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DOCKET NO. 40-1326
TEXAS-ZINC MINERALS CORPORATION
MEXICAN HAT, UTAH

July 25, 1961

Mr. Lyall Johnson
Chief, Licensing Branch
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, District of Columbia

Dear Mr. Johnson:

Enclosed is our progress report that describes the radiation surveys made by Texas-Zinc Minerals Corporation during the second quarter of 1961. These surveys were made in compliance with the Atomic Energy Commission "Standards for Protection Against Radiation, Part 20, Title 10, Code of Federal Regulations", dated January 29, 1957, amended September 7, 1960 and December 30, 1960, effective January 1, 1961.

This report describes radiation surveys made in the Mexican Hat mill area and environs, progress made on recent radiological safety programs and present and future projects which are designed to achieve compliance.

Very truly yours,

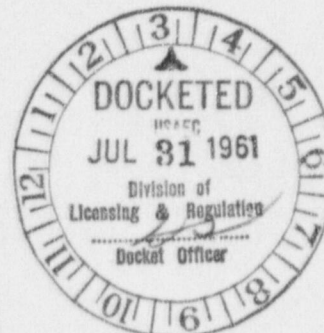
J. E. Nelson

J. E. Nelson
Plant Superintendent

GHCrouch/jmt

cc: W. Spencer Hutchinson, Jr., Director
Source Materials Procurement Division
United States Atomic Energy Commission
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Dr. D. I. Walker
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RESTRICTED AREA A - Ore Yard

Previous data have indicated that no radiation hazards exist in this area. It is presently scheduled to be surveyed twice yearly.

RESTRICTED AREA B - Sample Plant and Fine Ore Bins

A random survey of airborne radioactive dust concentrations was taken in this area during the quarter. Although some readings were obtained in excess of MAC, the average uranium concentration was less than 2.5×10^{-11} microcuries of uranium per milliliter of air. Another survey to include all sampling stations is planned for the third quarter.

RESTRICTED AREA C - Grinding, Flotation, LeachingRESTRICTED AREA D - Thickener TanksRESTRICTED AREA E - Solvent Extraction

Previous data have indicated that no radiation hazards present themselves in these areas. They are presently scheduled to be surveyed twice yearly.

RESTRICTED AREA F - Yellow Cake Section

Results of film badge exposures of operators in this area are shown in Table IV and are well below the maximum permissible dose for a calendar quarter.

Previous surveys of airborne radioactive dust concentrations in the yellow cake section have indicated that above average concentrations of uranium-bearing dust emanated from the drum-packaging zone. During the latter part of May a hooded enclosure with a high volume exhaust fan was installed around the drum-filling and packaging zone to decrease air contamination in the operating area. The plywood enclosure is approximately 5 ft. square by 6 ft. high, open on the north side for access and is topped by a pyramidal metal hood. The system is exhausted by a 24 inch Diehl belt-driven duct fan powered by a 3 hp 1800 rpm 3 phase motor. The fan has a 9300 cfm capacity and exhausts to atmosphere through a 24 inch ID stack 30 feet above ground level. This stack effluent will be sampled during the coming quarter. After this system was put into operation, a dust survey was taken in and around the drum packaging zone. Results of this survey are shown in Table I and are compared with results of two separate special surveys taken in the packaging zone prior to installation of the exhaust system.

TABLE I Special Dust Surveys of Drum Packaging Zone - Restricted Area F

Station	Average Dust Concentrations - Microcuries of Uranium per milliliter $\times 10^{-11}$		
	3rd Quarter, 1960	3rd Quarter, 1960	2nd Quarter, 1961
3	4.2	3.0	0.3
4	4.6	15.3	0.6
5	1.3	3.3	0.2
6	3.4	2.8	0.4
7	5.0	18.3	2.1
8	5.1	16.5	3.1

These data show that the installation of the new exhaust system has greatly reduced the concentrations of airborne radioactive dust in and around the drum packaging zone. Figure 1. shows the location of the new assembly and the stations sampled for this survey. Supplementary data will be collected during the coming quarter.

RESTRICTED AREA G - Mill Offices

RESTRICTED AREA H - Shop Area and Plant Office

RESTRICTED AREA I - Tailings Pond Area

Previous data have indicated that no radiation hazards present themselves in these areas. They are presently scheduled to be surveyed twice yearly.

BY-PRODUCT SOURCE MATERIAL

On June 22, 1961, a wipe test was made on the fifty millicurie Cesium source stored in our vault (By-Products Materials License Number 43-2666-1). No leakage or contamination was noted. Gamma radiation measured from 0.19 to 0.21 milliroentgens per hour approximately one foot outside the lead box in which the container is stored.

ATMOSPHERIC EFFLUENT

An environmental air survey including 16 samples from mill stacks and 24 random samples in the inhabited areas around the mill property was taken during the second quarter as groundwork for evaluating our atmospheric effluent. All air samples of the environs were taken for 2½ hour periods, each sample representing 3000 liters of air. In-stack samples were taken at sealed sampling stations located in the stack several feet from the discharge. Stack samples represent only 200 to 500 liters of air due to higher airborne concentrations.

Atmospheric Effluent (Cont.)

Concentration levels of airborne radioactive dust in inhabited areas surrounding the mill are shown in Table IV. Out of 24 samples, 23 were well below the maximum allowable concentrations for airborne dust released to unrestricted areas as specified in 10CFR20. One sample taken in the Texas-Zinc Minerals Corp. housing project was 1.98 times MAC. In view of the lower concentrations found in the rest of the townsite it is believed that this was a contaminated sample. However, additional samples will be collected at this location.

A summary of in-stack concentrations of airborne radioactive dust are shown in Table II. The maximum ground concentration, which may be caused by each stack is also shown. These calculations were made using equation 4.66, AECU 3066.

TABLE II. In-Stack Concentrations of Airborne Radioactive Dust and Maximum Ground Concentrations in Air Effluents

Stack	Microcuries of Uranium per milliliter $\times 10^{-15}$			
	In-Stack Concentration		$\chi_{\text{max}}^{(1)}$	times MAC
	Maximum	Average		
Sample Plant Rotoclone	200	105	0.209	0.026
Torit Bag Filter	32.3	13.7	0.345	0.043
#6-10 Leach Tank Exhaust	686	499	0.411	0.051
North Yellow Cake Rotoclone	2180	1600	1.897	0.237
South Yellow Cake Rotoclone	340	188	0.227	0.028

$$(1) \chi_{\text{mas}} = \frac{2Q}{e\pi\bar{u}h^2} = \text{maximum ground concentration which can occur from any given stack}$$

Q = In-stack concentration of airborne radioactive dust

\bar{u} = mean wind velocity

h = stack height

Atmospheric Effluent (Cont.)

Because no wind measurements have been taken to date an arbitrary figure of 2 meters per second was used for mean wind velocity in all calculations. This is considered to be a very low estimate and represents, probably, the worst possible conditions in this area where strong winds prevail. Data show that even under these adverse conditions, the maximum ground concentrations are well below MAC for atmospheric effluents.

As this survey was nearing completion a new stack was added in restricted area F to exhaust dust from in and around the drum-packaging zone (see Restricted Area F - Yellow Cake Section). The stack will be included in the next atmospheric effluent survey.

In addition to further surveys of the types reported here, several 24 hour samples will be collected during the coming quarter in order to include both the daytime and nighttime meteorological conditions.

LIQUID EFFLUENTS

Results of Ra-226, Th-230 and uranium analyses on quarterly composites of the neutralized raffinate and the upstream and downstream river water are shown in Table III. When the concentrations shown for downstream river water are inserted in the proper formula taken from 10CFR20 it can be shown that the San Juan river waters dilute the neutralized raffinate to less than MAC by the following calculation:

$$\begin{array}{rcl}
 \frac{\text{Conc. Ra-226}}{\text{MAC for Ra-226}} & + & \frac{\text{Conc. Th-230}}{\text{MAC for Th-230}} + \frac{\text{Conc. Uranium}}{\text{MAC for Uranium}} \\
 \frac{(1.05 \times 10^{-9}) \pm 0.64}{0.5 \times 10^{-9}} & + & \frac{(0.09 \times 10^{-8}) \pm .05}{0.07 \times 10^{-8}} + \frac{(0.034 \times 10^{-5}) \pm .06}{0} \\
 = \frac{1 \times 10^{-8}}{1 \times 10^{-8}} & + & \frac{2 \times 10^{-8}}{2 \times 10^{-8}} + \frac{2 \times 10^{-5}}{2 \times 10^{-5}} \\
 = .105 \checkmark & + & = .0004 \checkmark + = .017 \checkmark \\
 = 0.05 & + & 0.0004 + 0 \\
 = 0.05 \quad (\text{Less than } 1) & & \text{Considering max SD} = 0.2 \text{ (still less than } 1) \\
 = 0.12 \quad \text{"} & & \text{to take into account analytical errors}
 \end{array}$$

A request for exemption to discharge the neutralized raffinate pursuant to section 20.106a has been submitted to the AEC.

Analyses on the quarterly sample of tailings pond seepage are shown in Table III. If we apply these values to the formula, we find that the combined concentrations of Ra-226, Th-230 and uranium are less than MAC for liquid effluents being discharged to unrestricted areas.

*distance?
runoff ft/sec
intake stations?
discharge rate?*

OK

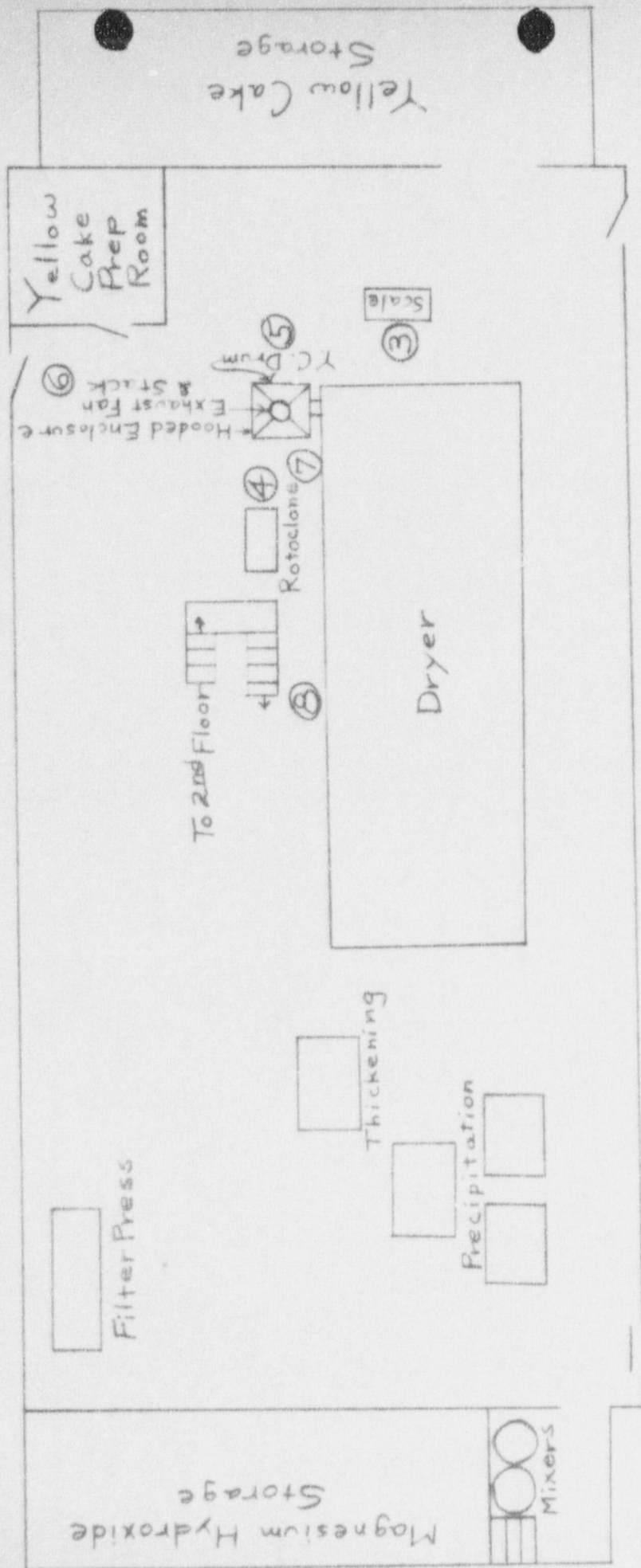
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Liquid Effluents (Cont.)

$$\begin{array}{rclclcl}
 \frac{7.6 \times 10^{-9}}{1 \times 10^{-8}} & + & \frac{0.009 \times 10^{-8}}{2 \times 10^{-6}} & + & \frac{0.4 \times 10^{-6}}{2 \times 10^{-5}} \\
 = & 0.76 & + & 0.00005 & + & 0.02 \\
 = & 0.78 & & & & \text{(Less than 1)}
 \end{array}$$

Data obtained during the fourth quarter of 1960 indicated that one of the components of the open drainage ditch, the solvent extraction sump waste, was the chief contributor to the excessive radium content of this stream. The major portion of the sump waste consisted of a small amount of organic scrub solution which was drained from the scrubbed organic storage tanks. A pump was installed during the first quarter of this year to return this solution to the circuit. It was thought that this would bring the open drainage ditch stream within limits for effluents being discharged to unrestricted areas. Since this revision, a scrub circuit has been installed to remove molybdenum from the feed nitrate. Aqueous scrub solution from this circuit, a stream of one-fourth to one liter per minute, was discarded to the solvent extraction sump and thence to the open drainage ditch. Analysis of the open drainage ditch for the second quarter show that the radium content of this stream has remained in excess of MAC (see Table III). Radium analyses on grab samples of solvent extraction sump waste and aqueous scrub solution from the molybdenum removal circuit, shown in Table III, are in excess of MAC for effluents being discharged to unrestricted areas. Upon receipt of these data, the solvent extraction sump discharge system was repiped to pump the entire amount of solvent extraction sump waste out with the raffinate for neutralization. This revision is definitely expected to bring the open drainage ditch stream within limits. A composite sample of the open drainage stream will be made early in the third quarter and submitted for radium analysis along with check composite samples of several stream components.

YELLOW CAKE SECTION



FIRST FLOOR PLAN

Figure 1

TABLE III Summary of Liquid Effluent Data

Type of Liquid	Date	Microcuries per milliliter		
		Ra-226	Pb-210	Uranium
Upstream River Water	October, 1960	1×10^{-8} mpc	Nil	Nil
	December, 1960	1.0×10^{-8}	0.1×10^{-8}	$< 0.1 \times 10^{-6}$
	March, 1961	2.6×10^{-8}	0.1×10^{-8}	0.03×10^{-6}
	June, 1961	*	*	Nil
Downstream River Water	October, 1960	1.8×10^{-8}	Nil	Nil
	December, 1960	1.0×10^{-8} SD = -9 ± 0.64	0.1×10^{-8} SD = -8 ± 0.05	$< 0.1 \times 10^{-6}$
	March, 1961	0.8×10^{-8} 1.05×10^{-8}	0.2×10^{-8}	0.03×10^{-6}
	June, 1961	0.3×10^{-8}	0.07×10^{-8}	Nil
Neutralized Raffinate (Leaving Property) (Entering River)	October, 1960	12×10^{-8} 1.0×10^{-8}	110×10^{-8} 1.0×10^{-8}	1.8×10^{-6}
	December, 1960	90×10^{-8}	132×10^{-8}	1.8×10^{-6}
	March, 1961	260×10^{-8}	2500×10^{-8}	1.2×10^{-6}
	June, 1961	216×10^{-8}	3500×10^{-8}	1.2×10^{-6}
	December, 1960	65×10^{-8}	146×10^{-8}	1.8×10^{-6}
	March, 1961	110×10^{-8}	3200×10^{-8}	1.7×10^{-6}
	June, 1961	112×10^{-8}	3500×10^{-8}	1.7×10^{-6}
Open Drainage Ditch (Acid Plant Blowdown) (Potable Water Filter Backwash) (Pregnant Liquor Filter Backwash) (Water Softener Backwash) (Solvent Extraction Sump Waste) (Sewage Plant Effluent)	October, 1960	43×10^{-8}		
		0.3×10^{-8}		
		0.3×10^{-8}		
		Nil		
		3.0×10^{-8}		
		126×10^{-8}		
Open Drainage (Solvent Extraction Sump Waste) (Mo Circuit Scrub Solution)		No discharge in 1960		
	June, 1961	70×10^{-8}	0.1×10^{-8}	Nil
		72×10^{-8}	0.7×10^{-8}	2.0×10^{-6}
Tailings Pond Seepage (Entering River) (Entering River)	October, 1960	12×10^{-8}		
	October, 1960	12×10^{-8} $> mpc$		
	June, 1961	7.6×10^{-8}	0.009×10^{-8}	0.4×10^{-6}

001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 021 022 023 024 025 026 027 028 029 030 031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047 048 049 050 051 052 053 054 055 056 057 058 059 060 061 062 063 064 065 066 067 068 069 070 071 072 073 074 075 076 077 078 079 080 081 082 083 084 085 086 087 088 089 090 091 092 093 094 095 096 097 098 099 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018

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