will be given. The systems were originally designed on the basis that all toxic and radioactive experiments would be performed in hoods. Blickman hoods with or without glove panels, and vacuum hoods, were generally adapted for the research activities which cover a wide range of chemistry applications. Special ventilation problems which the standard design would not accomodate were to be dealt with individually. Some of these special problems will be described later.

The Chemistry Building is divided up into six wings tied together at both ends by transverse corridors connecting with the wing corridors. The wings are separated by courtyards so that the plan resembles a ladder. Each wing is divided up into laboratories and offices with a corridor between them. The unit of width for a module is 10 feet so that a laboratory or office may be any multiple of this number. The normal laboratory unit consists of two 10 foot modules and two 10 foot offices. Hauserman steel panel partitions are used for dividing each wing into the required number of laboratories and offices, the maximum being 24 of each.

All six wings of the building are of similar design and construction and contain practically identical heating and ventilating equipment. Perhaps the starting point for an understanding of the ventilating and air conditioning systems is a description of the supply system. Slide 501-219 is a schematic diagram of the supply ventilation system in each wing. All fresh air is taken from the outside and passed through the primary and secondary filters. These are AAF Company Type PL-24 filters with standard 5 ply fire resistant airmat in the primary filters and standard 10 ply fire resistant airmat in the secondary filters. The life of the primary and secondary media ranges from 1 to 2 months and 2 to 4 months respectively based on a maximum pressure drop of approximately .5" WG for each. These filters are removing a high percentage of the dust particles as indicated by the particle size efficiency tests conducted by Mr. O'Neil on the hood prefilters.

The supply air is next drawn through the preheat coil by two fans and discharged into a plenum from which there are three separate branches. The first main branch supplies a constant volume of air to the offices and corridor, the second main branch supplies a constant volume of air to the laboratories and the third main branch supplies a variable amount of air to the corridor. Cooling and reheat coils in the three mains temper the air to the required conditions for maintaining the specified temperature and humidity. Special rooms are provided with booster heating and cooling coils in the supply risers where lower than general conditions are required.

The air flow pattern is as follows: air from the offices is vitiated to the corridor; the corridor air and the vitiated office air is vitiated into the laboratories; and this air together with the laboratory supply air is removed by the laboratory exhaust systems.

Whenever the laboratory exhaust air demand is greater than the minimum air supply, the extra supply air is provided through the variable air branch which discharges into the corridor from which it is vitiated to the laboratories. A static pressure regulator controls the opening of the variable air damper. The other temperature and humidity controls are also indicated but time does not permit further explanation of them.

The removal of the minimum supply air for air conditioning purposes and the maximum exhaust requirements will be discussed next. In view of the varying exhaust demands per laboratory and the necessity for flexibility, the exhaust systems were set up on a modular basis. Each ten foot module may have a maximum of two fans and two runouts exhausting approximately 1000 cfm each. The number of hoods in the laboratory determines the number of fans. A maximum of three Blickman hoods per runout has been established. One hood fully open requires 1000 cfm at a 150 fpm face velocity but this available quantity of exhaust air may be divided up between the other hoods on the runout. An alarm bell on the system notifies the occupant when the exhaust limit has been reached.

The runouts from the laboratory go up to the fan loft where they discharge into the dirty plenum. Slide 420-315 shows the risers connecting into the dirty plenum. Between the dirty plenum and the clean plenum are located the high efficiency filters. Slide 420-313 shows the mounting of the filters with inspection doors above and below the filters. The damper operating sectors which allow for the isolation of the filter from the system when filter changes are made are also shown. Slide 420-312 shows the exhaust fans connected to the clean plenum and discharging the air above the fan loft roof to the atmosphere.

Wherever radioactive hoods are installed, a laboratory bypass duct from the dirty plenum in the fan loft to a register in the laboratory is used so that a minimum amount of air is exhausted at all times from the laboratory. The hoods are provided with air velocity regulators which maintain nearly a constant air flow velocity for any position of the hood door. Air may either be exhausted from the hoods or from the laboratory bypass. A plenum static pressure regulator controls the laboratory bypass damper and also a clean plenum damper. All the exhaust fans on the system run continuously so that the above dampers regulate the amount of air removed from the laboratory up to the capacity of the fans. Slide 501-218 shows a control diagram for the hood, lab bypass and plenum bypass dampers. Where the minimum air is removed by a constant exhaust from another piece of equipment such as a vacuum hood or canopy no lab bypass is required.

No doubt you all are familiar with Blickman hoods. Slide 420-314 shows one of these hoods installed in a laboratory. At the back of the hood are four prefilters. These maintain uniformity of air distribution across the face of the hood, remove a certain portion of the particulate matter thereby increasing the life of the special filters and condense some of the vapors that would otherwise be carried into the system. Two types of media have been used in these filters namely 25 FG and PF 314 fiberglas. These filters have to be changed at anywhere from 3 to 6 month intervals depending upon the pressure drop. The maximum allowable resistance for these filters in order to maintain the required air flow is .7" WG. It is therefore economically advisable to start with as low an initial resistance as possible consistant with the required efficiency for obtaining the maximum life from the filters. With the above requirements in mind, AAF Co. has recently developed a new media for this filter with an initial resistance of .2" WG or less at an air flow of 250 cfm. The discoloration efficiency tests with atmospheric dust for these filters ran 47 to 56%. It is understood that AAF Co. is going to standardize on this media for this type of filter and discontinue the two other types.

One of the special air cleaning problems which has been under development at Argonne is that of removing perchloric acid fumes. This matter was referred to Dr. Silverman who developed a scrubber for this purpose. The constructed model which may be placed inside of a hood has been in operation at Argonne for approximately 6 months. Recently the filter which was made especially for this unit by Arthur D. Little, Inc. became clogged. The following slides show the unit as well as the condition of the filter after failure: Slide Nos. 235-108, 109, 124 and 125. Apparently the aluminum separators disintegrated either from the Na_2CO_3 or the acid fumes. Arthur D. Little, Inc. kindly made a replacement filter, the separators of which are made of sheet steel instead of aluminum. The Air Cleaning Studies Progress Report for February 1, 1951 to June 30, 1952 covers a description of the scrubber along with test data on the performance of the scrubber with sulphuric acid. Further tests by Mr. O'Neil on this unit with perchloric acid showed efficiencies ranging from 96 to 99.9%. Drawings are now in progress for the construction of several of these units.

There are other ventilation problems at Argonne still in the process of resolution. The one causing the most concern at present is the ventilation treatment required for metallic fluorides. It is hoped that some information in this connection may be obtained during this visit.