



Gouvernement
du Canada

Gouvernement
du Canada

MEMORANDUM

NOTE DE SERVICE

P.A. 850-5-X757

TO
À
Director General, Program Management

FROM
DE
Programs Medical Officer
N. W. T. Region

SECURITY - CLASSIFICATION - DE SÉCURITÉ
OUR FILE - N/RÉFÉRENCE 151 - 1 - 5
YOUR FILE - V/RÉFÉRENCE
DATE October 7, 1975

SUBJECT
OBJET

Arsenic - Yellowknife

I enclose a copy of the Phase II report as issued to the Press, Government of the N. W. T., D. I. N. A., Mine managers, Union representative on Friday, October 3rd, 1975.

You will note only slight changes from the form received over the telecopier in the interests of improved grammar (changes appear on page 8; the bottom two paragraphs).

I should comment that the release was well received at the news conference and the only dissident note came from the union representative who was new, and did not know the background.

We have received word of favourable comment in Yellowknife from those involved in that this time they received information by letter as was promised and that the reports were not delayed as was the case in the previous investigation.

Other than coming to a working agreement for the follow-up suggested in the report and news release it is hoped that this whole matter may now be laid to rest.

attach.

mlm

ACTION	PA date	IF date
11/10	1/10/71	
INFORMATION		
11/15		

R. D. P. Eaton, PhD., M. B., ChB.

[Signature]

File under [unclear] file (cont)

13, 15, 10

REPORT ON THE EFFECTS OF ARSENIC ON HUMAN HEALTH IN THE YELLOWKNIFE AREA

PHASE II - CLINICAL EXAMINATIONS

This report summarizes the clinical findings on those persons found on previous screening to have elevated ie. above 10 parts per million arsenic in their hair. The report is a compilation of the findings of three physicians, Drs. Brown and Krishnamoorthy of Yellowknife and Dr. Schaefer of Edmonton, Dr. Schaefer acted as organizer and was in general charge of the investigations. The clinical examinations included laboratory investigations of hemoglobin, red blood indices, blood smears with special regard to basophilic stippling and morphology of red cells, white cells and platelets, the S. M. 12 blood chemistry profile which includes serum electrolytes, blood urea, serum proteins, alkaline phosphatase, L.D.H. and S.G.O.T. all of which are important parameters of renal and hepatic function, spirometry, E.K.G., lung x-ray and a 24-hour urine sample which was measured, examined by dip-stick and the measured sample submitted for urinary arsenic analysis by an independent commercial assay laboratory.

A total of fifty-eight (58) individuals were seen in the arsenic examination. Fifty of these were all that were available of the sixty-three (63) individuals identified in Phase I of the 1975 investigation, the remainder having either left Yellowknife or been away on holiday at the time of the investigation. Six were employees of the Giant Mine who volunteered for the

examination feeling that they had an unduly large exposure to arsenic during the course of their duties and the remaining two were Indian children identified as having raised hair arsenic levels by an independent survey by the National Indian Brotherhood earlier this year.

Along with the clinical examinations a certain number of additional hair samples were taken both from scalp and body hair in a further attempt to distinguish between arsenic deposited on the hair or taken in by ingestion or inhalation.

A full hour was allowed for each patient to ensure adequacy of history taking and clinical examinations.

Hemoglobin and red cell indices were analyzed by the Laboratory of Stanton Hospital Yellowknife. The blood smears were read by laboratory technicians at the Charles Camsell Hospital and the S.M. 12 blood chemistry profile was done by a private laboratory in Edmonton.

Spirography was performed by our Special Task Nurse and the results were interpreted by Dr. Schaefer. X-ray of the chest was completed in each case at Yellowknife Hospital and the films were submitted to Edmonton for reading by Dr. Bhimji and Dr. Schaefer with referral of all doubtful cases to radiologists at the Charles Camsell Hospital. Electrocardiograms were read and analysed by Dr. Schaefer. Urinary measurements and simple dip-stick analyses were done by Dr. Schaefer and the Task Nurse.

Upon review of all the examination files one is impressed by the total absence of pathological findings normally to be found in chronic systemic

arsenic poisoning. These findings include wart-like hyperkeratoses, hyperpigmentation of skin, Mees' lines in finger nails, hemolytic and aplastic anemia and peripheral neuritis.

As in the survey in 1966 certain Mill employees, in particular Roasters, Cottrell operators and those working at times in the bag house, complained of episodes of a rapidly subsiding irritation and rash in the perioral and perinasal area, and less frequently also on neck, hands and forearms.

A total of seventeen persons claimed to have experienced episodes of irritation and rashes after exposure to arsenic dust commonly known by Mill employees as "arsenic rash". This rash was reported to last usually for only short periods and disappeared within a few days after the exposure to As_2O_3 dust ceased. It involved predominantly the nasolabial folds and nostrils and less often of the neck collar area and the hands and forearms and very rarely on areas of the trunk such as groin and penile shaft being apparently dependent on direct contact of the moist epidermis with As_2O_3 dust.

All seventeen of these individuals were Mill employees. Six of these experienced the "arsenic rashes" whilst employed as Roasters or Cottrell operators and the remaining eleven whilst being temporarily occupied in the bag house or otherwise exposed to As_2O_3 dust.

All Cottrell operators and Roasters in the fifty-eight persons examined experienced at one time or the other such rashes, eleven of the other thirty-five mill employees and none of the ten miners or nine other residents

in Yellowknife gave such a history.

Two men with long term Roasting experience showed skin lesions, one a dry erythematous rash on both forearms continuous for four months and the other an excessive dry peeling of palms and soles compatible with mild chronic systemic effects of Arsenicism, but neither showed any typical or more definitely pathognomonic signs of chronic arsenic toxicity such as warty hyperkeratosis or hyperpigmentation.

Four of those examined were found to have palpably enlarged livers, eighteen showed abnormalities in one or more than one liver function tests. These findings do not appear to be related to arsenic toxicity. Other pathology identified during the clinical examination included nine cases of obesity, nine with hypertension and twelve with varying degrees of obstructive or restrictive lung disease. A most careful analysis failed to reveal any evidence of an association between these findings and arsenic exposure or indeed arsenic levels in hair or urine. On the other hand, a clear association was to be demonstrated between the presence of such obstructive lung disease and a heavy smoking history or a work history of Hard Rock mining.

The literature is very confusing and to some extent contradictory in regards to what might be considered as normal and abnormal levels of arsenic as measured in hair or urine samples. A review of the available literature

has caused us to arrive at the following understanding.

Skin appendices (hair, finger and toenails) remove and accumulate on their SH radicals arsenic from the circulation which is then stored indefinitely. It is impossible by available analytical methods to distinguish between arsenic which has reached hair from the circulation and arsenic which has been deposited on and absorbed to the hair. It is also impossible to distinguish between the relatively harmless organically bound arsenic which is contained in large quantities in sea food and the more poisonous inorganic arsenic particularly arsenic trioxide. Interpretation of hair arsenic levels therefore must be tempered by an understanding of the various methods by which an increased level may be produced. It appears that there are no reported cases with arsenic hair levels less than 10 parts per 1,000,000 on repeated analysis which have been associated with clinically proven chronic arsenic toxicity. The selected cut off point at 10 parts per 1,000,000 for determining eligibility for further clinical investigation was therefore both justified and practical. Despite the well-documented fact that extremely high levels of arsenic may be found in the hair of persons never exposed to arsenic dust, gases or arsenic polluted water and the general statement in literature that arsenic levels in hair and urine analyses show little if any consistent relationship, there is some consistency though not a direct parallel in hair and urine analyses of samples collected in Yellowknife in June 1975. These are expressed in the table which follows.

HAIR p.p.m.	NO.	MEAN p.p.m. in hair	MEAN micro/l	MEAN micro/l
10 p.p.m.*	10	7.1	38.7	52.7
10-49 p.p.m.	34	21.2	51.7	73.7
50-99 p.p.m.	7	66.7	54.9	74.5
100 p.p.m.	6	203.0	52.0	103.7
TOTAL	57	43.5	49.8	73.1

* Unwashed samples 10 1 sample from the 58 persons examined was
Washed samples 10 not available for comparison or inclusion
in this table.

Assessment of the urinary arsenic excretion figures was complicated by the fact that a relatively large number of samples obtained were of very low specific gravity. This is to be associated with a high fluid intake. If we were to follow the standard methodology as given by NIOSH all urines with a specific gravity of less than 1,010 would be discarded. This however would invalidate our examinations. Therefore rather than use correction factors which are known to produce unrealistically modified urinary levels, we chose to estimate total daily arsenic excretion. Using this method we found fourteen individuals excreting more than the upper limit of normal namely 100 micrograms of

. . . /7

arsenic in twenty-four hours, two between 200 and 300 micrograms but none near the 700 to 1,000 micrograms which is given as "the bio-significant threshold indicative in exposed persons of harmful exposure". (H.B. Elkins)

While we may therefore with good justification state that persistent systemic over exposure to arsenic appears not to be a problem at present in Yellowknife, as there was not even one person found with a urinary excretion in the range generally accepted as "indicative of harmful exposure", there was evidence more historical than on physical findings that Cottrell operators and Roasters, and to a lesser degree chemical analysts and other Mill employees, were at the Giant Mine until this Spring repeatedly subject to excessive arsenical dust leading to typical facial skin irritations, particularly around the nostrils, nasolabial folds and under the collar commonly referred to as "arsenical rash". Some of this arsenic has found its way into the body as evidenced by higher hair and urinary arsenic levels. We must also comment that currently normal or only moderately elevated urinary excretion rates do not exclude previous arsenical damage during times of temporarily higher exposure and indeed such occurrence in several individuals appeared likely to have happened according to case histories in 1954 when they were reported to have had "arsenic poisoning" and were treated with blood transfusions and/or had other systemic symptoms and signs of acute or subacute arsenic poisoning.

Five men were found with both high arsenic levels in hair and arsenic excretion in the urine definitely above the level usually regarded as normal as well as presenting with history and/or clinical or lab findings suspicious of mild chronic systemic arsenic toxicity. Four of these were Roaster of Cottrell operators for more than five years and one was working in the assay office. It was recommended that these five and all others who work in a similar setting be monitored on a regular basis. To aid in this the entire findings of this clinical survey on all individuals will be made available to the workers' own physician in Yellowknife and to Edmonton consultants. Furthermore the National Health and Welfare Department will be prepared to provide in the future estimations and analyses which are not normally available in clinical laboratories. These include such things as arsenic examinations in hair and urine.

In respect of the mill environment it is recommended that greater emphasis be placed on a regular monitoring of the inplant sanitation and especially on the work habits and use of protective clothing and equipment by those workers who are perforce in a high dust environment.

It is also recommended that Medical Services Branch:

- (a) monitors the mill environment for occupational health hazards.
- (b) initiates a programme of routine medical examinations for workers in high dust exposure and monitors this programme.
- (c) provides copies of this report to mine management, union representatives, Territorial Government and the Department of Indian and Northern Affairs.

Finally although data collected in Yellowknife do not support the contention of some recent reports that arsenic exposure is associated with an excess long term cancer mortality we must recognize that workers in the gold mines tend to migrate elsewhere for retirement. If a practical method for doing this can be found it is recommended that a register be kept enabling long term surveillance of all workers in arsenic exposed occupation.