Ventilation and Air Cleaning Facilities For Normal Uranium Fabrication

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The fabrication of uranium necessitates rigid dust control procedures and effective air cleaning equipment to minimize the inhalation hazard both inside and outside the workroom areas. The effectiveness of control is evaluated through air analysis which in turn is correlated with urinalysis and integrated with a medical control program.

The level of air contamination reached high proportions in the early part of 1951 in the normal uranium processing areas which include the foundry and machining operations. The latter was moved into enlarged facilities and it was felt that hooding and exhaust ventilation were needed if widespread contamination was to be avoided.

After a preliminary study of diversified machining operations, it was decided that the polishing operation was the most dusty. Two hoods were installed and a substantial reduction in air contamination at the breathing zone of the machinist was noted.

In the design of the facilities, the contractor provided exhaust outlets, piping, and exhausters. Also air cleaning was apparent if operations were hooded since the uranium dust would concentrate in the effluent air and might constitute an air pollution problem. Fibrous filters were incorporated in the hoods in an effort to capture the dust as close to the source as possible. Both hand packed bronze fibrous filters and commercial glass fiber filters were tested and it was found that the former was inefficient as a particle collector whereas the latter deteriorated quickly under the high filtering velocity. Another objectionable feature of filters of this type is the buildup in resistance with loading with a diminution in the air flow rate thus reducing the performance of the hood. At this time, a central dust collecting system was considered, and a reversible jet bag type unit which handles dust from machining operations as well as foundry operations was chosen.

Since all machines were to be hooded, two standard hood designs were selected which were acceptable to production and were effective in abating dust part of machinists.

(3) Spreading operations over a larger [illegible]

large chips were found which could readily settle in the ducts thereby

(4) Minimizing and partial mechanization of polishing

constituting a potential fire hazard. A chip trap or inertial type collector

(5) Reduction in time required to machine parts

was installed as near as possible to the hood outlet, and two small lathes,

(6) Production

on which indentical work was done, were selected for testing. Uranium

Several hoods were installed on large and small lathes, and dust

loading was higher without the trap, and chip clusters, were found on the

samples were taken in the branch ducts to measure the dust [illegible]

probe tube of the sampler in the duct. The efficiency of the chip trap is

[illegible]

about 65% on a weight basis (amount collected was over 200 grams of

[illegible]

uranium over 400 hours of operation (not machine time), and the unit has

pressure drop of 2" Water Gage when handling 400 cfm. The unit collects considerable coolant mist which is returned to the machine. Also the device is readily demountable for cleaning at inventory time.

Air-borne contamination was not as great a problem in the foundry area as the machining area. The trend is downward in the general level of air contamination beginning with the latter part of 1951 to present. Factors responsible for the reduction in air-borne uranium are:

(1) Improvement in techniques (handling of material)

(2) Better housekeeping

(3) Renovation and improvement of existing source ventilation

(4) New equipment

(5) Production

Exhaust air ventilation from the hoods in the foundry were cleaned by AAF Multiduty units. These units discharge at roof level and constitute a potential hazard since air intakes are near. On several occasions, the units were without oil, and considerable quantities of uranium were discharged on the roof. The units required considerable maintenance and the cleaning operation, once monthly for inventory purpose, was very messy. Dust loadings were light and averaged about 5 gr/1000 ft^3.

The AAF units will be dismantled and all dust laden ventilation air will be passed through bag filters (self cleaning type). The outlet from each exhauster (27 units in all) which handles contaminated air from a given number of operations will discharge into a piping network proportioned to handle air at a velocity of 3000 fpm. The air from the main will split into two streams (150,000 cfm) and each portion distributed through a filter house containing 64 wool felt bags (white virgin wool, 26 oz., by American Felt Co.) 18" in diameter and 19' high with a filtering velocity of 30 cfm/sq. ft. bag surface. A 150,000 cfm (300 HP) exhauster will handle air from each bag filter at a negative pressure of 7" WG, and both units will discharge into a 25-ft stack.

A bypass damper is installed in the system to insure a negative pressure of about 2" WG in the main duct work. In the event that the exhauster fails and a positive pressure is built up in the system, the bypass damper will open and an audible alarm activated.

The dust collectors cost $58,000 and bags (non-treated with adjustable blow rings) about $15,000. Total cost of the system is $1.00 per cfm. (Interior of duct work has a prime coat and enameled). The system is still under construction and should be completed by November 1.

We hope to get some information on the performance of the system when it is put into operation. This system should complete ventilation, air cleaning and hooding at normal uranium operations.

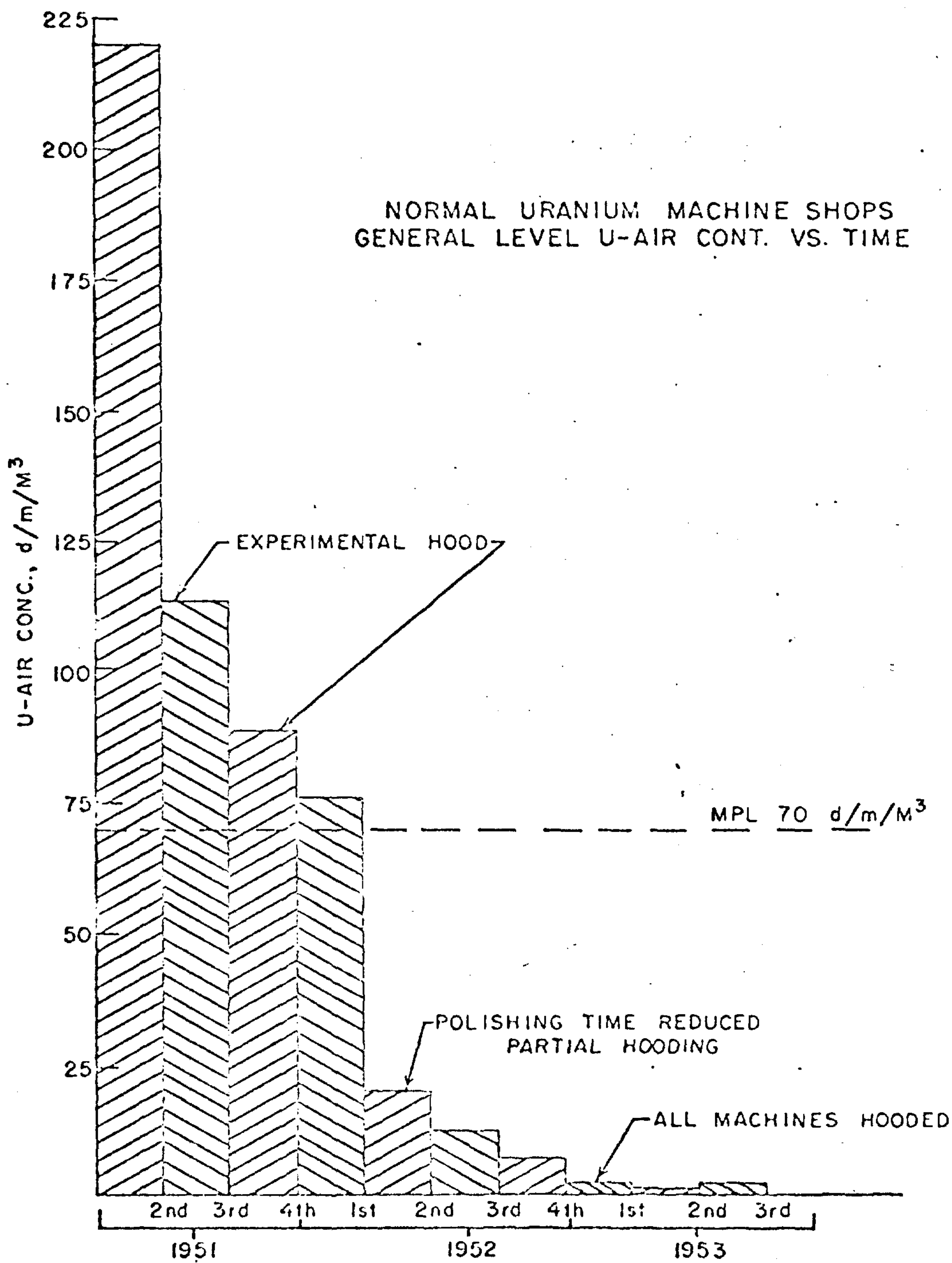
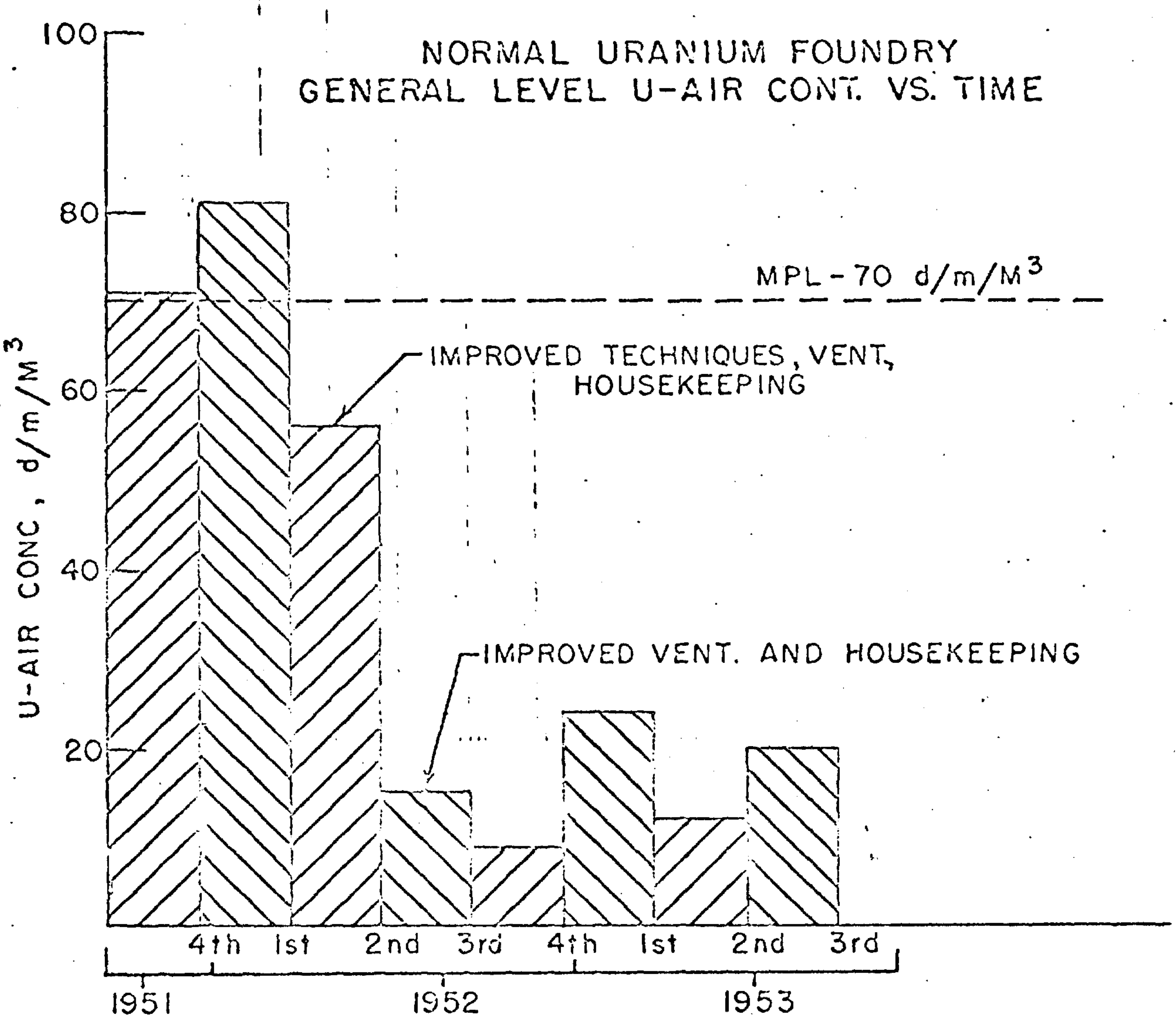


Fig. 1



NORMAL URANIUM FOUNDRY
GENERAL LEVEL U-AIR CONT. VS. TIME
MPL-70 d/m/M3
IMPROVED TECHNIQUES, VENT, HOUSEKEEPING
IMPROVED VENT. AND HOUSEKEEPING
U-AIR CONC, d/m/M3
100
80
60
40
20
4th
1st
2nd
3rd
4th
1st
2nd
3rd
1951
1952
1953

Fig. 2