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U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HAZARD EVALUATION AND TECHNICAL ASSISTANCE REPORT
TA 78-12
OREGON STATE UNIVERSITY
CORVALLIS, OREGON

May, 1978

I. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The National Institute for Occupational Safety and Health (NIOSH) received a request from the Oregon State University to determine if the diseases being experienced by several academic employees on the fourth floor of Cordley Hall were similar to each other and if they could be caused by the chemical and/or biological agents in use in Cordley Hall.

Based on information contained in the request, it appeared that, as a minimum, the following questions required consideration: (1) do those members of the staff now complaining of symptoms have a diagnosable disease; (2) if so, is there a commonality of signs and symptoms; (3) are other individuals affected; (4) is there a causal relationship between the complaint of symptoms and the work environment; (5) is there any link between the fatal diseases of Individuals A, B and J and the symptoms complained of by the individuals currently working at Cordley Hall?

After careful consideration of all of the information that has been gathered from interviewing University staff with medical complaints, University representatives, government officials, involved physicians, careful review of medical records of seven individuals (three of whom are deceased), inspection of the building facilities and observation of work practices, the following conclusions were made:

1. If there is a single disease process endemic among the present Cordley Hall staff, neither the NIOSH physicians nor other involved physicians have been able to identify it. This is not to say that some disease processes are not present; only that after careful interviews with all involved and review of extensive medical reports, no common disease process emerges. Although there appears to be certain similarities between the complaints of several of the Cordley Hall professors, these similarities are not sufficient to suggest the presence of endemic illness no matter what the diagnosis.

2. There is no patho-physiological link between the fatal neurological diseases of Individuals A, B, and J and the current complaints of the Cordley Hall professors.

3. No clearcut etiologic relationship between the work environment and symptoms is apparent; but of equal importance, such a relationship cannot be ruled out. Thus, it is recommended that immediate steps be taken to upgrade the ventilation capacity of the laboratory hoods, to modify the ventilation discharge ductwork to prevent reentry of exhaust air and to establish laboratory safety procedures in order to minimize potential inhalation, ingestion and skin absorption of toxic materials.

4. All the involved individuals should undergo continuing periodic medical evaluation by a single physician or institution. By utilizing a single physician or institution, any commonality of the disease processes that begin to emerge, could be more readily detected.

The University president indicated that the ventilation system revision would receive immediate attention and that the University would select a physician or institution to perform the continuing periodic medical evaluation.

II. BACKGROUND

Cordley Hall is a biology-botany science building which contains student laboratories, research laboratories and faculty offices. The original building was four stories with a mechanical room on top of the building. The 1967 building addition is five stories with a mechanical room on top. The new U-shaped addition created a quadrangle between the original building and the addition. Attachment #1 is a rough sketch of Cordley Hall.

The investigation principally involved a small number of academic employees who work in laboratories and offices on the fourth floor of the new addition. These individuals had/or are now experiencing disease processes that they feel could be related to the chemicals and/or biological agents they are exposed to. Their concerns can be divided into two categories - environmental and medical.

A. Environmental Concerns. Due to the location of the laboratory hood system discharge vents, they felt that materials exhausted through the laboratory hood could reenter the building through open windows and/or through the general ventilation air intakes. On various occasions the odor of vapors and gases that were being used in the laboratory hoods was detected in the office areas. Also, the new addition which is one story higher than the original building, is downwind during prevailing wind conditions and the laboratory hood discharge vents of the original building point toward the new addition.

One professor had tomato plants that, when transplanted from the greenhouse to the 4th floor environmentally controlled growth room, deteriorated and developed yellow spots on the leaves. He then conducted his own test in the growth room whereby he placed the plants in a plastic housing and filtered all the air to this housing through activated charcoal. When this was done the plants did better. He questioned why the plants did better in refiltered air since the air to the controlled growth room had its own supply air system, completely independent of the general ventilation system. Was it due to reentry of contaminated air?

Based on these observations, it appeared that the ventilation systems should be evaluated. In addition the laboratory work practices, should be observed.

B. Medical Concerns. In 1974, Individual A, a plant pathologist who worked for many years with cherry ring spot plant virus, died of a neurological disease. At about the same time, Individual B, an entomologist and a coworker of Individual A, also developed a progressive neurological disease. He died in 1975. Individual C developed stiffness and weakness during the summer of 1976. The symptoms have continued to date. Individual D developed dizziness, fatigue, back and neck pain, and cold feet in the summer of 1977; these symptoms have continued to date. Individual E developed extreme fatigue and coldness of the extremities in October of 1977.

Because the three latter individuals (all professors) worked on the fourth floor of the new wing of Cordley Hall (same area where Individuals A and B worked), there was some concern that Individuals C, D, and E were developing a similar type of disease process that led to the death of Individuals A and B. Individuals C, D, and E were all medically evaluated by a neurologist at the Corvallis Clinic, as well as by specialists at the Neurology Department of the University of Oregon Medical School, Portland.

III. STUDY PROGRESS AND DESIGN

A. General

The initial site investigation was conducted on January 17, 18 and 19, 1978, by Arvin Apol, NIOSH, Region X; Doctors Donald Whorton and Thomas Milby, NIOSH medical contractors. A representative from the State of Oregon Workmens Compensation Board, and the Safety Director of the University participated in the survey. A walk-through survey was conducted on the fourth floor of the new (1967) addition of Cordley Hall.

A news media conference was held on January 17 after the walk-through survey of Cordley Hall. The news media had prior news coverage involving the illness that was experienced by individuals working in Cordley Hall, especially on the 4th floor, and were aware that the NIOSH initial survey was being conducted on January 17. The survey team outlined the objectives of the initial survey and answered related questions.

A second visit was made to the university on February 21, 1978. At that time the results and conclusions of initial survey were explained to the University, the individual academic persons involved and then to the news media.

B. Environmental

The environmental study consisted of the following:

1. The mechanical drawings of the ventilation system of the new addition of Cordley Hall were obtained and studied. These drawings stated the designed exhaust rates for the laboratory hoods. They also showed detailed drawings of each laboratory hood system and the general ventilation system.

2. The mechanical room on the roof where the ventilation equipment is housed, was inspected to observe where the air exhaust dischargers and air supply inlets were located.

3. The laboratory hood exhaust rates for the hoods located in Rooms 4001, 4027, 4097 and 4121 were measured.

4. A portion of three air inlet filters located in the mechanical room were submitted for laboratory analysis.

5. A partial list of the chemicals used in the subject laboratories was obtained.

6. Work practices in the laboratories were observed.

7. A portion of the charcoal filter that was used in the tomato plant experiment was submitted for laboratory analysis.

C. Medical

During the afternoon of the 17th and the morning of the 18th, Individuals C, D, E, F, G, H, and I were interviewed. Individuals F, G, H, and I are all employed on the fourth floor of Cordley Hall and had requested interviews with the physicians. Several were interviewed on more than one occasion.

Individuals C, D, E, and F were interviewed jointly by the two NIOSH physicians, while individuals G, H and I were interviewed by one physician. Written medical release forms were obtained from Individuals C, D, E and F so that medical records could be obtained from the Corvallis Clinic and/or the University of Oregon Medical Center.

During the January 17 press conference one of the reporters asked about the death of another individual - J, who, although not a professor, had allegedly spent some time in Cordley Hall prior to his untimely death. This was the first indication that anyone other than the professors of the fourth floor of Cordley Hall might be involved.

During the morning of the 18th, the physicians met with an internist at Corvallis Clinic, to discuss the medical records of some of the affected individuals who had been examined by clinic physicians. The neurologist at the Corvallis Clinic, was not available due to illness. The mechanism for obtaining the medical records of the individuals who had signed medical releases was discussed with the internist. The records were reviewed and the sections to be photocopied and mailed were indicated. On the afternoon of the 18th, the physicians met with the State Epidemiologist and a resident physician from the University of Oregon. At that time, they were informed of an earlier investigation (June 20, 1975) of the deaths of Individuals A and B by an EIS Medical Epidemiologist, CDC. This report noted the fact that a NIH slow virus expert, obtained material at the autopsy of Individual B for animal inoculation. These specimens were also examined by Dr. Lambert, a pathologist in California. No virus particles were seen on electron microscopy. Also provided was the death certificate of Individual J; the diagnosis was "undiagnosed demyelating disease."

An associate professor of neurology at the University of Oregon School of Medicine was interviewed. The cases of Individuals A, B, C, D, E and J (all of whom were known to the professor) were discussed. He agreed to send pertinent medical information from the records of these individuals to the physicians and he was provided with copies of signed medical release forms.

By February 6, 1978, the medical records from the Corvallis Clinic and the Oregon Medical School had been received.

IV. EVALUATION RESULTS AND DISCUSSION

A. Environmental

1. There is a potential for reentry of contaminants that are being exhausted from the laboratory hoods into the air intake systems

and the open windows on the upper floors. Most of the laboratory hood exhaust dischargers are on the south and east side of the mechanical rooms and exhaust horizontally and downward about two feet from the roof of the mechanical room. One unit exhausts vertically, however, there is no duct work above the fan outlet. There are two fan inlets on the east side of the mechanical room, one on the south and one on the north end, that supply air to the south and north controlled environment rooms located on the fourth floor. Because of the proximity of the hood exhaust dischargers to the supply air inlets, it is possible for reentry to occur. About 1½ years ago, the inlet to the south end air supply unit was revised. The new air inlet is just above the roof. In this position, reentry is still possible. A second place where reentry could occur is from the laboratory exhaust dischargers located across the quadrangle from the new addition. These dischargers exhaust horizontally toward the supply air of the new addition. The old portion of the building contains one less floor than the new addition, so these discharge points are just slightly lower than the air intakes on the new portion. The prevailing wind is from the old to the new portion of the building making reentry possible. A third place for reentry is through open windows on the upper floors. Again, because the exhausts are discharged horizontally, under certain weather conditions reentry could occur.

After the initial survey, and the potential for reentry was discussed, a professor conducted a quick test. Mint oil was applied to a paper towel and placed in a laboratory hood whose exhaust vent is above his 4th floor office. Within 40 seconds the strong odor of mint oil was wafting through his open window. This quick test confirmed that not only is there a potential for reentry of the exhausted air, but that in reality, it does occur.

It is recommended that all the laboratory exhaust air be discharged vertically through exhaust stacks that extend above the mechanical rooms far enough to not be affected by the local meteorological conditions. Attachments #2 and #3 describe how the exhaust systems should be designed and placed.

2. The laboratory hood exhaust volumes in Rooms 4001, 4027, 4097 and 4121 were measured. In all cases they were less than the designed rates shown on the mechanical drawing for the new addition. Generally, they were about 2/3 of design. It appears that they were designed for a face velocity of 100 FPM of open hood area with the hood opening set at 18 inches. All the hoods that were being used were open approximately 18 inches. With the current air volumes, the face velocity is less than 100 FPM. The reason for the low exhaust rates could be due to underdesigning the fan size and/or RPM or such items as loose belts, improper pulley sizes.

It is recommended that the exhaust rates be increased to at least, and possibly to exceed, the designed rates. When this has been accomplished, the actual rates should be measured and recorded and thereafter, the rates should be measured on a regular periodic basis.

3. A portion of three air supply inlet filters were sent to Cincinnati NIOSH laboratory for analysis. Since only some particulates and no vapors will be trapped on this type of filter, the variety of contaminants that can be analyzed is limited. The list of chemicals used in the building provided a partial list of the potential chemicals to be analyzed for at this time. They are: organic phosphates such as paraoxon, parathion, and diisopropylflurophosphate; chlorinated compounds such as diedrin and aldrin; and heavy metals such as mercury and chrome.

The bulk dusts collected on air filters were qualitatively analyzed by the emission spectroscopic method using a direct current arc. Results are reported as follows:

LOCATION OF AIR INLET FILTER	Fe	K	Ti	Zn	Na	Si	Mn	Mg	Al	Cu	Ca
N Environment Controlled Room Supply Air	+	+	+	+	+	+	+	+	+	+	+
S Environment Controlled Room Supply Air	+	-	+	-	+	+	+	+	+	+	+
N General Ventilation System New Addition	+	-	+	-	+	+	+	+	+	+	+

Legend: + for positive identification
- for not detected

The following elements were not detected in any of the samples under the excitation conditions used: Pb, Ta, Sn, P, Sb, Pt, Au, Li, Tl, As, Cd, Mo, Al, Cr, Bi, Be, Co, and Hg.

The filters had been in place for over one year. The chemicals that were found in all three filters are common items that could be present in the general atmospheric dust. One filter contained potassium and zinc which the other did not. An explanation for this could be reentry of these materials that were exhausted near the supply air inlet in which they were found.

Chlorinated hydrocarbons and organic phosphates were not detected on the filters.

4. A portion of the charcoal that was used to filter air supplied to plants in a plastic housing located in the south environmental controlled growth room was sent to the NIOSH laboratory for qualitative analysis. The organic vapors collected on the charcoal were desorbed and analyzed with a gas chromatograph. Toluene, xylene, C-9 to C-11 aliphatic isomers and perchloroethylene were qualitatively identified. These chemicals are used in some of the laboratories in Cordley Hall. Since the air supply to the environmental controlled growth room is independent from the rest of the building, the presence of these solvents in the room indicate that reentry of exhausted air probably has occurred.

5. There are three routes of entry by which contaminants can enter the body. They are inhalation, ingestion, and skin absorption. Prevention of several work practices observed can reduce the potential for the contaminants to enter the body.

   Inhalation of airborne contaminants can be prevented or minimized by using laboratory hoods when working with volatile chemicals or with biological agents that could be released into the atmosphere. Ingestion can be prevented if good work practices are observed in all laboratories. This includes using only suction devices (never use the mouth) for pippetting, never consuming or storing food or liquids in the laboratory, prevention of smoking in the labs, washing hands and removing laboratory coats before leaving the labs. Skin absorption can be prevented by wearing the appropriate protective clothing such as rubber gloves when working with materials that are highly absorbed through the skin. These and other recommended good practices can be found in the Handbook of Laboratory Safety published by the Chemical Rubber Company, 18901 Cronwood Parkway, Cleveland, Ohio and Lab Safety, at the Center for Disease Control. Dept. of Health, Education, and Welfare publication No. CDC 75-8118

B. Medical

The medical records from the Corvallis Clinic and from the University of Oregon were carefully studied. This included the clinical notes as well as all the laboratory data. Both

Individuals A and B died of diagnosed neurological diseases: A of multiple sclerosis plus Alzheimer's disease; B of primary parenchymatous degeneration (cerebello-olivary degeneration). To date no evidence of viral disease has been demonstrated in either of these two individuals.

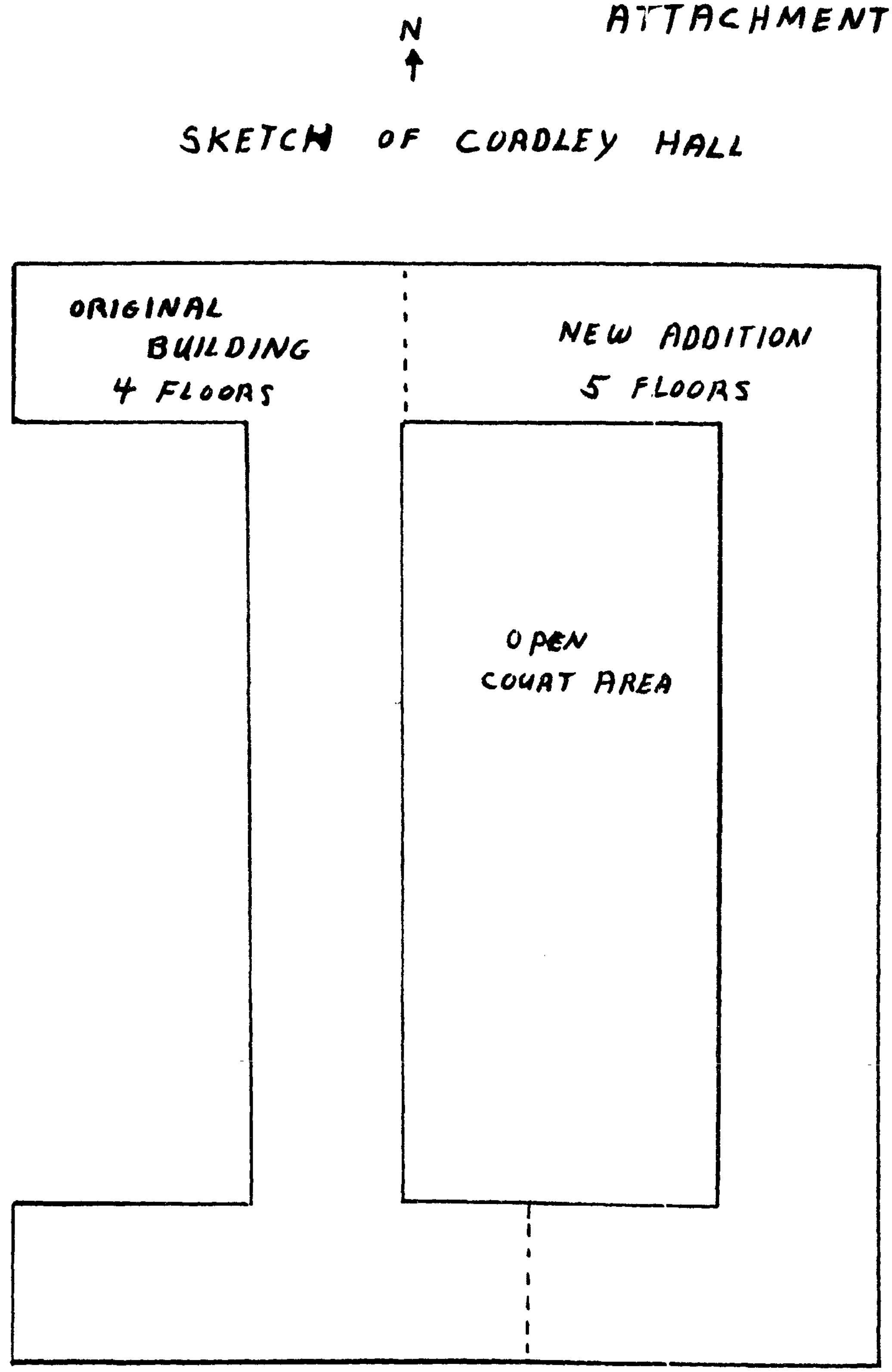
The medical reports of the other individuals who were interviewed noted the following complaints: fatigue, weakness, myalgias, arthralgias, and cold extremities. Only one had focal neurological signs. In the others, neurological examination was unremarkable. Two had evidence of Raynaud's syndrome. All of the laboratory data that were positive at the Corvallis Clinic were normal or negative at the University of Oregon Hospital. This included sedimentation rate, creatine phosphokinase (CPK), and antinuclear antibody (ANA). Muscle biopsies from two of the individuals were also interpreted as normal.

Individual A's symptomatology was first noted in 1957 and the diagnosis of multiple sclerosis was made in 1963. In the last years of his life, he experienced a progressive degenerative course. Individual B first noted symptoms in 1970 and his course also degenerated rapidly in the last few years of his life. Individual J experienced the onset of disease approximately six months prior to death. Neurological diagnosis was Behcet's disease.

From a clinical-pathological point of view, there appears to be no relationship between the fatal disease processes observed in A, B, and J and the symptoms and physical findings noted among individuals with present complaints.

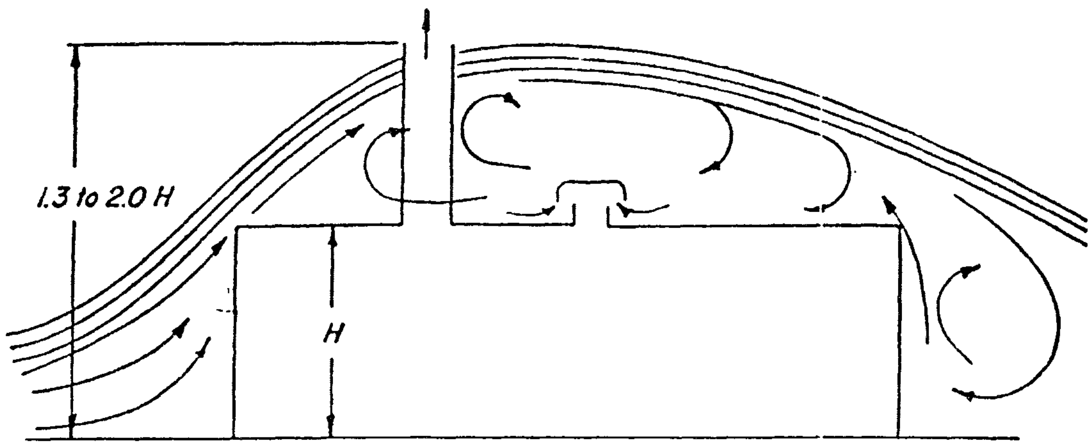
ATTACHMENT 1

SKETCH OF CORDLEY HALL



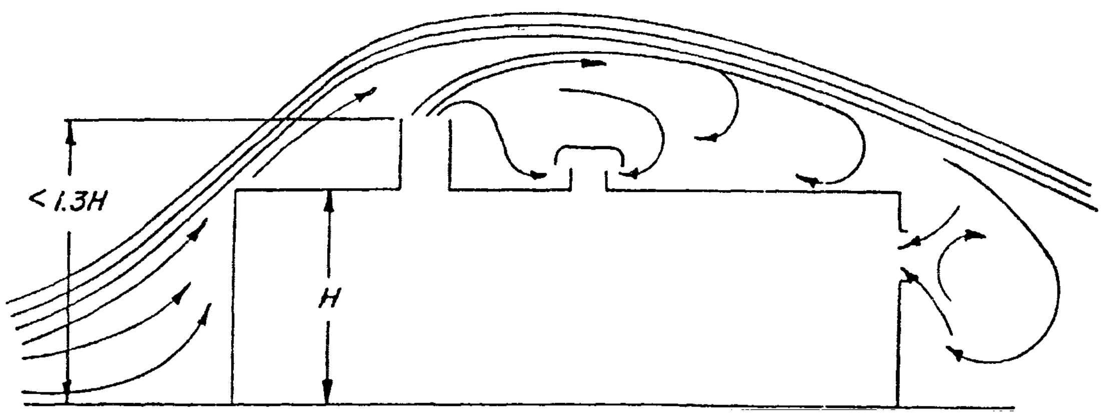
1" = APPROX 40'

ATTACHMENT 2



GOOD

High discharge stack relative to building height, air inlet on roof.



POOR

Low discharge stack relative to building height, air inlet on roof and wall.

These guidelines apply only to the simple case of a low building without surrounding obstructions on reasonably level terrain.

See Fig. 6-24

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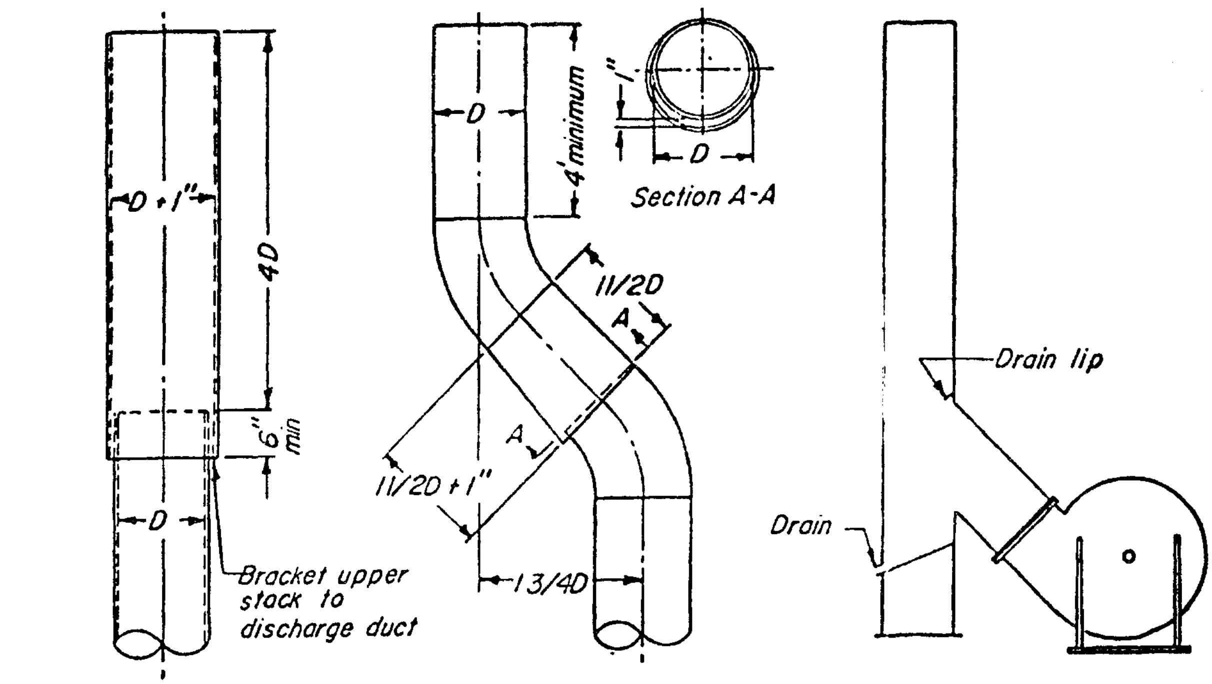
BUILDING AIR INLETS AND OUTLETS

(Ref 87)

DATE 1-76 | Fig. 6-23

ATTACHMENT 3



VERTICAL DISCHARGE(87)(116) — No loss

OFFSET ELBOWS(106) — OFFSET STACK(106) — Calculate losses due to elbows

1. Rain protection characteristics of these caps are superior to a deflecting cap located 0.75D from top of stack.

2. The length of upper stack is related to rain protection. Excessive additional distance may cause "Blowout" of effluent at the gap between upper and lower sections.(86)

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STACKHEAD DESIGNS	
DATE 1-76	Fig. 6-24