LICENSE FILE ROUTING	
JGD	
JAF	
	ERN-File

MAR 26 1962

Prior II + III
1st Enforce. Ltr
Same as R. III citations

LR:CGW
12-4932-1
40-2061
C-3377

American Potash and Chemical Corporation
Lindsay Chemical Division
258 Ann Street
West Chicago, Illinois

Attention: Mr. Bruce J. Bennett
Manager of Manufacturing

Gentlemen:

This refers to the inspections conducted on April 19 through 21 and 24, 1961, and June 23, 1961, of your activities authorized under AEC Byproduct Material License No. 12-4932-1 and Source Material License Nos. R-234 and C-3377.

There were no items of noncompliance noted for License No. C-3377. With respect to License Nos. 12-4932-1 and R-234, it appears that certain of your activities were not conducted in full compliance with the requirements of the AEC's "Standards for Protection Against Radiation," Part 20, Title 10, Code of Federal Regulations, in that:

LICENSE NO. 12-4932-1 Prior III

1. The area in which licensed byproduct material was stored was not posted as required by Section 20.203(e)(1), "Caution signs, labels and signals."

LICENSE NO. R-234 Prior II

2. Surveys conducted pursuant to Section 20.201(b), "Surveys," were inadequate in that time occupancy studies had not been conducted and time weighted exposure determinations had not been made to determine compliance with Section 20.101(b), "Exposure of individuals to radiation in restricted areas."

REGISTERED MAIL
RETURN RECEIPT REQUESTED

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3. The quantities of radiation existing in unrestricted areas on the railroad right-of-way adjacent to the solid waste storage area were such that an individual could have received a dose in excess of 100 millirems in any seven consecutive days, in violation of Section 20.105(b)(2), "Permissible levels of radiation in unrestricted areas."

4. Airborne radioactivity areas were not posted as required by Section 20.203(d)(2), "Caution signs, labels and signals."

5. Form AEC-3 was not posted as required by Section 20.206(c), "Instruction of personnel; posting of notices to employees."

6. Records of air survey results were not maintained in the units specified in Section 20.401(b), "Records of surveys, radiation monitoring and disposal."

It is noted that the deficiencies described in Items 1, 4 and 5 above were corrected prior to the June 23, 1961 inspection visit.

With respect to Items 2, 3 and 6, pursuant to the provisions of Section 2.201(a), "Notice of violation," of the AEC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, you are requested to notify this office, within thirty days of your receipt of this notice, of the steps taken or to be instituted to achieve correction of the alleged violations, and the date when such correction has been or will be achieved.

The information you submit concerning Item 2 should include the date by which weighted exposure determinations will have been completed for individuals who continuously or occasionally work in areas having concentrations of airborne radioactivity.

We note that the validity of your air sampling data is questionable in that the volume of air sampled appears insufficient, the alpha count time appears too short, and a self-absorption factor had not

MAR 26 1962

been determined and applied to the count data. In your answer to this letter, indicate the steps you have taken or will take to develop and apply appropriate self-absorption factors, and state the overall lower limits of sensitivity in microcuries per milliliter of air, of your sampling and analytical procedures. Also indicate what steps will be taken to improve the lower limits of sensitivity of your procedures if air sampling results are not sufficiently reliable to show that personnal are not being exposed in excess of MPC.

Your reply will be considered by the Commission in determining what further action, if any, may be taken with respect to the deficiencies described in Items 2, 3 and 6, and what action will be taken with respect to your application for renewal of License No. R-234.

Your letter of January 29, 1962, requesting authorization to make allowance for the protection provided by respirators in determining whether roaster operators are being exposed to concentrations of airborne radioactivity in excess of Commission standards has been referred to the Source and Special Nuclear Materials Branch, Division of Licensing and Regulation. You should soon hear from them concerning this matter.

Very truly yours,

Eber R. Price
Assistant Director
Division of Licensing
and Regulation

Enclosures:
1. 10 CFR 20
2. 10 CFR 2

bcc: Compliance Division, HQ)
Compliance Division, III) w/cpy ltr 1/29/62
Public Document Room)

SIGNED CONCURRENCE COPY IN BYPRODUCT FILE

LR:EB	LR:SNMB	CO	LR
EBCGW:lrm:REC	DMassbeumer		EBPrice

2-27-62

AIR SAMPLING RECORDS

A separate file for air sampling records is maintained for each separate area in the facility where operations are such that airborne radioactivity may constitute a problem.

A file is maintained for the following:

Building #3 - Thorium Furnace Room
Building #2 - Cascade Room
Building #9 - Fourth Floor Pot Baking Area
Building #9 - Third Floor Area (D-7 tanks)
Building #9 - Second Floor Area
Sand Roasting Shed

All folders show the following information:

"a. Time schedule. Every other week take one-half sampling spots shown on floor plan so all spots are covered every 4 weeks.

b. 5 minute samples. Until sufficient data is accumulated to show daughter activity:

Count 1 min. - 1 hr. after sample
1 min. - 10.6 hr. after sample
60 min. - 106 hr. after sample
60 min. - 465 hr. after sample
For each count complete activity is:

$$uc/ml \times 10^{-11} = c/m \times d/c \times \frac{1.29}{T} \times \frac{1}{.7}$$

(1) From 10.6 hour count record Rn-220 by multiplying activity by 2. MPC for Rn-220 is $30,000 \times 10^{-11}$ uc/ml.

(2) Obtain Bi 212 activity by subtracting 0.9 (10.6 hr act. tot.) from 1 hr activity. Multiply by 2 equals Bi 212. MPC is $10,000 \times 10^{-11}$ uc/ml.

(3) Obtain Ra 224 by dividing corrected 106 hr count by 1.7. MPC is 70×10^{-11} uc/ml.

(4) To obtain Th(nat) subtract 0.1 Ra-224 activity from 465 hour total activity. Divide answer by 5.9. MPC is 3×10^{-11} uc/ml.

"When C-R samples are completely counted a review of procedure will be made with a view to determining Th(nat) only from 106 hr count."

In addition to the above information, the following is included for the third Floor Area (D-7 Tanks) and the Sand Roasting Shed:

- continued -

"Time Schedule . . . .

Also every other week take 2 random samples so that the entire area is covered systematically. These are not to be diagrammed, but if a trouble spot appears check with RSO."

The air sampling results are recorded on the form attached to this Exhibit.

Documentation of exposure time (weighed time study) has been made for the Sand Roasting Shed. Documentation is in progress for the Thorium Furnace Room but has been interrupted for installation of new equipment in that room, and is in progress for the third floor area (D-7 tanks). No other areas have been documented.

The documentation for the Sand Roasting Shed consists of the following statement:

"Time spent by operators in Sand Shed. Estimated by J. Clayton, Day Operator and Bradford, Night Foreman.

1. Day Operator spends 8 hours in shed, 6 hours at the hopper.

2. Night Operator spends 6 hours in the shed, 4 hours at the hopper."

RECORDS OF EXPOSURE TO AIRBORNE RADIOACTIVITY

The only record of exposure of individuals to airborne radioactivity consists of a report of overexposure dated January 29, 1962. Determination of this exposure was made as set forth in Exhibit G.

For those areas in which air samples show less than 3×10^{-11} uc/cc of thorium, no determination of exposure received from these lesser concentrations is made and consequently no records of exposures due to these concentrations are made. The licensee states by knowledge of the area in which an individual is assigned (Records of such assignment are kept) and by sample results, he can arrive at such records of exposure assuming eight hours per work day.

The licensee considers exposure resulting from exposure to airborne radioactivity and exposure from external sources of radiation as two separate entities.

EXHIBIT K

AIR SAMPLING TECHNIQUES

Beginning in May 1962 the licensee instituted a revised air sampling program. Prior to the institution of the revised program, the licensee used a variety of sampling times and sample counting times varying from 1 minute to 1 hour.

Under the revised procedures, the licensee intends to take 5 minute samples (175 liters) in restricted areas and 1 hour samples (2100 liters) for environmental samples. For samples from restricted areas, counting times are of 1 minute duration for the sample after 1 hour decay and 10.6 hours decay. After the 106 hour and 465 hour decay, the counting time is 1 hour. For environmental samples, counting will be performed only for the 106 hour and 465 hour decay. One hour counting time will be used.

Air sampling is accomplished using a locally constructed air sampler drawing 35 liters per minute. The sampling medium is 1.25 inch Whatman 41 Filter paper.

No chemical processing is performed on the sample. Thorium content is determined solely by measurement of radioactive content.

The counting time and length of sampling, according to Dr. Healy, were dictated by the numerical value for the maximum permissible concentration as set forth in the Federal Regulation. Dr. Healy stated that a value as counts was calculated which would give good statistical precision and would represent the maximum permissible concentration. Based on this value, he had determined the sampling time and counting time necessary to arrive at this calculated value assuming that the air being sampled was at the maximum permissible concentration. He stated that for samples below this calculated value, a loss in statistical precision has little significance since the samples are below the maximum permissible concentration.

The formula used for calculation is:

$$\text{uc/ml} \times 10^{-11} = \text{c/m} \times \text{d/c} \times \frac{1.29}{T} \times \frac{1}{.7}$$

c/m is the measured counts per minute.
d/c is the disintegrations per count based on a direct conversion using a uranium standard.
$\frac{1.29}{T}$ is a factor based on volume sampled and time of sampling.
$\frac{1}{.7}$ is a factor to allow for self-absorption by the filtering medium.

Currently, measurements are made at 1 hour, 10.6 hours, 106 hours, and 465 hours after sampling. The 465 hour count divided by 6 is considered to represent the thorium content. The results are divided by 6 due to 6 alpha emissions per disintegration.

EXHIBIT I

Exhibit H Attachment 2

AMERICAN POTASH & CHEMICAL CORPORATION

West Chicago Plant

Paper size

1/m = 35

Counted on _____ By _____

Absorption factor _____

Sample			Counting								
No.	Hour-Date	Time (min)	Hour-Date	Time (min)	Ns (c/min)	Nb (c/min)	Ns-Nb (c/min)	Calib (d/c)	Total Concentration (μc/ml x 10^{-11})	Isotopic Concentration (μc/ml · 10^{-11})	Decimal Frac. of Permissible

COMPILATION OF LICENSEE'S AIR MONITORING PROGRAM RESULTS

Listed below are the air sample results as shown by the licensee's records for the period June 1961 through April 2, 1962. All results are shown as microcuries per milliliter of natural thorium. Attachment 1 to this exhibit shows the same results arranged to show samples taken per area. Attachment 2 shows the form used by the licensee for recording sample results.

6/15/60 - Samples taken outside of Building 1 when oxalate was being burned: 14 samples of 15 minutes duration; counting time of 5 minutes; total counts from 7.7 to 105.5. Maximum results 7.9 x 10^{-11}uc/ml. (Note: since this sample, facilities have been changed.)

6/7/61 - Building #2 Cascade Room: 4 breathing zone samples of 1 minute duration; counted after 1 hr, 10.6 hr, 106 hr, 35 days; duration of first two counts - 1 minute; duration of second two counts - 1 hour. Maximum result 2.8 x 10^{-11}uc/ml (natural thorium)

6/7/61 - Building #2, First Floor Area: 3 breathing zone samples of 1 minute duration; counted after 1 hr, 10.6 hr, 106 hr, 35 days; duration of first two counts - 1 minute; duration of second two counts - 1 hour; total counts from 9.6 to 400. Maximum result 16.2 x 10^{-11}uc/ml (natural thorium). On a weighed time basis, this was below limits. This operation has been moved to the Cascade Room where hooded areas are available.

6/13/61 - Building #1, Thorium Furnace: 4 samples of 1 minute duration; counted after 3.2 hr, 10.3 hr, 106 hr, and 35 days; duration of first 2 counts - 1 minute; duration of second two counts - 1 hour; total counts from 9 to 11,103. Maximum result 205 x 10^{-11}uc/ml. On a weighed time basis, this is recorded as 0.5 mpc.

8/14/61 - Environmental samples: 3 samples of 1 hour duration. Counting time of 1 hour duration; total counts from 277 to 337. Results - plant site - 0.28 x 10^{-12}uc/ml; Vedder's - .05 x 10^{-12}uc/ml; Ball's - .16 x 10^{-12}uc/ml.

10/20/61- Environmental samples: 3 samples of 30 minutes each. Counting time of 15 minutes; total counts from 70 to 79. Results - Plant site - .04 x 10^{-11}uc/ml, Vedder's - .009 x 10^{-11}uc/ml; Ball's - .02 x 10^{-11} uc/ml.

10/20/61- Thorium Furnace Room: 16 samples of 60 minutes; counting time of 30 minutes; total counts from 221 to 12,207. Maximum results of 10.2 x 10^{-11}uc/ml. On a weighed time basis this was below limits.

11/15/61- Building 9, First floor: 18 samples of 15 minutes duration; counting time of 10 minutes; total counts from 36 to 149. Maximum results of 1.11 x 10^{-11}uc/ml.

11/16/61- Building 9, Second floor: 22 samples of 15 minutes duration; counting time of 10 minutes; total counts from 33 to 121. Maximum results of 0.805 x 10^{-11}uc/ml.

11/16/61- Building 9, Third floor: 23 samples of 15 minutes duration; counting time of 10 minutes; total counts of 40 to 88. Maximum results of 0.488 x 10^{-11}uc/ml.

11/16/61- Building 9, Fourth Floor: 18 samples of 15 minutes duration; counting time of 10 minutes; total counts from 38 to 134. Maximum results of 0.654 x 10^{-11}uc/ml.

11/17/61- Building 9 Roof: 17 samples of 15 minutes duration; counting time of 10 minutes; total counts of 36 to 88. Maximum results of 0.483 x 10^{-11}uc/ml.

11/27/61- Building Roof: 7 samples of 30 minutes duration; counting time of 10 minutes; total counts of 36 to 40. Maximum results of 0.043 x 10^{-11} uc/ml.

- continued -

EXHIBIT H

11/27/61 - Sand Roasting Shed: 12 samples of 15 minutes duration; counting time of 10 minutes; total counts of 39 to 66. Maximum results of 0.369 x 10^{-11}uc/ml.

12/11/61 - Building 5, First floor: 11 samples of 1 hour duration; counting time of 1 hour; total counts of 234 to 460. Maximum results of 0.076 x 10^{-11}uc/ml.

12/12/61 - Building 3, Floor area: 13 samples of 1 hour duration; counting time of 1 hour; total counts of 230 to 470. Maximum results of 0.068 x 10^{-11}uc/ml.

12/13/61 - Buildi.. 1, First floor: 12 samples of 1 hour duration; counting time of 1 hour; total counts of 216 to 282. Maximum results of 0.076 x 10^{-11}uc/ml.

12/13/61 - Building 5 Balcony: 18 samples of 15 minutes duration; counting time of 10 minutes; total counts of 37 to 61. Maximum results of 0.315 x 10^{-11}uc/ml.

12/13/61 - Building 3, Floor Area: 10 samples of 1 hour duration; counting time of 1 hour; total counts of 218 to 542. Maximum results of 0.146 x 10^{-11}uc/ml.

1/5/62 - Sand Roasting Shed: 12 samples of 1 hour duration; counting time of 1 hour; total counts of 1,011 to 18,175. Maximum results of 11 x 10^{-11}uc/ml.*

1/9/62 - Sand Roasting Shed: 4 breathing zone samples of 2 minutes duration; counting time of 1 hour; total counts of 323 to 5135. Maximum results of 7.8 x 10^{-11}uc/ml.*

1/30/62 - Area around D-7 tanks (not in operation): 11 samples of 5 minutes duration; counting time of 5 minutes; total counts of 425 to 1221. Maximum results of 3.7 x 10^{-11}uc/ml.

1/30/62: - D-7 Tanks and Area: 18 samples of 5 minutes duration; counting time of 1 minute; total counts of 365 to 2007. Maximum results of 0.76 x 10^{-11}uc/ml.

2/13/62 - D-7 Tanks Catwalk Area: 12 samples of 2 minutes duration; counting time of 1 minute; total counts of 365 to 510. Maximum results of 5.1 x 10^{-11}uc/ml.

2/21/62 - D-7 Tanks Catwalk Area: 12 samples of 5 minutes duration; counting time of 5 minutes; total counts of 8,874 to 32,734. Maximum results of .98 x 10^{-11}uc/ml.

3/2/62 - Sand Roasting Shed: 17 samples of 5 minutes duration; counting time of 5 minutes; total counts of 25 to 205. Maximum results of 8.2 x 10^{-11}uc/ml.

3/2/62 - Building 9 - Nitrate Evaporation Area: 8 samples of 5 minutes duration; counting time of 5 minutes; total counts of 1399 to 2510. Maximum results of .42 x 10^{-11}uc/ml.

3/6/62 - Building 9 - Nitrate Evaporation Area: 10 samples of 5 minutes duration; counting time of 5 minutes; total counts of 1375 to 2748. Maximum results of .27 x 10^{-11}uc/ml.

3/9/62 - Sand Roasting Shed: 7 samples of 5 minutes duration; counting time of 5 minutes; total counts of 25 to 296. Maximum results of 10.7 x 10^{-11}uc/ml. (Note: Empty skid dropped on floor creating dust cloud) Next highest result: 2.8 x 10^{-11}uc/ml.

*Above limit specified in 10 CFR 20.

- continued -

3/10/62 - Centrifuge Area: 8 samples of 5 minutes duration; counting time of 5 minutes; total counts of 547 to 750. Maximum results of 0.53 x 10^{-11}uc/ml.

3/10/62 - Sand Roasting Shed: 15 samples of 5 minutes duration; counting time of 5 minutes; total counts of 20 to 190. Maximum results of 6.5 x 10^{-11}uc/ml.

3/13/62 - Sand Roasting Shed: 7 samples of 5 minutes duration; counting time of 5 minutes; total counts of 22 to 70. Maximum results of 2.5 x 10^{-11}uc/ml.

3/30/62 - Sand Roasting Shed: 4 samples of 5 minutes duration; counting time of 10 minutes; total counts of 30 to 156. Maximum results of 2.3 x 10^{-11}uc/ml.

4/2/62 - Sand Roasting Shed: 5 samples of 5 minutes duration; counting time of 10 minutes; total counts of 43 to 140. Maximum results of 2.3 x 10^{-11}uc/ml.

EXHIBIT H

COMPILATION OF LOCATION OF LICENSEE'S AIR SAMPLES

Location	Date	No. of Samples	Maximum Results uc/ml
Cascade Room	6/7/61	4	2.8×10^{-11}
Bldg. 2, 1st floor	6/7/61	3	16.2×10^{-11} *
(Note: This operation moved to hooded area in Cascade Room)			
Furnace Room	6/13/61	4	205×10^{-11} *
	10/20/61	16	10.2×10^{-11} *
(Note: Furnace Room has been modified to place operations within hoods)			
Sand Roasting Shed	11/27/61	12	0.369×10^{-11}
	1/ 5/62	4	7.8×10^{-11} *
	1/ 9/62	12	11×10^{-11} *
	3/ 2/62	17	8.2×10^{-11} *
	3/ 9/62	7	10.7×10^{-11} *
	3/10/62	15	6.5×10^{-11} *
	3/13/62	7	2.5×10^{-11}
	3/30/62	4	2.3×10^{-11}
	4/ 2/62	5	2.3×10^{-11}
(Note: Weighed time study shows personnel exposures below permitted limits except for 3 individuals reported in licensee's letter of 1/29/62.)			
D-7 Tank Area	1/30/62	11	3.7×10^{-11} * (Tanks not in
	1/30/62	18	0.76×10^{-11} operation)
	2/13/62	12	5.1×10^{-11} *
	2/21/62	12	0.98×10^{-11}
Centrifuge Area	3/10/62	8	0.53×10^{-11}
Nitration Evaporation	3/ 2/62	8	0.42×10^{-11}
	3/6/ 62	10	0.27×10^{-11}
Bldg. 9, 1st floor	11/15/61	18	1.11×10^{-11}
2nd floor	11/16/61	22	0.805×10^{-11}
3rd floor	11/16/61	23	0.458×10^{-11}
4th floor	11/16/61	18	0.654×10^{-11}
Roof	11/27/61	7	0.043×10^{-11}
	11/17/61	10	0.463×10^{-11}
Bldg. 1, 1st floor	12/13/61	12	0.076×10^{-11}
Bldg. 3, floor area	12/12/61	13	0.068×10^{-11}
	12/13/61	10	0.146×10^{-11}
Bldg. 5, 1st floor	12/11/61	11	0.076×10^{-11}
Balcony	12/13/61	18	0.315×10^{-11}
Outside Bldg. 1 when oxalate burned	6/15/60	14	7.9×10^{-11} *
(Note: Oxalate burning facilities have been modified.)			
Environmental	8/14/61	3	0.28×10^{-12}
	10/20/61	3	0.04×10^{-11}

* - Above limit specified in 10 CFR 20.