

IL.28-5

Weston

United States Government

Department of Energy

memorandum

DAD 7316
IL.28

DATE: MAR 11 1991

REPLY TO
ATTN OF: EM-421

SUBJECT: Authority Determination--Granite City Steel Site, Granite City, Illinois

The File

TO:

The attached review documents the basis for determining whether DOE has authority for taking remedial action at the Granite City Steel Site in Granite City, Illinois, under the Formerly Utilized Sites Remedial Action Program (FUSRAP). The Betatron Building at the Granite City facility was used by the Mallinckrodt Chemical Works as a subcontractor for uranium metal quality control work from 1958 to 1966. The services furnished at the Granite City Steel site under a series of purchase orders consisted of x-ray services for determining the quality of uranium metal products produced by Mallinckrodt. The following factors are significant in reaching a determination:

- o The uranium was owned by the AEC and delivered to the Granite City Steel site by Mallinckrodt personnel.
- o The Atomic Energy Commission (AEC) approved the use of the site for the x-ray services by the approval of purchase orders.
- o The betatron machine used for the x-ray studies was owned by the government.
- o The Mallinckrodt contract indemnified Mallinckrodt against any loss caused by atomic energy hazards from its activities.

A draft copy of the attached authority review was furnished to the Office of General Counsel for review. That office indicated that the draft review was satisfactory.

After review of the available original records, the radiological survey report, and the authority review, I have determined that the Department of Energy has authority to conduct remedial action at the Granite City Steel

**Authority Review
Granite City Steel**

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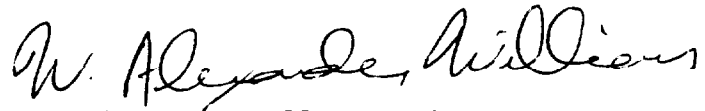
bcc:
Weston
EM-40 (3)
EM-42 (2)
Williams reader

EM-421:AWilliams:jh:353-8149:3/5/91:granite.waw

EM-421 *W*
Williams
3/8/91
EM-421 *W*
Wagoner
3/9/91

02/25/91

Company facility in Granite City, Illinois. This authority includes the only the residual uranium at the site. It does not include the elevated Radium-226 concentrations found on the grounds of the site.

A handwritten signature in cursive script that reads "W. Alexander Williams".

W. Alexander Williams, PhD
Designation and Certification Manager
Off-Site Branch
Division of Eastern Area Programs
Office of Environmental Restoration

Attachment

cc:

Steve Miller, GC-11

**Authority Review for
Granite City Steel Site
in Granite City, Illinois**

1. INTRODUCTION

As part of the Formerly Utilized Remedial Action Program (FUSRAP), the U.S. Department of Energy (DOE) has reviewed available information on the Granite City Steel site in Granite City, Illinois. This site is being investigated as a candidate for inclusion in the FUSRAP, which includes certain sites that were previously involved with activities of the Manhattan Engineering District (MED) or U.S. Atomic Energy Commission (AEC), both DOE predecessors. Such sites may require remedial action, if they have residual contamination from those previous activities. This review is conducted to determine whether DOE would have the authority for remedial action at the Granite City Steel site.

The Granite City Steel site is located at 1417 State Street in southwest Granite City, Illinois, northeast of St. Louis, Missouri, across the Mississippi River. The site is now called the South Plant facility of the Granite City Steel Division and is owned by the Granite City Steel Company. The period of interest is the 1950's and early 1960's when uranium ingots were x-rayed.

The remainder of this review consists of the following:

- Sections:
2. Operational History
 3. Current Conditions
 4. Authority Analysis
 5. Discussion and Conclusions
 6. Copies of References

The information presented in these sections is in summary form. Pertinent references are identified in the text and provided in Section 6 for further use.

2. OPERATIONAL HISTORY

In the 1950's, General Steel Castings Corporation was the custodian of a government-owned betatron believed to have been used in support of contracts with the Department of the Army. Purchase orders issued by the Uranium Division, Mallinckrodt Chemical Works from February 1958 through June 1966, indicate that Mallinckrodt, under the direction of the AEC, used this facility to x-ray materials. (However, similar work involving uranium ingots may have been performed as early as 1953.) The purchase orders issued by Mallinckrodt indicate that General Steel Casting furnished the film and film developing services. Mallinckrodt personnel delivered the uranium to the site. It is not clear from the scope of work described in the purchase orders whether Mallinckrodt personnel may have handled the material they provided and operated the betatron equipment used to x-ray the metal. The betatron and support equipment is located in a building on the southern section of the

02/25/91

plant property. The purchase orders do not specify actual periods of operation or the quantity and configuration of the metal x-rayed. The use of the facility and services was on an as-required basis.

Although the initial purchase orders were issued to the General Steel Castings Corporation, the purchase order dated 14 July 1961 and subsequent purchase orders were issued to General Steel Industries, Inc. All of the purchase orders were under Mallinckrodt's prime contract Number W-14-108-Eng-8 with the AEC. This prime contract involved Mallinckrodt's St. Louis operations to refine and process uranium ore concentrates and pitchblende ores into uranium metal. It is probable that the x-raying was performed on uranium ingots (and, later, dingots) as a check on the quality of the metal before subsequent work. The dingots, weighing almost 3,000 pounds, were thought to have been brought into the building by rail. The residual radioactivity probably resulted from the handling of the uranium metal; it is likely that the surface of some of the uranium ingots were oxidized and the uranium was rubbed off during handling.

The Mallinckrodt contract, number W-14-108-Eng-8, indemnified Mallinckrodt against any loss, expense, or damage caused by the radioactivity of any uranium products that were involved in the performance of work under the contract (Ref. a).

By the time the plant was purchased by the current owner, Granite City Steel Company, General Steel had vacated the plant site. No other operation or period of involvement with processing or handling of radioactive materials at the General Steel Castings Corporation facilities have been discovered.

3. CURRENT CONDITIONS

No records have been found that would indicate any anticipation of residual radioactive contamination as a result of the operations conducted at the Granite City facility or if cleanup activities were conducted following periods of use of the betatron equipment by Mallinckrodt. The betatron building has not been used since it was vacated by General Steel Industries, Inc.; the equipment is still in place. No records have been found that would indicate the radiological condition of the environment in and around the building at the completion of work under the Mallinckrodt purchase orders.

In 1989, DOE conducted a radiological survey to establish the current radiological condition in and around the building in which the x-ray equipment is housed. Survey results show that a small amount of residual radioactivity from former operations remains in several discrete, localized spots in the x-ray building at the Granite City Steel facility. Indoors, Uranium-238 was found in elevated concentrations in debris from an industrial vacuum cleaner, and in dust and debris in scattered locations throughout the building. These levels are in excess of the DOE concentration guidelines (Guidelines for

**Authority Review
Granite City Steel**

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Residual Radioactive Materials at Formerly Utilized Sites Remedial Action Programs Sites, 1987) and are attributable to the uranium work for Mallinckrodt.

The 1989 radiological survey also located elevated soil concentrations of Radium-226 in excess of the DOE guidelines for surface and subsurface soil. Since the Radium-226 was found to be in equilibrium with Uranium-238, it appears to be a naturally occurring material (e.g., coal ashes). Thus, the elevated concentrations found outdoors are not the result of the uranium metal work for Mallinckrodt.

4.0 AUTHORITY ANALYSIS

The authority determination is made according to the FUSRAP protocol by considering the answers to five questions based on available records. The answers to these questions from a review of available information are provided below.

4.1 Was the site/operation owned by a DOE predecessor or did a DOE predecessor have significant control over the operations or site?

Although the facility was owned by General Steel Industries, Inc., the x-raying of material was performed by purchase order as requested by the AEC (c/o Mallinckrodt Chemical Works, Uranium Division under prime contract W-14-108-Eng-8). The betatron x-ray equipment was Government owned. The uranium to be x-rayed was owned by the AEC and provided by Mallinckrodt. No evidence has been found to suggest that AEC had direct control or supervision of activities at this site, other than through the Mallinckrodt contract and its indemnity clause.

4.2 Was a DOE predecessor agency responsible for maintaining or ensuring the environmental integrity of the site (i.e., was it responsible for clean up)?

A review of the records does not indicate specifically that a DOE predecessor agency was responsible for the maintenance of the site's environmental integrity. The AEC purchase orders do not include any mention of environmental responsibilities; it is likely that no environmental problems were expected from the handling of metallic uranium. The prime contract indemnified Mallinckrodt for any loss from radioactivity of uranium.

4.3 Is the waste or radioactive material on the site the result of DOE predecessor related operations?

Only two records of the provided material are known at this time. One is for ingots of uranium metal and the other for Austenitic manganese steel. No copies have been found of the service logs (required by the AEC purchase orders), which may have indicated the materials involved.

02/25/91

However, it is thought that the bulk of material provided for x-raying was uranium metal, because of Mallinckrodt's large uranium operations under prime contract W-14-108-Eng-8. It is likely that some uranium contamination resulted from the handling of the oxidized uranium.

Elevated concentrations of radium found adjacent to the building are not the result of uranium metal work.

4.4 Is the site in need of further clean up and was the site left in a nonacceptable condition as a result of DOE predecessor related activity?

The radiological survey conducted in 1989, indicated limited areas of uranium contamination, which can be associated with DOE predecessor activities. The concentrations of Uranium-238 in and around an industrial vacuum cleaner and other scattered spots within the betatron building were in excess of DOE guidelines for use without radiological restrictions (Guidelines for Residual Radioactive Materials at Formerly Utilized Sites Remedial Action Program Sites, 1987). The building was not in use and still contained the betatron equipment.

4.5 Did the present owner accept responsibility for the site with knowledge of its contaminated condition and that additional remedial measures are necessary before the site is acceptable for use without radiological restrictions?

No documents have been discovered to indicate that General Steel Industries was aware of the site's contaminated condition. A final contract release has not been located. The AEC prime contract indemnified Mallinckrodt against any loss caused by the radioactive properties of uranium.

5. DISCUSSION AND CONCLUSIONS

A survey of the Granite City Steel site in Granite City, Illinois, indicates that contamination includes radioactive uranium. Its extent is limited to the betatron building and is most probably attributable to the x-raying of materials, including uranium, performed under purchase order for the AEC between 1958 and 1966, possibly as early as 1953.

Therefore, based on the Mallinckrodt and AEC role in site operations and the AEC indemnification of Mallinckrodt, DOE has the authority for remedial action at the Granite City Steel site under the Atomic Energy Act through FUSRAP. This authority does not include the elevated radium levels found in the soil at the facility; the radium is from a natural material~~X~~ and is not the result of uranium metal work for the AEC.

6. COPIES OF REFERENCES

The following is the list of references that are provided in this section. The majority of these are comprehensive references that in turn refer to original sources.

- a. Historical records regarding General Steel Castings Company and Mallinckrodt contracts, various dates (December 1953 through July 1965).
- b. Cottrell, W.D. and R.F. Carrier, 1990: "Results of the Radiological Survey at the Granite City Steel Facility, Granite City, Illinois." ORNL/RASA-90/10. Oak Ridge National Laboratory, Oak Ridge, Tennessee, July.
- c. DOE communications with Granite City Steel, various dates (May 1988 through July 1990).

[REDACTED]

3.0

Box 1
#1 was attached to [unclear]
December 5, 1952
[unclear]

TO: W. E. Kelley

FROM: Virginia C. Dancombe

SUMMARY: Regarding ingots of uranium metal furnished to General Steel Castings Co. for beta-ray testing.

FILED: Security - 1

INDEXER: SA

REMARKS: Secret - 711

U. S. ATOMIC ENERGY COMMISSION
CORRESPONDENCE REFERENCE FORM

a-1

2

[REDACTED]

~~SECRET~~

THIS DOCUMENT CONSISTS OF 1 PAGE
NO. 6 OF 7 COPIES, SERIES 7

CONFIDENTIAL

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November 17, 1954

THIS DOCUMENT CONSISTS OF 1 PAGES
NO. 1 OF 6 COPIES, SERIES B

Mr. S. H. Anonson
Assistant Project Manager
Mullinckrodt Chemical Works
65 Westman Street
St. Louis, Missouri

Subject: PRODUCTION REQUIREMENTS FOR THE FIRST THIRD CALENDAR
YEAR 1955

Dear Mr. Anonson:

Reference is made to my letter of November 2, 1954, in which it was
stated we would give you firm requirements for the first Third 1955
about November 15.

The following tonnages (U-basis) are the production requirements for
the first Third Calendar Year 1955:

	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>Total</u>
Orange	325	325	325	325	1300
Green	315	320	320	320	1275
Brown	10				
Derby (pickled)	2 1/2	2 1/2	2 1/2	2 1/2	10
Ingot (virgin)	340	340	340	340	1360
Ingot (recast)	10	-	5	5	20
Dingot	-	-	50	50	100
Green from H-2	150	150	150	150	600

Feed for the refinery will include approximately 50 tons (U-content) of
C-11 per month.

Costs during this Third should include the cost of preparation of billets
for the ~~Refined~~ Cored Slug Program.

~~RESTRICTED DATA~~

This document contains restricted data
as defined in the Atomic Energy Act of
1954. Its transmission or the disclosure
of its contents in any manner to an un-

Very truly

~~SECRET~~
a-2

CLASSIFICATION CANCELLED	
OR GRANTED TO	
BY AUTHORITY OF DPE/DPC	
REVIEWED BY	DATE
V. Henderson	9/28/78

cc: C. L. Karl, Fernald	A/11	F. H. Balsher		
F. SURNAME: King, G-10		Area Manager		
DATE: 11/17/54				

~~SECRET~~

UNITED STATES
ATOMIC ENERGY COMMISSION
ST. LOUIS, MISSOURI

ADDRESS REPLY TO:

THE AREA MANAGER
U. S. ATOMIC ENERGY COMMISSION
P. O. BOX 36, BREMEN STATION
ST. LOUIS 7, MISSOURI

and refer to: O:HRO

February 7, 1955

Mr. S. H. Anonsen
Assistant Manager
Uranium Division
Mallinckrodt Chemical Works
65 Destrehan Street
St. Louis, Missouri

CLASSIFICATION CANCELLED
OR CHANGED TO.....
BY AUTHORITY OF DGE/DPC
W. Hendon 9/29/98
REVIEWED BY DATE

Subject: REVISED PRODUCTION REQUIREMENTS FOR THE FIRST THIRD
CALENDAR YEAR 1955

Dear Mr. Anonsen:

Reference is made to my letters of January 7th, 18th and 28th revising production requirements for the first third calendar year 1955. Due to the delay in installing the semi-works dingot program, the production requirement for this installation will have to be rescheduled in the metal plant.

The following are the new requirements for the first third of calendar year 1955 (all figures in tons uranium):

	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>April</u>	<u>Total</u>
Orange	415	400	480	385	1680
Green	313	300	337	325	1275
Brown	10	0	0	15	25
Ingot (virgin)	353	326	373	358	1410
Ingot (recast)	10	10	5	5	30
Derby (pickled)	2½	2½	2½	2½	10
Green from NLO	124	152	197	187	660
Orange to NLO	107	100	140	40	387

In addition to the above, it is estimated you will ship the following tonnages:

Pilot Plant (ingots)	13	5	5	23
Dingots	15	15	15	45

Your delivery of billits for the Hanford cored slug program has been decreased from 528 billits per month to 336 billits per month starting April 1955.

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~~RESTRICTED DATA~~

This document contains restricted data as defined in the Atomic Energy Act of 1954. Its transmittal or the disclosure of its contents in any manner to an unauthorized person is prohibited.

SECRET

Mr. S. H. Anonsen

- 2 -

In my letter of January 28th it was requested that you work a maximum number of Sundays during February and March. Since the known delivery of virgin feeds through February indicates an overall shortage of about 50 tons under those estimated by the Raw Materials Division, there will not be sufficient quantities available to operate on Sundays.

It is understood that you will have revised cost estimates available in about one week so that new unit prices can be negotiated in about two weeks. In addition to the estimated costs of the products included in the schedule above, it is also desired to have costs available on processing the enriched WAPD order, the ionium process and also establish a price for UNH.

Very truly yours,

F. H. Belcher
Area Manager

cc: F. R. Dowling, ORO

Osterwald:ag

~~SECRET~~

a-4

Office Memorandum • UNITED STATES GOVERNMENT

TO : S. R. Sapirie, Manager, Oak Ridge Operations

DATE: MAY 12 1955

FROM : R. A. Foor, Assistant Chief, Administrative
Branch, St. Louis Area

SUBJECT: REQUEST FOR AMENDMENTS

SYMBOL: A:RAF

ATTENTION: Mr. J. R. Moore

Reference is made to our memorandum of May 6, 1955, and enclosures thereto, Subject: Request for Amendments.

On page 2, paragraph 1, reference is made to letter dated April 14, 1955, (copy attached) in which the contract administrator advised the Mallinckrodt Chemical Works of the production requirements under Contract No. W-14-108-eng-8 for the Second Third of the Calendar Year 1955. It is requested that the date of the letter be changed to March 24, 1955. Enclosed are 6 copies of the March 24th letter.

It is also requested that Copies 1 thru 6B of the April 14th letter, attached to our memorandum of May 6, 1955, be returned to this office for destruction.

R. A. Foor

R. A. Foor

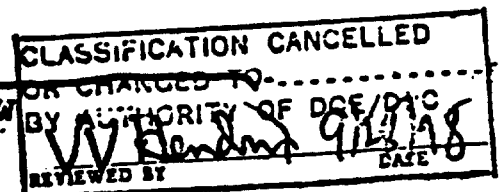
1 Enclosure --

Ltr. dtd March 24, 1955 - fm

J. P. Morgan to S. H. Anonsen, MCW

Copies 1 thru 6B

Foor:bmb



"When separated from inclosures, handle this document as Unclassified"
(insert proper classification)

"Document transmitted herewith contains RESTRICTED DATA"

SECRET

a-5

ORO 69650

15056

SECRET

COPY

COPY

UNITED STATES
ATOMIC ENERGY COMMISSION
ST. LOUIS, MISSOURI

ADDRESS REPLY TO:

THE AREA MANAGER
U. S. ATOMIC ENERGY COMMISSION
P.O. BOX 36, BREMEN STATION
ST. LOUIS 7, MISSOURI

THIS DOCUMENT CONSISTS OF 2 PAGES
NO. 1 OF 6 COPIES, SERIES B

and refer to:

March 24, 1955

Mr. S. H. Anonsen
Assistant Manager
Uranium Division
Mallinckrodt Chemical Works
65 Destrehan Street
St. Louis, Missouri

Subject: PRODUCTION REQUIREMENTS FOR SECOND THIRD OF CALENDAR
YEAR 1955

Dear Mr. Anonsen:

The production requirements for the second third of calendar year 1955
are as follows (all numbers are uranium basis):

	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>
QM-2	341	354	354	355
TA-7	338	348	348	365
IM-5 (virgin)	344	358	374	389
IM-5 (scrap)	5	5	5	61
Dingot or p.p. ingot	20	20	20	20
Dingot (recast)	0	35	35	35
Derby	5 tons for third			
Brown	1 ton for third			

In addition to your own production, sufficient green salt will be
shipped from National Lead of Ohio to meet the above metal require-
ments.

The Hanford cored slug program will require 50 billets per month.

You will receive 100 tons of Q-11 during May and June. It is planned
to transfer the processing of this material to Fernald on or before
July 1, 1955.

CLASSIFICATION CANCELLED
OR CONTINUED TO
BY AUTHORITY OF DOE
REVIEWED BY
DATE

a-6
SECRET

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as defined in the Atomic Energy Act of
1954. Its transmittal or disclosure to
its contents in any manner to an unautho-
rized person is prohibited.

SECRET

Mr. S. H. Anonsen

- 2 -

You will receive some Beaverlodge material in May only. Colorado material will be supplied at the rate of approximately 150 tons per month.

In addition to your own recycle material, the remaining material will be South African concentrate.

Very truly yours,

J. P. Morgan
Acting Area Manager

Osterwald:ag

~~SECRET~~

a-7

GENERAL STEEL CASTINGS CORPORATION

a-8

11.28

BRIGGS
CATALOG NO.
ARE TO BE
RIE M C P

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION
WELDON SPRING

pink PO copy

February 21, 1958

COPY

TO: Mr. J. P. O'Haire

FROM: C. M. Brownfield

SUBJECT: General Steel Castings Corporation Invoice #M-216

Req M-1196-D

We are submitting the attached invoice and requisition for payment without a purchase order because the requirement was completed prior to our receipt of the requisition.

Based on the cost of a previous contract this price is fair and equitable and should be paid as received.

C. M. Brownfield
Manager of Purchasing

CMB
/a

AB

PURCHASE ORDER

Acting under
U. S. Atomic Energy Commission
Cont. No. W-14-108-ENG-8

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION
P. O. Box 472
ST. CHARLES, MISSOURI

PURCHASE ORDER

TO

General Steel Casting Company
1417 State Street
Granite City, Illinois

U-5258-0

3-6-58

DATE

F.O.B.

ROUTING

DELIVERY
(BUYERS PLANT)

As Required

PLEASE SHIP THE FOLLOWING MATERIALS SUBJECT TO INSTRUCTIONS ON REVERSE SIDE, ATTACHED TERMS AND CONDITIONS, AND IN ACCORDANCE WITH YOUR QUOTE OF

Mr. G.K. Hobiltselle

MAIL THREE (3) COPIES OF YOUR INVOICE GIVING ITEM NUMBERS, DESCRIPTION, AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER.

TERMS

Net 30 days

ADDRESS ALL CORRESPONDENCE PERTAINING TO THIS ORDER TO THE ATTENTION OF L. L. Blumensky BUYER

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
			<p>Acquisition Numbers -- (H-1300-C (H-1199-C</p> <p>This order is to cover the services listed below for the period of March 1, 1958 through June 30, 1958</p> <p>(1) X-ray material as requested by Mallinckrodt Chemical Works, Uranium Division or Government owned X-ray Equipment.</p> <p>(2) General Steel Casting Co. will furnish film required for Betatron X-raying at actual cost. in 117 film at .917 sheet.</p> <p>(3) Furnish films showing result of X-ray. Mallinckrodt Chemical Works, Uranium Division will furnish forms on which to record time of services as to when started and completed. The invoices are to be issued on a monthly basis with time sheets attached.</p> <p>Betatron X-ray services will be conducted under the regular straight time shift, (Hours- 7:00 A.M. through 3:30 P.M. only).</p> <p>Mallinckrodt Chemical Works, Uranium Division will notify Mr. W.E. Davis of the schedule prior to time service is required. Mr. A.B. Urinkle and H.V. Schaffer are persons authorized to release against this order. Labor charges including overhead shall be \$16.00 per hour.</p> <p>Estimated monthly total \$500.00. Estimated Total \$2000.00</p>		

~~653 (2033-20) Tubes (Metallurgical)~~

a-10

STORES COPY

PURCHASER: MALLINCKRODT CHEMICAL WORKS
ORDER: URANIUM DIVISION

P.O. BOX 472
ST. CHARLES, MISSOURI

ACTING UNDER
UNITED STATES ATOMIC ENERGY COMMISSION
ORNL CONTRACT NO. W-14-103-ENG. 2 (AMERICAN TIG)

FOR YOUR INVOICE, ATTENTION:
TABLE, GIVING ITEM NUMBERS, DESCRIPTION,
BE EXACTLY AS SHOWN ON THIS ORDER.

PURCHASE ORDER NO.
U-52538-C No. 1

SHOW THIS NUMBER ON ALL INVOICES,
PACKAGES, BILLS OF LADING, AND
PACKING LIST.

REGISTRATION NO.
M-1326-C

DATE
6-12-58

General Steel Casting Company
1417 State Street
Granite City, Illinois

U. S. ATOMIC ENERGY COMMISSION
3 MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION U-52538-C No. 1

DELIVERY: * See Policy

FORM 1649-CA

PLEASE SHIP THE FOLLOWING MATERIALS SUBJECT TO INSTRUCTIONS ON REVERSE SIDE, ATTACHED TERMS AND CONDITIONS, AND IN ACCORDANCE WITH YOUR BID #2

ADDRESS CORRESPONDENCE ATTENTION

L.L. Alexander, Buyer

TERMS
Net 30 days

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
			<p>This change order is issued to extend the effective expiration date of this order through 10-31-58.</p> <p>All other terms with the exception of the estimated total are to remain as shown on the original order.</p> <p style="text-align: right;">Original Est. Total Addition (Est.) Revised Est. Total</p> <p style="text-align: right;">\$2000.00 1300.00 \$3800.00</p> <p>* Material that is to be X-Rayed will be delivered to General Steel Casting Company, 1417 State Street Granite City, Illinois, by Mallinckrodt Chemical Works, Uranium Division personnel. X-Ray film is to be delivered to MCH personnel by General Steel Casting Company on arrival at using site.</p> <p>6-5-3 (31035-310) Follows Metallurgical</p>		

APPROVED: U.S. ATOMIC ENERGY COMMISSION

L.G. Fair
Authorized Representative

a-11
W.P. J...
...

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION

Carl Brown
MANAGER OF PURCHASING

LIA:18

PURCHASE ORDER
MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 P. O. BOX 472
 ST. CHARLES, MISSOURI
 ACTING UNDER
 UNITED STATES ATOMIC ENERGY COMMISSION
 PRIME CONTRACT NO. W-14-103-ENG. 8 (AMENDMENT 115)

PLEASE TAKE NOTE OF YOUR INVOICE, ATTENTION
 ACCOUNTS PAYA GIVING ITEM NUMBERS, DESCRIPTION,
 AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER.

PURCHASE ORDER NO. U-52538-C, No. 2
SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, AND PACKING LIST.

EXECUTION NO. H-1326-C
DATE 10/6/58

TO **General Steel Casting Corporation**
 1417 State Street
 Granite City, Illinois

SHIP TO **U.S. ATOMIC ENERGY COMMISSION**
 5 MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION - U-52538-C
 DELIVERY: As Required

FORM 1240-2A

PLEASE SHIP THE FOLLOWING MATERIALS SUBJECT TO INSTRUCTIONS ON REVERSE SIDE, ATTACHED TERMS AND CONDITIONS, AND IN ACCORDANCE WITH YOUR BID OF	ADDRESS CORRESPONDENCE ATTENTION L. L. Alexander, Buyer
F.O.B.	ROUTING

TERMS Net 30 days

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
			This change order issued to add the following to paragraph two of the original order: ADD 4 1/2 x 17" Film at \$.30 per sheet Reason: To include additional film size necessary for the accomplishment of the services. All other terms and conditions remain the same as shown on original order and alteration No. 1		
			Original Total		3300.00
			No Change		
			Revised Est. Total		<u>3380.00</u>
	6-3-3		(31033-410) Fellows, Metallurgical		

a-12

MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 BY *[Signature]*
 MANAGER OF PURCHASING

July 10, 1958

TO: Mr. J. P. O'Haire
FROM: C. M. Brownfield
SUBJECT: GENERAL STEEL CASTINGS INVOICE # M-216

We are submitting the attached invoice and requisition for payment without a purchase order in that the requirement was completed prior to our receipt of the requisition.

Based on the cost of a previous contract, this price is fair and equitable and should be paid as received.

General Steel Casting	Requisition # M-1196	\$48.00
-----------------------	----------------------	---------

C.M. Brownfield,
Manager of Purchasing

CMB/RDD/a

So.
this was posted Feb '58, but ltr
never went through. Post again as of this date (7/10)
+ file w/pink

URANIUM DIVISION P.O. BOX 472 ST. CHARLES, MISSOURI

ACTING DIRECTOR UNITED STATES ATOMIC ENERGY COMMISSION PRIME CONTRACT NO. W-14-108-ENG. 8 (AMENDMENT 115)

PURCHASE ORDER NO. U-57809-M SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, AND PACKING LIST.

REQUISITION NO. M-1477-M

DATE 10/13/58

General Steel Castings Corp. 1417 State Street Granite, City, Illinois

U. S. ATOMIC ENERGY COMMISSION 2 MALLINCKRODT CHEMICAL WKS. URANIUM DIVISION - U-57809-M DELIVERY: As required

FORM 1649-2A

PLEASE SHIP THE FOLLOWING MATERIALS SUBJECT TO INSTRUCTIONS ON REVERSE SIDE, ATTACHED TERMS AND CONDITIONS, 10/10/58 ADDRESS CORRESPONDENCE ATTENTION: W. M. Bortosky, Buyer

P.O. NO. REFERENCE TERMS Net 30 days

Table with columns: ITEM NO., QUANTITY, UNIT, DESCRIPTION, UNIT PRICE, AMOUNT. Description includes: Order is issued to cover services specified below for the period November 1, 1958 through June 30, 1959. Scope: A) X-Ray material as requested by Mallinckrodt Chemical Works, Uranium Division, on Government owned X-Ray Equipment. B) Vendor shall furnish all film required for Betatron X-raying at actual procurement cost as follows: 14" x 17" \$.915 per sheet 4 1/2" x 17" .30 per sheet C) Labor charges including operation, maintenance and all overhead shall be billed at \$16.00 per hour. D) Furnish films showing results of X-Ray. E) Mallinckrodt shall furnish forms on which time of commencement and termination of service shall be recorded. This time record shall be included with all monthly billings. F) Service shall be conducted during normal work hours only (7:00 AM through 3:30 PM Monday through Friday, Holidays excluded). G) Work shall be scheduled with Mr. W.E. Davis of General Steel Castings prior to time work is required. Service shall be authorized only by Mr. R.B. Brinkley and/or W.M. Bortosky of Mallinckrodt. Estimated Monthly Total 450.00 (30008-410-30) Unnerstain, Nat. Dev. (Estimated Total 3600)

APPROVED: U.S. ATOMIC ENERGY COMMISSION [Signature] Authorized Representative

a-14 [Handwritten notes]

MALLINCKRODT CHEMICAL WORKS URANIUM DIVISION [Signature] MANAGER OF PURCHASING

U. S. Atomic Energy Commission
Contract No. W-31-109-ENG-35 (SHEET 214)

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION
P.O. BOX 472
ST. CHARLES, MISSOURI

ORDER NO

U-57809-M

10/13/58

DATE

ITEM No.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
			<p>*Material that is to be X-Rayed will be delivered to General Steel Casting Company, 1417 State Street Granite City, Illinois, by Mallinckrodt Chemical Works, Uranium Division personnel. X-Ray film is to be delivered to HCN personnel by General Steel Casting Company on arrival at using site.</p>		

Handwritten: a-15

Handwritten signature: [Signature]

a-15

R.B./uls

PURCHASE ORDER
MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION
P.O. BOX 172, ST. CHARLES, MISSOURI

ACTING UNDER
UNITED STATES ATOMIC ENERGY COMMISSION
PRIME CONTRACT NO. W-14-108 ENG. 8 (AMENDMENT 118)

TO: General Steel Castings Corp.
1417 State Street
Granite City, Illinois

SHIP TO: U. S. ATOMIC ENERGY COMMISSION
% MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION
Weldon Spring, Missouri

DATE	-59	PURCHASE ORDER NO.	U-57809-V. Alt. #1
SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, PACKING SLIPS.			
REQUIRED DELIVERY DATE:		As Required	

FORM 1640-2A REV. 12-58
F.O.B.

ROUTING

TERMS
Net 30 Days

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
			7-5-3	<p>Change Order is issued to provide for use of 8" x 10" X-Ray film and to revise Mallinckrodt Personnel authorized to release work.</p> <p><u>ADD</u></p> <p>8" x 10" Film</p> <p>Services shall be authorized by Messrs. Unnerstall, R. B. Wrinkle and G. Kerr and/or W. K. Bortosky.</p> <p><u>REASON FOR CHANGE:</u></p> <p>To authorize use of 8" x 10" X-Ray film in addition to that specified by original order and to allow for additional MCW employees to authorize service.</p> <p>Unnerstall - Nat. Dev. Bldg. 404</p>	.35 Per Sheet

IMPORTANT INSTRUCTIONS & INFORMATION



GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
	DEPT.	EXP.	
	410	30	3000S

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 144.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER
THIS IS A DEFENSE RATED ORDER - PRIORITY - A DO-E-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS (

), TERMS AND CON-

ADDRESS CORRESPONDENCE ATTENTION

DITIONS () AND IN ACCORDANCE WITH YOUR BID OF

5/7/59

W. M. Bortosky

BUYER

APPROVED: U. S. ATOMIC ENERGY COMMISSION

a-16 MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION

Authorized Representative

MANAGER OF PURCHASING

VENDOR FILE

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION

PA. 2 OF 2	
DATE 6/26/59	PURCHASE ORDER NO U-55125-M

FORM 1640 2B REV 12-58

CONTINUATION SHEET

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
				<p>F) Service shall be conducted during normal work hours only (7:00 AM through 3:30 PM Monday through Friday, Holidays excluded).</p> <p>G) Works shall be scheduled with Mr. W.E. Davis of General Steel Castings prior to time work is required. Service shall be authorized culy by Mr.G.Kerr, Mr.L.A.Understall,Mr.V. Griffey, Mr.R.B.Wrinkle and/or W.M. Bortosky of Mallinckrodt.</p> <p>* Material that is to be X-Rayed will be delivered to General Steel Castings Company, 1417 State Street, Granite City, Illinois by Mallinckrodt Chemical Works, Uranium Division personnel. X-Ray film is to be delivered to MCW personnel by General Steel Casting Company on arrival at using site.</p>	
(Est. Monthly Total 450)					
7-5-3-	J. Hansen-Bldg.	404	(Est. Total 7200)		

IMPORTANT INSTRUCTIONS & INFORMATION

GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
	DEPT.	EXP.	
	410	30	30008 AJW

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 144.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A DO-E-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, TERMS AND CONDITIONS, 6591 AND IN ACCORDANCE 6/25/59 ADDRESS CORRESPONDENCE ATTENTION W.M. Bortosky BUYER

APPROVED: U.S. ATOMIC ENERGY COMMISSION
A.A. Fear
Authorized Representative

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION
BY *W.M. Bortosky*
MANAGER OF PURCHASING

:ab

Page 1 of 2

PURCHASE ORDER CHANGE ORDER
MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 P.O. BOX 472, ST. CHARLES, MISSOURI

ACTING UNDER
 UNITED STATES ATOMIC ENERGY COMMISSION
 PRIME CONTRACT NO. W-14-109 ENG. 8 (AMENDMENT 115)

TO:

General Steel Castings Corporation
 1417 State Street
 Granite City, Illinois

SHIP TO:

U. S. ATOMIC ENERGY COMMISSION
 3 MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 U-55125-N CO#1
 See Below *

SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, PACKING SLIPS

DATE	PURCHASE ORDER NO.
8/6/59	U-55125-N CO#1
REQUIRED DELIVERY DATE:	As Required

FORM 1419-2A REV. 12-58
 F.O.B.

Unchanged				ROUTING	Unchanged		TERMS	Unchanged	
ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION			UNIT PRICE		
				Change Order is issued to revise Paragraph #B of Scope. <u>DID READ:</u> Vendor shall furnish all film required for Betatron X-Raying at actual procurement cost as follows: 8"x10" .35 per sheet 4-1/2"x17" .30 per sheet 14"x17" .915 per sheet <u>SHOULD READ</u> 8"x10" .352 per sheet 4-1/2"x17" .330 per sheet 14"x17" .998 per sheet 7"x17" .512 per sheet Only film cost is revised. Labor charge and all other terms and conditions remain as originally shown.					

MALLINCKRODT CHEMICAL WORKS

URANIUM DIVISION

P.O. CONTINUATION SHEET

AGE 2 OF 2

DATE 8/6/59

PURCHASE ORDER NO. U-55125-M CO

FORM 1640.2B REV 12-58

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
				<p>REASON FOR CHANGE: To add provision for use of 7"x17" size film and revise schedule of cost in accordance with vendor's letter of 7-6-59.</p> <p>⇒ Material that is to be X-Rayed will be delivered to General Steel Castings Company, 1417 State Street, Granite City, Illinois by Mallinckrodt Chemical Works, Uranium Division personnel X-Ray film is to be delivered to MCW personnel by General Steel Casting Company on arrival at using site.</p>	
				7-5-3- J.Hansen-Bldg.404	

IMPORTANT INSTRUCTIONS & INFORMATION

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 144.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A DO-E-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
	DEPT.	EXP.	
	410	30	30008 AJW

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, TERMS AND CONDITIONS, AND IN ACCORDANCE WITH YOUR BIO OF 6591

a-20

ADDRESS CORRESPONDENCE ATTENTION W.M. Bortosky BUYER

APPROVED: U.S. ATOMIC ENERGY COMMISSION
 BY: *R.A. Foor*
 Authorized Representative

MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 BY: *[Signature]*
 MANAGER OF PURCHASING

WHE

FURC ORDER Change Order 2
MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION
P.O. BOX 472, ST. CHARLES, MISSOURI

ACTING UNDER
UNITED STATES ATOMIC ENERGY COMMISSION
PRIME CONTRACT NO. W-14-108 ENG. 9 (AMENDMENT 115)

USE THIS NUMBER ON ALL INVOICES, BILLS OF LADING, PACKING SLIPS	
DATE 10-9-59	PURCHASE ORDER NO. U-55125-M CO 2
REQUIRED DELIVERY DATE: As Required	

TO: General Steel Castings Corporation
1417 State Street
Granite City, Illinois

SHIP TO:

U. S. ATOMIC ENERGY COMMISSION
MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION U-55125-M CO 2
Unchanged

FORM 1640.2A REV. 12-58
F.O.B.

Unchanged

ROUTING

Unchanged

TERMS

Unchanged

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
			7-5-3	<p>Change order issued to arrange for additional Mallinckrodt personnel to release.</p> <p><u>ADD:</u></p> <p>In addition to above personnel, service shall be authorized by Mr. J. Hansen of Mallinckrodt.</p> <p>REASON: To allow for release by Mr. J. Hansen</p> <p>Only personnel authorized to release is revised. All other terms and conditions remain as originally shown.</p>	
				Hansen, Deliver: 404	

IMPORTANT INSTRUCTIONS & INFORMATION

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 144.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A DO-R-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, TERMS AND CONDITIONS, WITH YOUR BID OF 6591 AND IN ACCORDANCE

ADDRESS CORRESPONDENCE ATTENTION

W. M. Bortolky, BUYER

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION

BY *[Signature]*
MANAGER OF PURCHASING

a-21

PURCHASE ORDER
MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 P.O. BOX 472, ST. CHARLES, MISSOURI

ACTING UNDER
 UNITED STATES ATOMIC ENERGY COMMISSION
 PRIME CONTRACT NO. W-74-103 ENG. 8 (AMENDMENT 121)

TO: **General Steel Industries, Inc.**
 1417 State St.
 Granite City, Illinois

SHIP TO:

U. S. ATOMIC ENERGY COMMISSION
 5 MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION U-83621-F
 Weldon Spring, Missouri

SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, PACKING SLIPS	
DATE 6-5-62	PURCHASE ORDER NO. U-83621-F
REQUIRED DELIVERY DATE: 6-15-62 AT DESTINATION	

FORM 1440-2A REV. 12-58
 P.O.B.

Granite City, Ill.

ROUTING

Bee Line c/o Triangle

TERMS
 1/2% 10 Days, Net 30 Days

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
1	Approx. 50 (1 ea.)	lb.	E-360-402-9	Piston Rod, per MCW Sketch 3604-16, estimated rough weight 50#, material Austenitic Manganese Steel ASTM A-128-33	.70/ per lb
2	1	ea.		Pattern, per MCW Sketch 3604-16	120.00

Tagging Instructions:
 Engineering Project 22-360-402
 Breakout Machine
 Attention: R. W. Aubert

Handwritten: 22-2120
 R.W. Aubert

6-5-3 Aubert - Deliver to W.S. Stores. (155)

IMPORTANT INSTRUCTIONS & INFORMATION

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 134.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A CO-E-2 RATING CERTIFIED UNDER OAS REGULATION NO. 1 APPLIES TO THIS ORDER

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, TERMS AND CONDITIONS, AND IN ACCORDANCE WITH YOUR BID OF 6589

GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
	DEPT.	EXP.	
2320			22-360-402 II

ADDRESS CORRESPONDENCE ATTENTION
 5-29-62 R. McCormick BUYER

MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 BY *[Signature]*
 PURCHASING Agent

a-22

MB/lms

PURCHASE ORDER
MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION,
P.O. BOX 472, ST. CHARLES, MISSOURI

ACTING UNDER
UNITED STATES ATOMIC ENERGY COMMISSION
PRIME CONTRACT NO. W-14-103 ENG. 8 (AMENDMENT 115)

TO: **General Steel Castings Corporation**
1417 State Street
Granite City, Illinois

SHIP TO:

U. S. ATOMIC ENERGY COMMISSION
% MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION U-00045-M

* See Below

SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, PACKING/SLI	
DATE 6-17-60	PURCHASE ORDER U-00045-M
REQUIRED DELIVERY DATE: *As Required	

FORM 1840-2A REV. 12-58
F.O.B.

ROUTING

TERMS

Net 30 Days

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PR										
			M-1962-M	<p>Order is issued to cover services specified below for the period July 1, 1960 thru June 30, 1961.</p> <p>SCOPE:</p> <p>(A) X-Ray material, as requested, by Mallinckrodt Chemical Works, Uranium Division, on Government owned, Betatron X-Ray equipment.</p> <p>(B) Vendor shall furnish all film required for X-Raying at actual procurement cost as follows:</p> <table border="1"> <thead> <tr> <th>SIZE</th> <th>PRICE</th> </tr> </thead> <tbody> <tr> <td>4-1/2" x 17"</td> <td>.330 per sheet</td> </tr> <tr> <td>8" x 10"</td> <td>.352 per sheet</td> </tr> <tr> <td>14" x 17"</td> <td>.998 per sheet</td> </tr> <tr> <td>7" x 17"</td> <td>.512 per sheet</td> </tr> </tbody> </table> <p>(C) Labor charges including operation, maintenance and all overhead shall be billed at \$16.00 per hour.</p> <p>(D) Vendor shall furnish film showing results of completed X-Rays.</p> <p>(E) Mallinckrodt shall furnish forms on which time of commencement and termination of service shall be recorded. This time record shall be included with all monthly billings.</p> <p>(F) Service shall be conducted during normal work hours only 7:00 AM through 3:30 PM, Monday through Friday, (Holidays excluded).</p> <p>(G) Work shall be scheduled with Mr. W. E. Davis of General Steel Castings, prior to time work is required. Service shall be authorized only by</p>	SIZE	PRICE	4-1/2" x 17"	.330 per sheet	8" x 10"	.352 per sheet	14" x 17"	.998 per sheet	7" x 17"	.512 per sheet	
SIZE	PRICE														
4-1/2" x 17"	.330 per sheet														
8" x 10"	.352 per sheet														
14" x 17"	.998 per sheet														
7" x 17"	.512 per sheet														

MALLINCKRODT, CHEMICAL WORKS
URANIUM DIVISION

SE 2 OF 2	
DATE 6-17-60	PURCHASE ORDER NO. U-00045-M

FORM 1640 2B REV 12-58

P.O. CONTINUATION SHEET

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
				<p>Mr. J. Hansen, Mr. R. Rucker, Mr. M. Schafer, Mr. L. Unnerstall, adn/or Mr. G. Kerr of Mallinckrodt.</p> <p>*Material that is to be X-Rayed will be delivered to General Steel Castings Company, at 1417 State Street, Granite City, Illinois, by Mallinckrodt personnel. X-Ray film to be used shall be delivered to Mallinckrodt personnel by General Steel Castings Company, on arrival at using site.</p> <p>Paragraph 33 of the attached Terms and Conditions are hereby made a definite part of this Purchase Order.</p>	
			7-5-3	Hansen-Bldg 301-Met. Tech.	

(estimate monthly total(450))

IMPORTANT INSTRUCTIONS & INFORMATION

GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
	DEPT.	EXP.	
	410	30	58000 WQ

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 164.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A DO-E-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, TERMS AND CONDITIONS, AND IN ACCORDANCE WITH YOUR BID OF

a-24

ADDRESS CORRESPONDENCE ATTENTION

APPROVED BY: U.S. ATOMIC ENERGY COMMISSION

H. M. Bortosky, BUYER

R. A. Fear

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION

BY *W. M. Brownfield*

Authorized Representative

MANAGER OF PURCHASES

WMB

RA:JG

PURCH E ORDER
MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION
P.O. BOX 472, ST. CHARLES, MISSOURI

ACTING UNDER
UNITED STATES ATOMIC ENERGY COMMISSION
PRIME CONTRACT NO. W-74-168 ENG. 8 (AMENDMENT 121)

TO: General Steel Industries, Inc.
1417 State Street
Granite City
Illinois

SHIP TO:

U. S. ATOMIC ENERGY COMMISSION
% MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION U-00211-M
* See Below

SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, PACKING SLIPS	
DATE 7-14-61	PURCHASE ORDER NO. U-00211-M
REQUIRED	AS Required
DELIVERY DATE: 7-1-61 thru 6-30-62	

FORM 1549-2A REV. 12-58
F.O.B.

ROUTING

TERMS

Net 30 Days

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE										
			UW-3491-M	<p>This purchase order is issued to cover services specified below for the period of July 1, 1961, through June 30, 1962.</p> <p>SCOPE</p> <p>A. X-Ray material, as requested by Mallinckrodt Chemical Works, Uranium Division, on Government owned Betatron X-Ray equipment.</p> <p>B. Vendor shall furnish all film required for X-raying at actual procurement cost as follows:</p> <table border="0"> <tr><td>SIZE</td><td>PRICE</td></tr> <tr><td>4-1/2" x 17" Film</td><td>.330 per sheet</td></tr> <tr><td>8" x 10" Film</td><td>.345 per sheet</td></tr> <tr><td>7" x 17" Film</td><td>.502 per sheet</td></tr> <tr><td>14" x 17" Film</td><td>1.035 per sheet</td></tr> </table> <p>C. Labor charges including operation and maintenance and all overhead shall be billed at \$16.00 per hour.</p>	SIZE	PRICE	4-1/2" x 17" Film	.330 per sheet	8" x 10" Film	.345 per sheet	7" x 17" Film	.502 per sheet	14" x 17" Film	1.035 per sheet	
SIZE	PRICE														
4-1/2" x 17" Film	.330 per sheet														
8" x 10" Film	.345 per sheet														
7" x 17" Film	.502 per sheet														
14" x 17" Film	1.035 per sheet														

a-25

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION

P.O. CONTINUATION SHEET

FORM 1440 25 REV 12-59

PAGE 2 OF 2	
DATE 7-14-61	PURCHASE ORDER NO. U-00211-M

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
			7-5-3	<p>D. MW shall furnish forms on which time of commencement and termination of service shall be recorded. This time record shall be included with all monthly billings.</p> <p>E. Vendor shall furnish film showing results of X-Rays.</p> <p>F. Services shall be conducted during normal work hours only, 7:00 AM through 3:30 PM, Monday through Friday (Holidays excluded).</p> <p>G. Work shall be scheduled with Mr. W. E. Davis of Granite Steel Industries, prior to time work is required. Services shall be authorized by: Mr. J. Hansen R. Rucker M. Schafer L. Unnerstall G. Kerr of Mallinckrodt Chemical Works, Uranium Division.</p> <p>* Material to be X-rayed will be delivered to General Steel Industries, Inc. at 1417 State Street, Granite City, Illinois, by Mallinckrodt Chemical Works, Uranium Division personnel. X-ray film to be used shall be delivered to Mallinckrodt Chemical Works, Uranium Division personnel by General Steel Industries, Inc., on arrival at using site.</p> <p>Paragraph 33 of the attached Terms and Conditions are hereby made a part of this purchase order.</p> <p>This purchase order is not to exceed \$7000.00 without prior written approval by Mallinckrodt Chemical Works Purchasing Department, Mr. C. M. Brownfield.</p> <p style="text-align: right;">(Est 7000)</p>	

IMPORTANT INSTRUCTIONS & INFORMATION	GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
		DEPT.	EXP.	
		410	80	56000 AJW

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 144.020

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A DC-E-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, TERMS AND CONDITIONS, WITH YOUR RIO OF 6591	AND IN ACCORDANCE 6-14-61	ADDRESS CORRESPONDENCE ATTENTION R. Adamson, BUYER
APPROVED: U. S. ATOMIC ENERGY COMMISSION a-26	BY: <i>R. A. Foss</i> Authorized Representative	MALLINCKRODT CHEMICAL WORKS URANIUM DIVISION BY: <i>C. M. Brownfield</i> MANAGER OF PURCHASING

MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 P.O. BOX 472, ST. CHARLES, MISSOURI

ACTING UNDER
 UNITED STATES ATOMIC ENERGY COMMISSION
 PRIME CONTRACT NO. W-14-103 ENG. 3 (AMENDMENT 121)

TO: General Steel Industries, Inc.
 1417 State Street
 Granite City
 Illinois

SHIP TO:

U. S. ATOMIC ENERGY COMMISSION
 MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION U-00339-M

*See Below

SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, PACKING SLIPS	
DATE 7-16-62	PURCHASE ORDER NO. U-00339-M
REQUIRED AS REQUIRED DELIVERY DATE: 7-1-62 thru 6-30-63	

FORM 1949-2A REV. 12-58
 F.O.B.

ROUTING

TERMS

Net 30 Days

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE										
			MO-1274	<p>This purchase order is issued to cover services specified below for the period of July 1, 1962, through June 30, 1963.</p> <p>SCOPE</p> <p>A. X-Ray material, as requested by Mallinckrodt Chemical Works, Uranium Division, on Government owned Betatron X-Ray equipment.</p> <p>B. Vendor shall furnish all film required for x-raying at actual procurement cost as follows:</p> <table border="0"> <tr> <td>SIZE</td> <td>PRICE</td> </tr> <tr> <td>4-1/2" x 17" Film</td> <td>.485 per sheet</td> </tr> <tr> <td>8" x 10" Film</td> <td>.334 per sheet</td> </tr> <tr> <td>7" x 17" Film</td> <td>.485 per sheet</td> </tr> <tr> <td>14" x 17" Film</td> <td>.946 per sheet</td> </tr> </table> <p>C. Labor charges including operation and maintenance and all overhead shall be billed at \$16.00 per hour.</p> <p>D. MCW shall furnish forms on which time of commencement and termination of service shall be recorded. This time record shall be included with all monthly billings.</p>	SIZE	PRICE	4-1/2" x 17" Film	.485 per sheet	8" x 10" Film	.334 per sheet	7" x 17" Film	.485 per sheet	14" x 17" Film	.946 per sheet	
SIZE	PRICE														
4-1/2" x 17" Film	.485 per sheet														
8" x 10" Film	.334 per sheet														
7" x 17" Film	.485 per sheet														
14" x 17" Film	.946 per sheet														

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION

P.O. CONTINUATION SHEET

FORM 1040 28 REV 12-58

PAGE	2 OF 2	PURCHASE ORDER NO.
DATE	7-16-62	U-00339-M

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
			7-5-3	<p>E. Vendor shall furnish film showing results of X-Rays.</p> <p>F. Services shall be conducted during normal work hours only, 7:00 A.M. through 3:30 P.M. Monday through Friday (Holidays excluded).</p> <p>G. Work shall be scheduled with Mr. W. E. Davis of Granite Steel Industries, prior to time work is required. Services shall be authorized by: Mr. J. Hansen E. Rucker M. Schafer L. Unerstall G. Kerr of Mallinckrodt Chemical Works, Uranium Division.</p> <p>* Material to be X-rayed will be delivered to General Steel Industries, Inc. at 1417 State Street, Granite City, Illinois, by Mallinckrodt Chemical Works, Uranium Division personnel. X-ray film to be used shall be delivered to Mallinckrodt Chemical Works, Uranium Division personnel by General Steel Industries, Inc., on arrival at using site.</p> <p>Paragraph 33 of the attached Terms and Conditions are hereby made a definite part of this purchase order.</p> <p>This purchase order is not to exceed \$2000.00 without prior written approval by Mallinckrodt Chemical Works Purchasing Department, Mr. O. L. Luthenauer, Purchasing Agent.</p> <p style="text-align: right;">(Est. 2000)</p>	

IMPORTANT INSTRUCTIONS & INFORMATION

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 144.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A 00-E-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, TERMS AND CONDITIONS, AND IN ACCORDANCE WITH YOUR BID OF 6591

GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
	DEPT.	EXP.	
	351	30	AJH

ADDRESS CORRESPONDENCE ATTENTION
 W. H. Kortosky, BUYER
 MALLINCKRODT CHEMICAL WORKS, URANIUM DIVISION
 BY *[Signature]*
 MANAGER OF PURCHASING

APPROVED BY: U. S. ATOMIC ENERGY COMMISSION
[Signature]
 Authorized Representative

6-14-62
 a-28

MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 P.O. BOX 472, ST. CHARLES, MISSOURI

ACTING UNDER
 UNITED STATES ATOMIC ENERGY COMMISSION
 PRIME CONTRACT NO. W-14-109 ENG. 3 (AMENDMENT 121)

TO: General Steel Industries, Inc.
 1417 State St.
 Granite City, Illinois

THIS NUMBER ON ALL INV PACKETS, BILLS OF LADING, PACK	
DATE	PURCHASE
10/5/62	U-00339-
REQUIRED DELIVERY DATE: Unchanged	

U. S. ATOMIC ENERGY COMMISSION
 MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION U-00339-1

FORM 1840-2A REV. 12-58
 F.O.B.

Unchanged				ROUTING	TERMS
ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	Net 30 days
				Change Order is issued to ADD the name of below shown Mallinckrodt representative to those presently authorized to release against this purchase order: <u>ADD:</u> G. Mr. C. Daniels Original Est. Total 2000 Net Revision -1 Revised Est. Total 2000. Reason For Change: To provide authority for additional personnel to release service. 7-5-3	

IMPORTANT INSTRUCTIONS & INFORMATION

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 144.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A DO-E-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, TERMS AND CONDITIONS, AND IN ACCORDANCE WITH YOUR BID OF

APPROVED: U.S. ATOMIC ENERGY COMMISSION
 [Signature]
 Authorized Representative

GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
	DEPT.	EXP.	
	351	30	

6591
 10/5/62
 ADDRESS CORRESPONDENCE ATTENTION
 W. M. Bortosky BUYER
 MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 BY [Signature]
 MANAGER OF PURCHASING

a-29

ums

PURCHASE ORDER
MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 P.O. BOX 472, ST. CHARLES, MISSOURI

ACTING UNDER
 UNITED STATES ATOMIC ENERGY COMMISSION
 PRIME CONTRACT NO. W-14-109 ENG. 8 (AMENDMENT 121)

TO: General Steel Industries, Inc.
 1417 State Street
 Granite City, Illinois

SHIP TO:

SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, PACKING SLIPS

DATE 5/9/63

PURCHASE ORDER NO. U-00399-M

REQUIRED DELIVERY DATE: As Required

U. S. ATOMIC ENERGY COMMISSION
 5 MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION U-00399-M

FORM 1540-1A REV. 12-55
 F.O.B.

Not Applicable

ROUTING

Not Applicable

TERMS

Net 30 days

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE										
			MO 1512	<p>This purchase order is issued to cover services specified below for the period of July 1, 1963 through June 30, 1964.</p> <p><u>SCOPE</u></p> <p>A. X-ray material, as requested by Mallinckrodt Chemical Works, Uranium Division, on Government owned Betatron X-ray equipment.</p> <p>B. Vendor shall furnish all film required for x-raying at actual procurement cost as follows:</p> <table border="0"> <thead> <tr> <th><u>SIZE</u></th> <th><u>PRICE</u></th> </tr> </thead> <tbody> <tr> <td>4-1/2" x 17" film</td> <td>.345 per sheet</td> </tr> <tr> <td>8" x 10" film</td> <td>.364 per sheet</td> </tr> <tr> <td>7" x 17" film</td> <td>.528 per sheet</td> </tr> <tr> <td>14" x 17" film</td> <td>1.035 per sheet</td> </tr> </tbody> </table> <p>C. Labor charges including operation and maintenance and all overhead shall be billed at \$16.00 per hour.</p> <p>D. MCW shall furnish forms on which time of commencement and termination of service shall be recorded. This time record shall be included with all monthly billings.</p>	<u>SIZE</u>	<u>PRICE</u>	4-1/2" x 17" film	.345 per sheet	8" x 10" film	.364 per sheet	7" x 17" film	.528 per sheet	14" x 17" film	1.035 per sheet	
<u>SIZE</u>	<u>PRICE</u>														
4-1/2" x 17" film	.345 per sheet														
8" x 10" film	.364 per sheet														
7" x 17" film	.528 per sheet														
14" x 17" film	1.035 per sheet														

2-30

MALLINCKRODT CHEMICAL WORKS

URANIUM DIVISION

P.O. CONTINUATION SHEET

PAGE 2 OF 2	
DATE 5/9/63	PURCHASE ORDER NO. U-00399-M

FORM 1040 2B REV 12-62

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
			7-5-3	<p>Hartmann (Est. 450)</p> <p>E. Vendor shall furnish film showing results of X-rays.</p> <p>F. Services shall be conducted during normal work hours only, 7:00 AM through 3:30 PM, Monday through Friday (holidays excluded).</p> <p>G. Work shall be scheduled with Mr. W. E. Davis of Granite Steel Industries, prior to time work is required. Services shall be authorized by:</p> <p style="padding-left: 40px;">C. Daniels J. Hansen R. Rucker M. Schafer L. Unerstall G. Kerr</p> <p>of Mallinckrodt Chemical Works, Uranium Division.</p> <p>Material to be x-rayed shall be delivered to General Steel Industries, Inc. at 1417 State Street, Granite City, Illinois, by Mallinckrodt Chemical Works, Uranium Division personnel. X-ray film to be used shall be delivered to Mallinckrodt Chemical Works, Uranium Division personnel by General Steel Industries, Inc., on arrival at using site.</p> <p>Paragraph 33 of the attached Terms and Conditions is hereby made a definite part of this purchase order.</p> <p>This purchase order is not to exceed \$450.00 without prior written approval by Mallinckrodt Chemical Works, Purchasing Department, Mr. O. L. Luthenauer, Purchasing Agent.</p>	

IMPORTANT INSTRUCTIONS & INFORMATION

GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
	DEPT.	EXP.	
	351	30	AJW

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 144.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A DO-E-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, 6391 AND IN ACCORDANCE WITH YOUR BID OF 5/8/63

ADDRESS CORRESPONDENCE ATTENTION W. M. Bortosky BUYER

APPROVED: U.S. ATOMIC ENERGY COMMISSION

Authorized Representative

a-31 MALLINCKRODT CHEMICAL WORKS URANIUM DIVISION BY O. L. Luthenauer MANAGER OF PURCHASING

PURCHASE ORDER
MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION
 P.O. BOX 472, ST. CHARLES, MISSOURI

ACTING UNDER
 UNITED STATES ATOMIC ENERGY COMMISSION
 PRIME CONTRACT NO. W-14-108 ENG. 8 (AMENDMENT 121)

TO: **General Steel Industries, Inc.**
 1417 State Street
 Granite City, Illinois

SHIP TO:

SHOW THIS NUMBER ON ALL INVOICES, PACKAGES, BILLS OF LADING, PACKING SLIPS	
DATE 5/20/64	PURCHASE ORDER NO. U-00497-M
REQUIRED DELIVERY DATE: As Required	

U. S. ATOMIC ENERGY COMMISSION
 MALLINCKRODT CHEMICAL WORKS
 URANIUM DIVISION U-00497-M

FORM 1040-2A REV. 12-55
 F.O.B.

Not Applicable				ROUTING	Not Applicable		TERMS										
							Net 30 days										
ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION			UNIT PRICE										
			DN 2382	This purchase order is issued to cover services specified below for the period July 1, 1964 through June 30, 1965. <u>SCOPE</u> A. X-ray material, as requested by Mallinckrodt Chemical Works, Uranium Division, on Government owned Betatron X-ray equipment. B. Vendor shall furnish all film required for x-raying at actual procurement cost as follows: <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;"><u>SIZE</u></td> <td style="text-align: center;"><u>PRICE</u></td> </tr> <tr> <td>4-1/2" x 17" film</td> <td>.325 per sheet</td> </tr> <tr> <td>8" x 10" film</td> <td>.339 per sheet</td> </tr> <tr> <td>7" x 17" film</td> <td>.494 per sheet</td> </tr> <tr> <td>14" x 17" film</td> <td>.963 per sheet</td> </tr> </table> C. Labor charges including operation and maintenance and all overhead shall be billed at \$16.00 per hour. D. MCW shall furnish forms on which time of commencement and termination of service shall be recorded. This time record shall be included with all monthly billings.			<u>SIZE</u>	<u>PRICE</u>	4-1/2" x 17" film	.325 per sheet	8" x 10" film	.339 per sheet	7" x 17" film	.494 per sheet	14" x 17" film	.963 per sheet	
<u>SIZE</u>	<u>PRICE</u>																
4-1/2" x 17" film	.325 per sheet																
8" x 10" film	.339 per sheet																
7" x 17" film	.494 per sheet																
14" x 17" film	.963 per sheet																

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION

2 OF 2	
DATE 5/20/64	PURCHASE ORDER NO. U-00497-M

FORM 1040 28 REV 12-55

P.O. CONTINUATION SHEET

ITEM NO.	QUANTITY	UNIT	REQUISITION NO.	DESCRIPTION	UNIT PRICE
				<p>E. Vendor shall furnish film showing results of x-rays.</p> <p>F. Services shall be conducted during normal work hours only, 7:00 AM through 3:30 PM, Monday through Friday (holidays excluded).</p> <p>G. Work shall be scheduled with Mr. W. E. Davis of Granite Steel Industries, prior to time work is required. Services shall be authorized by:</p> <p style="text-align: center;">Mr. N. Robinson Mr. W. Bradford Dr. N. Neumann</p> <p>of Mallinckrodt Chemical Works, Uranium Division.</p> <p>Material to be x-rayed shall be delivered to General Steel Industries, Inc. at 1417 State Street Granite City, Illinois, by Mallinckrodt Chemical Works, Uranium Division personnel. X-ray film to be used shall be delivered to Mallinckrodt Chemical Works, Uranium Division personnel by General Steel Industries, Inc. on arrival at using site.</p> <p>Paragraph 33 of the attached Terms and Conditions is hereby made a definite part of this purchase order.</p> <p>This purchase order is not to exceed \$450.00 without prior written approval by Mallinckrodt Chemical Works, Purchasing Department, Mr. O. L. Luthenauer, Purchasing Agent.</p>	
			7-5-3	Ruehle	(Est 450)

IMPORTANT INSTRUCTIONS & INFORMATION

DO NOT BILL MISSOURI SALES TAX - EXEMPTION IN ACCORDANCE WITH MISSOURI CODE, SECTION 144.030

INVOICING - MAIL TWO (2) COPIES ATTENTION ACCOUNTS PAYABLE, GIVE ITEM NUMBER, DESCRIPTION AND UNIT PRICE EXACTLY AS SHOWN ON THIS ORDER

THIS IS A DEFENSE RATED ORDER - PRIORITY - A DO-E-2 RATING CERTIFIED UNDER DMS REGULATION NO. 1 APPLIES TO THIS ORDER

GEN. LEDGER ACCOUNT	SUB. ACCT.		JOB NUMBER
	DEPT.	EXP.	
	450	30	4530

SHIP ABOVE MATERIALS SUBJECT TO ATTACHED INSTRUCTIONS, TERMS AND CONDITIONS, WITH YOUR BID OF 5/20/64 AND IN ACCORDANCE 6589

ADDRESS CORRESPONDENCE ATTENTION W. M. Bortosky BUYER

APPROVED: U.S. ATOMIC ENERGY COMMISSION

Authorized Representative

MALLINCKRODT CHEMICAL WORKS
URANIUM DIVISION

MANAGER OF PURCHASING

a-33

REQ. NO. DM 2724	DATE NEEDED	DELIVER TO: Cook Lab	BLDG. NO.	REQUISITIONER J. Via	DEPT.	EST. TOTAL
SUGGESTED VENDOR	DEPT. APPROVAL/DATE		U.D. MGR. APPROVAL/DATE		CONTROLLER/DATE	

VENDOR:
**General Steel Industries, Inc.
1417 State St.
Granite, City, Illinois**

P.O. NO. 00623	LTR. REL. NO. L	LTR. CHANGE ORDER NO.	TYPE OF ORDER <input type="checkbox"/> SUBCONTRACT <input checked="" type="checkbox"/> OPEN-END	CAPITAL <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	INITIAL
VENDOR CODE 1365	ORDER DATE 7/7/65	DELIVERY DATE As Required	EXPEDITE DATE	TERMS & CONDITIONS 6592 <input type="checkbox"/> RE: YOUR 6591 <input type="checkbox"/> BFO	CARD CODE 240
GROSS COMMITMENT 450	PROC. CODE 1 753	PROC. CODE 2	VAL. PROC. CODE 2	DO NOT DUPLICATE - CONFIRMED TO:	
TERMS OF PAYMENT Net 30 days		ROUTING Not Applicable		FOB POINT Not Applicable	

ITEM NO.	REQ'N. NO.	ACCOUNTING CHARGES				STORES QUAN.	U / I	PURCH. QUAN.	U / P	FURNISH & DELIVER THE FOLLOWING EQUIPMENT, MATERIALS & SUPPLIES AS DESCRIBED BELOW:	QUAN. RECD.	UNIT PRICE
		GEN. LED.	DEPT.	EXP.	JOB. NO.							
	272A		450	30								

This purchase order is issued to cover services specified below as required for the period July 1, 1965 through June 30, 1966.

SCOPE

A. X-Ray material, as requested by Mallinckrodt Chemical Works, Uranium Division, on Government owned Detatron X-Ray equipment located at General Steel Industries, 1417 State St. Granite City, Illinois.

B. Seller shall furnish all film required for x-raying at actual procurement cost as follows:

SIZE	PRICE
4-1/2" x 17" film	.225 per sheet
6" x 10" film	.339 per sheet
7" x 17" film	.494 per sheet
14" x 17" film	.963 per sheet

C. Detatron labor charges, including operation and maintenance and all overhead shall be billed at \$35.00 per hour.

CODES TER. ROUTE FOB CARD C P 4 241	VENDOR ACCEPTANCE	DATE	BUYER
AUTHORIZED REPRESENTATIVE			BUYER

SHIPPING INSTRUCTIONS: SHIP TO: **U.S. ATOMIC ENERGY COMMISSION
c/o MALLINCKRODT CHEMICAL WORKS**

USE: **1. ST. CHARLES, MO. - VIA REA EXPRESS 3. WELDON, MO. (CARLOAD)**

A-34

PURCHASE ORDER - FORM 1671A 12/64
 REG. NO. DATE NEEDED DELIVER TO: BLDG. NO. REQUISITIONER DEPT. EST. TOTAL PAGE 01 OF 2
 SUGGESTED VENDOR: DEPT. APPROVAL/DATE U.D. MGR. APPROVAL/DATE CONTROLLER/DATE

General Steel Industries Inc.

P.O. NO. **00623** LTR. REL. NO. **1** LTR. CHANGE ORDER NO. TYPE OF ORDER SUBCONTRACT OPEN-END CAPITAL YES NO INITIAL
 VENDOR CODE ORDER DATE DELIVERY DATE EXPEDITE DATE TERMS & CONDITIONS 6582 RE: YOUR 6591 BID
 GROSS COMMITMENT PROC. CODE 1 PROC. CODE 2 -C- VAL. PROC. CODE 2 DO NOT DUPLICATE - CONFIRMED TO: CARD CODE 240
 TERMS OF PAYMENT ROUTING FOB POINT

ITEM NO.	REQ'N. NO.	ACCOUNTING CHARGES				STORES QUAN.	U / I	PURCH. QUAN.	U / P	FURNISH & DELIVER THE FOLLOWING EQUIPMENT, MATERIALS & SUPPLIES AS DESCRIBED BELOW:	QUAN. REC'D.	UNIT PRICE
		GEN. LED.	DEPT.	EXP.	JOB. NO.							
									<p>D. The Company shall furnish forms on which time of commencement and termination of service shall be recorded. This time record shall be included with all monthly billings.</p> <p>E. Seller shall furnish film showing results of x-rays.</p> <p>F. Services shall be conducted during normal work hours only, 7:00 AM through 3:30 PM, Monday through Friday (holidays excluded).</p> <p>G. Work shall be scheduled with Mr. W. E. Davis of Granite Steel Industries, prior to time work is required. Services shall be authorized by the following Company personnel: Mr. J. Vito Mr. E. Hermann</p> <p>Material to be x-rayed shall be delivered to General Steel Industries, Inc. at 1417 State St, Granite City, Illinois, by the Company. X-ray film to be used shall be delivered to the Company personnel by the Seller on arrival at using site.</p> <p>This purchase order is not to exceed \$450.00 without prior written approval by Mallinckrodt Chemical Works,</p>			

A-35

CODES: TEA-3 ROUTE FOB CARD 241
 VENDOR ACCEPTANCE DATE
 AUTHORIZED REPRESENTATIVE BUYER
 ABOVE PRICES FIRM AND NOT SUBJECT TO INCREASE
 ADDRESS CORRESPONDENCE TO:

SHIPPING INSTRUCTIONS: SHIP TO: U.S. ATOMIC ENERGY COMMISSION c/o MALLINCKRODT CHEMICAL WORKS USE: 1. ST. CHARLES, MO. - VIA REA EXPRESS 3. WELDON, MO. (CARLOAD)

REQ. NO.	DATE NEEDED	DELIVER TO:	BLDG. NO.	REQUISITIONER	DEPT.	EST. TOTAL
SUGGESTED VENDOR		DEPT. APPROVAL/DATE		U.D. MGR. APPROVAL/DATE		CONTROLLER/DATE

VENDOR: General Steel Industries Inc.		P.O. NO. 00623	LTR. REL. NO. L	LTR. CHANGE ORDER NO.	TYPE OF ORDER <input type="checkbox"/> SUBCONTRACT <input type="checkbox"/> OPEN-END	CAPITAL <input type="checkbox"/> YES <input type="checkbox"/> NO	INITIAL
VENDOR CODE	ORDER DATE	DELIVERY DATE	EXPEDITE DATE	TERMS & CONDITIONS 6582 <input type="checkbox"/> RE: YOUR 6591 <input type="checkbox"/> BID		CARD CODE 240	
GROSS COMMITMENT	PROC. CODE 1	PROC. CODE 2	-C-	VAL. PROC. CODE 2	DO NOT DUPLICATE - CONFIRMED TO:		
TERMS OF PAYMENT		ROUTING		FOB POINT			

ITEM NO.	REQ'N. NO.	ACCOUNTING CHARGES				STORES QUAN.	U / I	PURCH. QUAN.	U / P	FURNISH & DELIVER THE FOLLOWING EQUIPMENT. MATERIALS & SUPPLIES AS DESCRIBED BELOW:	QUAN. REC'D.	UNIT PRICE
		GEN. LED.	DEPT.	EXP.	JOB. NO.							

Purchasing Department, Mr. O. L. Isthauer, Purchasing Agent.

This order shall be subject to the written approval of the U.S. Atomic Energy Commission and shall not be binding unless so approved.

A-36

TERMS	ROUTE	FOB	CARD	VENDOR ACCEPTANCE	DATE	ABOVE PRICES FIRM AND NOT SUBJECT TO INCREASE ADDRESS CORRESPONDENCE TO: BUYER	
			241	AUTHORIZED REPRESENTATIVE		[Signature] BUYER	

SHIPPING INSTRUCTIONS: SHIP TO: U.S. ATOMIC ENERGY COMMISSION
 c/o MALLINCKRODT CHEMICAL WORKS

USE: 1. ST. CHARLES, MO. - VIA REA EXPRESS 3. WELDON, MO. (CARLOAD)

HEALTH AND SAFETY RESEARCH DIVISION

**Waste Management Research and Development Programs
(Activity No. AH 10 05 00 0; NEAH001)**

**RESULTS OF THE RADIOLOGICAL SURVEY
AT THE GRANITE CITY STEEL FACILITY,
GRANITE CITY, ILLINOIS**

W. D. Cottrell and R. F. Carrier

Date of issue - July 1990

Investigation Team

**R. E. Swaja - Measurement Applications and Development Manager
W. D. Cottrell - FUSRAP Project Director**

Survey Team Members

R. D. Foley	W. H. Shinpaught†
D. D. Folse*	P. F. Tiner
R. A. Mathis	A. Wallo III‡

***Student**

†Stone Associates

‡U. S. Department of Energy

**Work performed by the
MEASUREMENT APPLICATIONS AND DEVELOPMENT GROUP**

**Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U. S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400**

ABSTRACT

In the late 1950s and early 1960s, uranium ingots were x-rayed for the Atomic Energy Commission at the South Plant facility of the Granite City Steel Company, Granite City, Illinois. The x-ray equipment is still housed in a building on the southern end of the property. At the time of the survey, neither the equipment nor the building had been used for some time. It is the policy of the U. S. Department of Energy (DOE) to verify that such sites are in compliance with current federal guidelines. Because documentation establishing the current radiological condition of the property is unavailable, a radiological survey was conducted by members of the Measurement Applications and Development Group of the Oak Ridge National Laboratory in March 1989. The survey included: (1) measurement of gamma exposure rates both indoors and outdoors; (2) collection and radionuclide analysis of soil and debris samples; and (3) measurements to determine alpha and beta-gamma surface contamination.

The results of the survey demonstrate that the building, its roof, and the area surrounding it are generally free of residuals originating from former DOE-sponsored activities. Most radiological measurements in the building were within the range of background values for southwestern Illinois. The exceptions were a contaminated vacuum cleaner inside the building, its contents, some of the building surfaces in its immediate vicinity, and two additional localized spots on the surface of the ground level floor. Concentrations of residual radioactive material in and around the vacuum cleaner and in scattered spots inside the building are in excess of concentration guidelines established by DOE to determine the eligibility of a site for remedial action. However, the contamination is very localized and limited in extent, rendering it highly unlikely that an individual working in or frequenting the area would receive a significant radiation exposure.

5-3



RESULTS OF THE RADIOLOGICAL SURVEY AT THE GRANITE CITY STEEL FACILITY, GRANITE CITY, ILLINOIS*

INTRODUCTION

During the late 1950s and early 1960s, the General Steel Casting Corporation x-rayed uranium ingots for the Atomic Energy Commission (AEC) under purchase orders issued by Mallinckrodt Chemical Company. The facility used for this purpose is located at 1417 State Street in southwest Granite City, Illinois, northeast of St. Louis, Missouri, across the Mississippi River (Fig. 1). Although purchase orders dated July 14, 1961, and others subsequent to that time are available, actual periods of operation are unknown. Ostensibly, the facility was used on an "as required" basis. During operations, the film and film developing services were apparently provided by General Steel Casting with Mallinckrodt personnel handling the uranium metal and using the x-ray apparatus. The two Allis-Chalmers betatrons (Magnetic Induction Electron Accelerators) still remain in a building on the southern section of the plant property. Granite City Steel Company representatives indicate that the building is no longer in use. The site is now called the South Plant facility of the Granite City Steel Division and is owned by the Granite City Steel Company.¹

It is the policy of the U. S. Department of Energy (DOE) to verify that radiological conditions at such sites or facilities comply with current Federal guidelines. If they are found to deviate to any significant degree from those guidelines, remedial action may be implemented (where DOE has the authority to do so) to correct the unacceptable condition. Furthermore, guidelines for release and use of such sites have become more stringent as research has provided more information since previous cleanups. No records have been found to suggest that any residual radioactive contamination remained on the Granite City site as a result of past operations or of any cleanup activities conducted following use of the betatron equipment. Neither is it believed that activities conducted at this site represent a potential for significant radiological contamination. However, because no documentation has been discovered to establish the current radiological condition of the environment in and around the building in which the x-ray equipment is housed, Oak Ridge National Laboratory (ORNL) conducted a preliminary survey at the request of DOE to

*The survey was performed by members of the Measurement Applications and Development group of the Health and Safety Research Division at Oak Ridge National Laboratory under U. S. DOE contract DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc.

determine if this site should be included for further assessment in the Formerly Utilized Sites Remedial Action Program (FUSRAP). The following radiological survey discussed in this report was conducted by ORNL in March 1989.

SITE DESCRIPTION

The building housing the betatrons is largely constructed of metal and concrete (Figs. 2 and 3). A railroad track extends from the north end of the building through a high bay area into a large, open room at the south end (Fig. 4). The walls around this room and high bay area are of 10-ft thick concrete. The remaining northeast quarter of the building is subdivided into offices and utility rooms over which is a second level. At the time of the survey, the betatrons, one of which is shown on Fig. 5, were located on the east side of the large room (Fig. 4). Against the north wall of this room is a concrete pad on which stand several transformers (Fig. 6). Much of the building contains abandoned equipment and rubbish. Floors in some indoor areas were wet at the time of the survey.

SURVEY PROCEDURES

The radiological survey included: (1) gamma scanning of the ground surface outdoors near the building; (2) gamma scanning at floor and wall surfaces throughout the building and on the roof; (3) collection and radionuclide analysis of outdoor soil samples and indoor dust and debris; (4) the determination of direct and transferable beta-gamma and alpha activity levels on indoor surfaces and on the roof. A comprehensive description of the survey methods and instrumentation has been presented in another report.¹

Using a portable gamma scintillation (NaI) survey meter, ranges of exposure rates were recorded by scanning near the ground surface outdoors and near the building floor, wall, and roof surfaces. Beta-gamma dose rates and total alpha activity levels were determined by direct measurement on indoor surfaces and on the roof. Smears were also taken in selected locations indoors and on the roof to establish transferable alpha and beta-gamma activity levels. Samples of outdoor soil and indoor dust and debris were collected from locations selected without regard to gamma levels (systematic samples) and where gamma levels were elevated (biased samples). The samples were analyzed for radionuclide content.

SURVEY RESULTS

Applicable DOE guidelines for sites included within the FUSRAP are summarized in Table 1. Typical radiation background levels in the southwestern Illinois area are presented in Table 2. These data are provided for comparison with the survey results presented in this section. With the exception of measurements of transferable activity, which are reported as net disintegration rates, all direct measurements presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations in soil and environmental samples.

BUILDING SURVEY

INDOOR SURVEY

Gamma Exposure Rate Measurements

Inside the building, scan measurements generally ranged from 3 to 16 $\mu\text{R/h}$ with a range of 3 to 8 $\mu\text{R/h}$ on the second level as shown on Fig. 7 and 8. Gamma levels were slightly higher on walls. The first-floor values are slightly above the range of background for the southwestern Illinois area (Table 2) but below the DOE indoor guideline of 20 $\mu\text{R/h}$ above background (Table 1). However, gamma exposure rates in the northeast corner of the x-ray room were 90 $\mu\text{R/h}$ on contact with an industrial vacuum cleaner and 40 $\mu\text{R/h}$ beneath it. A photo of the vacuum cleaner is reproduced in Fig. 9; its location is shown on Fig. 4. These elevated gamma levels are above the guideline value.

Alpha and Beta-gamma Activity Levels

Ranges of directly measured alpha and beta-gamma activity levels on surfaces of the ground floor of the building are shown on Fig. 7. Results of alpha measurements for the second level are given on Fig. 8. Alpha measurements on surfaces of the ground floor of the building ranged from background ($<25^*$) to 540 dpm/100 cm^2 . Second floor alpha values ranged from 36 to 108 dpm/100 cm^2 . These values are lower than the DOE guideline of 5,000 dpm/100 cm^2 for uranium alpha-emitters (Table 1). Beta-gamma dose rates on ground floor surfaces ranged from 0.02 to 0.06 mrad/h except on contact with the vacuum cleaner, and in one isolated spot nearby (Fig. 7). There, the dose rate was 0.2 mrad/h. All measurements except the latter are below the DOE guideline of 0.2 mrad/h for maximum dose rate over any 100 cm^2 area.

*The instrument-specific minimum detectable activity is 25 dpm/100 cm^2 .

D-4

The locations of smears obtained inside the building are shown on Fig. 10. The resulting alpha activity levels are shown in the table below.

Transferable alpha (α) activity levels
(dpm/100 cm²), first floor

	#24	#25	#27	#28	#29	#33	#34	#35	#38
α	<10	<10	<10	41	12	<10	<10	<10	<10

Analysis of smears disclosed transferable alpha levels ranging from less than the minimum detectable activity (10 dpm/100 cm²) to 41 dpm/100 cm² with the maximum measurement, 41 dpm/100 cm², taken on the vacuum cleaner. All removable beta-gamma levels were less than the instrument-specific minimum detectable activity of 200 dpm/100 cm². The DOE guidelines for transferable alpha and beta-gamma activity levels are 1,000 dpm/100 cm² (from ²³⁸U decay).

Debris Analysis

Six systematic (S1-S6) and two biased (B1-B2) samples of dust and debris were collected indoors at the locations shown on Fig. 10. Results of analyses are listed in Table 3. Concentrations of ²²⁶Ra and ²³²Th in samples from inside the building ranged from 0.85 to 2.4 pCi/g, and 0.40 to 0.53 pCi/g, respectively. Uranium-238 was present at concentrations of 0.70 to 75 pCi/g. In two biased samples, concentrations (pCi/g) of ²²⁶Ra and ²³²Th were <0.88 and 1.6 pCi/g and <1.3 and 0.75 pCi/g, respectively. Concentrations of ²³⁸U were 3,300 and 4,000 pCi/g in samples from the floor beside the contaminated vacuum cleaner and from the cleaner itself, respectively. All concentrations of ²²⁶Ra and ²³²Th are below the applicable soil guideline (Table 1) and near background values (Table 2). In systematic samples collected from the floor near the railroad tracks (S4), from the damper in a vent above the vacuum cleaner (S5), and from the floor near the center of the high bay (S6), ²³⁸U concentrations were at or above values of 35 to 40 pCi/g used as the criterion at other FUSRAP sites. Uranium-238 concentrations in the sample from the cleaner (B2) and in the sample from beneath it (B1) were also above these guidelines.

ROOF SURVEY

Gamma Exposure Rate Measurements

Exposure rates ranged from 5 to 10 μ R/h on the roof surface with the highest measurement taken at two spots on the outside wall of the upper part of the structure (Fig. 11). These values are within the range of background for the southwestern Illinois area (7-11 μ R/h, Table 2).

Alpha and Beta-gamma Activity Levels

Directly measured alpha activity levels on the roof (Fig. 11) were less than the guideline for uranium (Table 1), ranging from 20 to 500 dpm/100 cm². Beta-gamma dose rates were 0.02 to 0.03 mrad/h, values below the applicable guideline. Results of analysis of smears taken at the roof locations shown on Fig. 11 (smears 31 and 32) showed transferable alpha activity levels of 16 and 96 dpm/100 cm², respectively. These values are less than the DOE guideline for removable activity (Table 1).

Debris Analysis

Concentrations of ²²⁶Ra, ²³²Th, and ²³⁸U in the sample of material from the roof (B4) were 1.7, 0.42, and 1.6 pCi/g, respectively. Values for ²²⁶Ra and ²³²Th are below the DOE guideline for surface soil (Table 1). The concentration of ²³⁸U, 1.6 pCi/g, is below DOE guidelines used at other sites (35-40 pCi/g).

OUTDOOR SURVEY

Gamma Exposure Rate Measurements

Gamma levels ranged from 5 to 36 μ R/h outdoors on the property (Fig. 12). The maximum measurement (36 μ R/h) was taken ~75 ft from the northeast corner of the building. Exposure rates of 30 μ R/h were measured on some mounds of dirt north and east of the property, and at the southeast corner of the building. Some exposure rates were above background for the southwestern Illinois area (7-11 μ R/h, Table 2).

Soil Sample Analyses

Locations of soil samples are shown on Fig. 12 with results of analyses listed in Table 4. The radionuclides ²²⁶Ra and ²³⁸U, found in the three systematic samples from the top 15-cm layer of soil, were in secular equilibrium. Their concentrations ranged from 5.7 to 13 pCi/g, and 5.4 to 13 pCi/g, respectively. Thorium-232 in these 15-cm surface samples ranged from 1.4 to 2.2 pCi/g. The concentrations of ²²⁶Ra in samples S7A and S8A (8.4 and 13 pCi/g, respectively) exceed the DOE guideline (Table 1). However, this type of radionuclide distribution would not result from the DOE-related operations which had taken place at this site.

Systematic samples taken from subsurface soil at depths of 15 to 45 cm showed ²²⁶Ra and ²³⁸U in approximately equal amounts, ranging from 3.8 to 12 pCi/g and 4.2 to 12 pCi/g, respectively. Concentrations of ²³²Th in subsurface soil were 0.75 to 1.9 pCi/g. Radionuclides in subsurface samples are below guidelines.

In the three biased soil samples from depths of 0 to 41 cm, concentrations of ^{226}Ra and ^{238}U were again approximately equal at 20 to 21 pCi/g, and 18 to 21 pCi/g, respectively. Concentrations (pCi/g) of ^{232}Th were 3.3 to 3.4. The values for ^{226}Ra exceed the DOE guideline in all three samples but are in equilibrium with ^{238}U in those samples.

The ratio and distribution of the radiotopes ^{226}Ra and ^{238}U found here are consistent with those for other samples known to contain naturally occurring material such as coal ashes and/or cinders. In any case, DOE-related operations conducted at this site would not have resulted in the type of radionuclide distribution found outdoors on this property.

SIGNIFICANCE OF FINDINGS

Survey results show that a small amount of residual radioactivity from former operations remains in several discrete, localized spots in the x-ray building at the Granite City Steel Facility. Uranium-238 was found indoors in elevated concentrations in debris from an industrial vacuum cleaner, and in dust and debris in scattered locations throughout the building.

Gamma levels inside the building were generally acceptable in all areas of the building and on the roof, ranging from 3 to 16 $\mu\text{R}/\text{h}$. Background in the southwestern Illinois area averages 9 $\mu\text{R}/\text{h}$. However, exposure rates were 90 and 40 $\mu\text{R}/\text{h}$ on and beneath the vacuum cleaner, respectively. These values are above the DOE guideline of 20 $\mu\text{R}/\text{h}$ above background (Table 1). All directly measured alpha activity levels were below the guideline for uranium (Table 1). No beta-gamma dose rate measurements exceeded the criterion of 0.2 mrad/h over 100 cm^2 (two measurements on and near the contaminated cleaner were equal to the guideline). Evaluation of smear results indicated that all transferable alpha and beta-gamma activity levels were below the DOE guideline of 1,000 dpm/100 cm^2 uranium. Nevertheless, sampling of indoor dust and debris confirmed the presence of ^{238}U residuals. Uranium-238 was found in concentrations as high as 4,000 pCi/g in and around the vacuum cleaner.

Concentrations of ^{226}Ra in excess of the DOE guidelines for surface and subsurface soil were found in apparent equilibrium with ^{238}U outdoors. However, because former DOE-supported operations at this site would not result in radionuclide distributions of this type, the outdoor contamination found at this facility is not the result of DOE-related operations.

In summary, concentrations of residual radioactive material found in and around an industrial vacuum cleaner on the site, and in scattered spots inside the building, are in excess of concentration guidelines established by DOE to determine the eligibility of a site

for remedial action. These conservative guidelines are based on possible exposure through inhalation, ingestion, or direct contact, and are typically derived to ensure that unrestricted use (including residential use) will not result in above-guideline doses to the general public. Furthermore, the contamination is very localized and limited in extent, and an examination of any credible use scenario for this site suggests that no significant radiation exposures would accrue to individuals frequenting the area.

B-C

REFERENCES

1. J. I. Fiore, U.S. Department of Energy, Washington, D. C., letter (with attachments) to C. Cannon, Granite City Steel Company, Granite City, Illinois, June, 1988.
2. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the ORNL Remedial Survey Activities Program*, Oak Ridge National Laboratory, Oak Ridge, Tennessee, ORNL/TM-8600 (September 1982).
3. T. E. Myrick and B. A. Berven, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, Oak Ridge National Laboratory, ORNL/TM-7343 (November 1981).

b-7

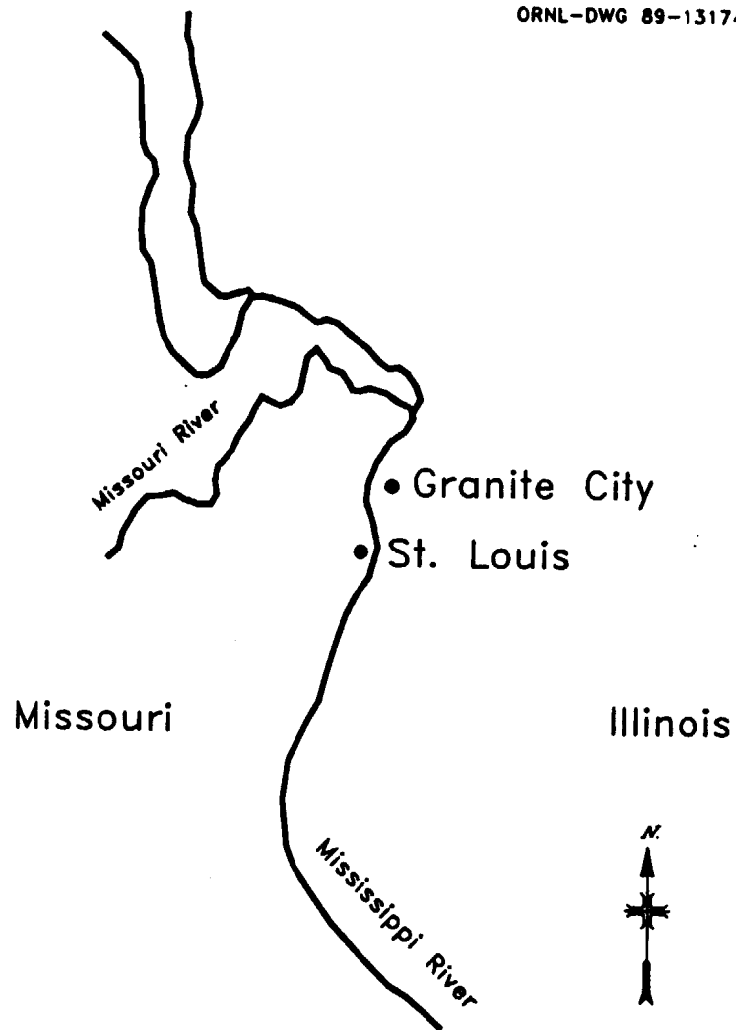
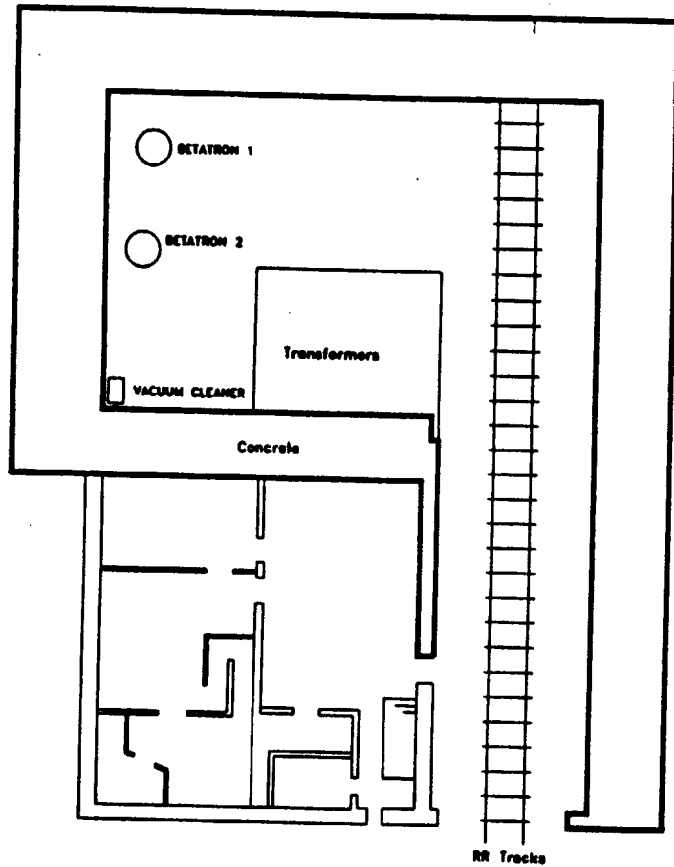


Fig. 1. General location of the Granite City Steel Facility, Granite City,



FEET
0 5 10
1" = 10'

Fig. 4. Diagram of the ground floor of the betatron building.

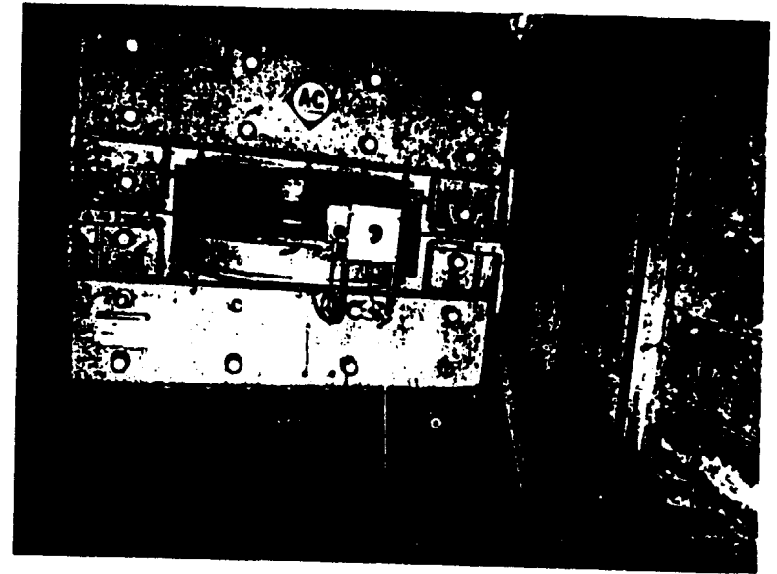


Fig. 5. Photo showing the larger of the two betatrons (no. 1, Fig. 4).



Fig. 6. View of transformer storage area inside the betatron building.

6-9

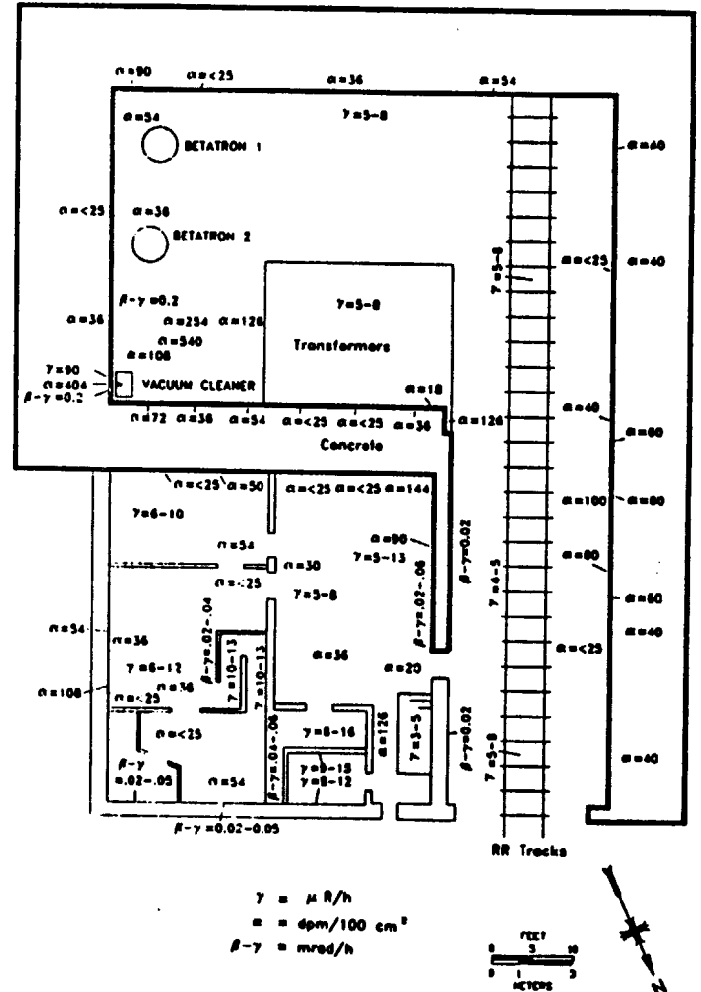


Fig. 7. Directly measured radiation levels inside the betatron building, first level.



B-10

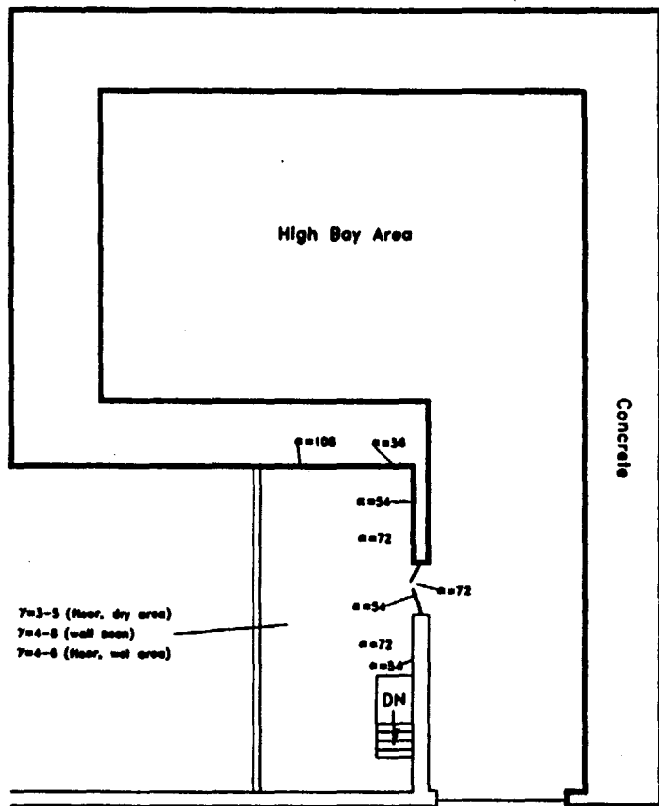
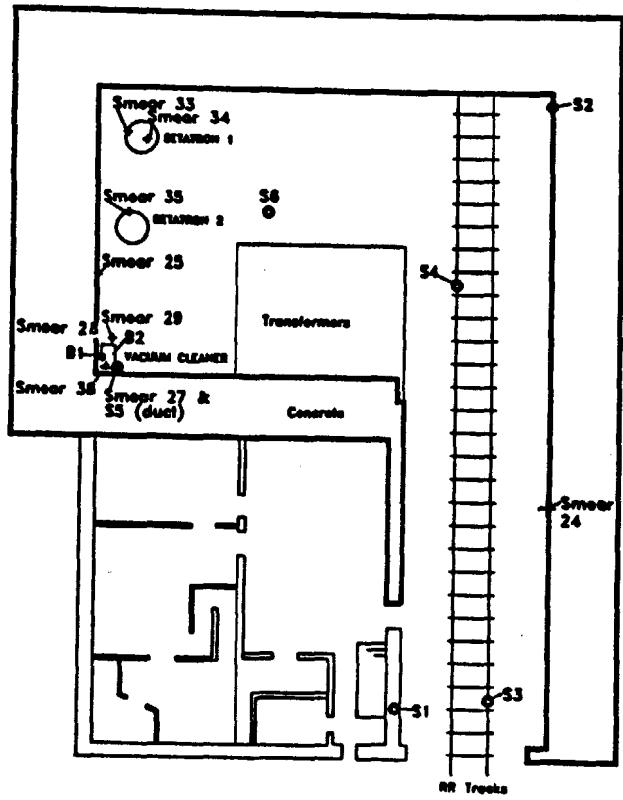


Fig. 8. Results of directly measured radiation levels taken in the betatron building, second level.



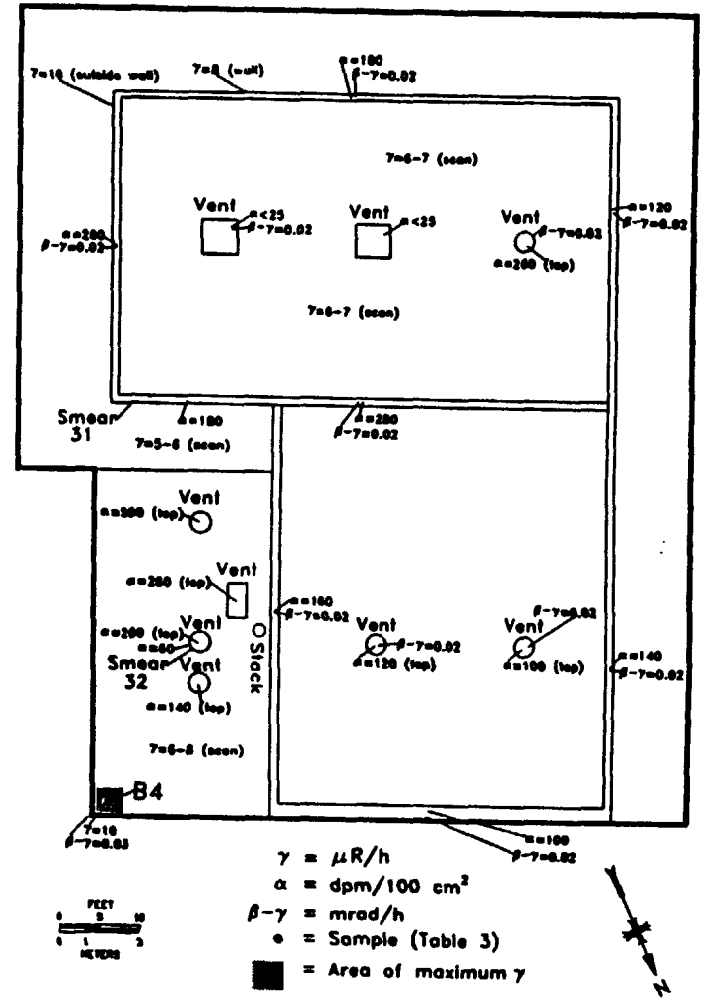
Fig. 9. Industrial vacuum cleaner having elevated radiation levels and radionuclide concentrations.

B-11



- = Biased Sample (B)
- ⊙ = Systematic Sample (S)
- ◐ = Smear Sample

Fig. 10. Locations of smears, and indoor dust and debris samples.



- $\gamma = \mu R/h$
- $\alpha = \text{dpm}/100 \text{ cm}^2$
- $\beta-\gamma = \text{mrad/h}$
- = Sample (Table 3)
- = Area of maximum γ

Fig. 11. Results of direct radiation measurements and locations of smear and debris samples taken from the building roof.

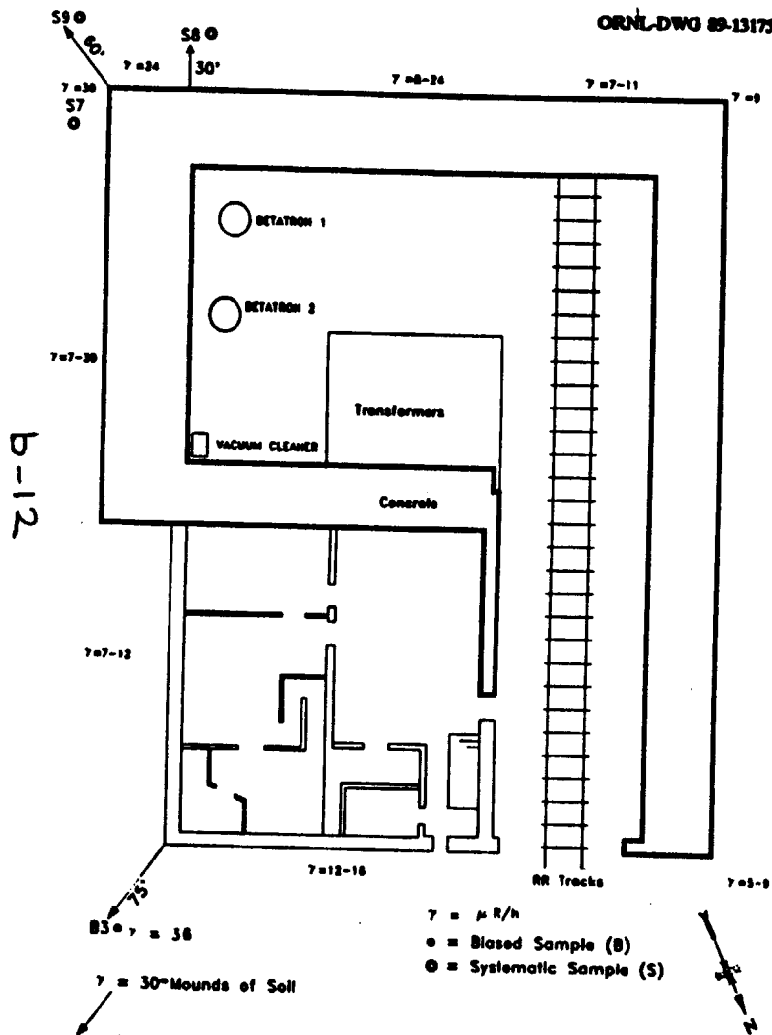


Fig. 12. Outdoor gamma exposure rates and locations of soil samples.

Table 1. Applicable guidelines for protection against radiation^a

Mode of exposure	Exposure conditions	Guideline value
Gamma radiation	Indoor gamma radiation level (above background)	20 μ R/h
Surface contamination	²³⁸ U, U-natural Fixed on surfaces Removable	5000 dpm/100 cm ² 1000 dpm/100 cm ²
	²³² Th, Th-natural Fixed on surfaces Removable	1000 dpm/100 cm ² 200 dpm/100 cm ²
	²²⁶ Ra Fixed on surfaces Removable	100 dpm/100 cm ² 20 dpm/100 cm ²
Beta-gamma dose rates ^b	Surface dose rate averaged over not more than 1 m ²	0.20 mrad/h
	Maximum dose rate in any 100 cm ²	1.0 mrad/h
Radionuclide concentrations in soil	Maximum permissible concentration of the following radionuclides in soil above background levels averaged over 100 m ² area ²³² Th ²³⁵ Th ²²⁶ Ra ²²⁸ Ra ²³⁸ U	5 pCi/g averaged over the first 15-cm of soil below the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface Derived (site specific)

^aU.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites (April 1987).
^bBeta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except ⁹⁰Sr, ²²⁶Ra, ²³²Ra, ²²⁷Ac, ¹³⁷I, ¹³⁴I, ¹³¹I, ¹²⁹I, ¹²⁹Xe.

Table 2. Background radiation levels and concentrations of selected radionuclides in soil samples taken in southwestern Illinois

Type of radiation measurement or sample ^a	Radiation level or radionuclide concentration	
	Range	Average
Gamma exposure rate at 1 m above ground surface ($\mu\text{R/h}$)	7-11	9
Concentration of radionuclides in soil ($\mu\text{Ci/g dry wt}$)		
^{232}Th	1.0-1.2	1.1
^{226}Ra	0.88-0.93	0.90
^{238}U	1.0-1.1	1.0

^aWith the exception of ^{226}Ra concentrations that were derived from two sampling locations, values were obtained from 3 locations in southwestern Illinois.³

B-13

Table 3. Concentrations of radionuclides in soil and debris samples at the General Steel Facility, Granite City, Illinois

Sample ^a	Depth (cm)	Radionuclide concentration ($\mu\text{Ci/g}$)		
		^{226}Ra ^b	^{232}Th ^b	^{238}U ^b
<i>Systematic samples^c</i>				
S1	d	0.85 ± 0.02	0.40 ± 0.02	0.70 ± 0.36
S2	d	2.2 ± 0.04	0.53 ± 0.04	2.8 ± 0.74
S3	d	2.0 ± 0.06	0.46 ± 0.04	2.8 ± 0.44
S4	d	2.3 ± 0.12	e	35 ± 11
S5	d	1.5 ± 0.1	e	75 ± 25
S6	d	2.4 ± 0.1	e	60 ± 12
S7A	0-15	8.4 ± 0.12	1.5 ± 0.15	8.5 ± 0.42
S7B	15-30	3.8 ± 0.04	0.75 ± 0.04	4.2 ± 0.98
S8A	0-15	13 ± 1.3	2.2 ± 0.04	13 ± 1.3
S8B	15-30	12 ± 0.10	1.9 ± 0.08	12 ± 1.9
S9A	0-15	5.7 ± 0.04	1.4 ± 0.08	5.4 ± 0.56
S9B	15-30	6.7 ± 0.06	1.3 ± 0.06	5.7 ± 1.1
S9C	30-45	8.7 ± 0.10	1.6 ± 0.02	7.1 ± 2.9
<i>Biased samples^f</i>				
B1	g	<0.88	<1.3	3300 ± 58
B2	g	1.6 ± 0.89	0.75 ± 0.16	4000 ± 1000
B3A	0-15	20 ± 0.12	3.3 ± 0.04	21 ± 5.5
B3B	15-28	20 ± 0.14	3.3 ± 0.06	21 ± 6
B3C	28-41	21 ± 0.2	3.4 ± 0.2	18 ± 4
B4	g	1.7 ± 0.02	0.42 ± 0.02	1.6 ± 0.34

^aLocations of samples are shown on Figs. 10, 11, and 12.

^bIndicated counting error is at the 95% confidence level ($\pm 2\sigma$).

^cSystematic samples are taken at selected locations irrespective of gamma exposure rates.

^dSamples of dust and debris from overhead beams (S1, S2), floor near R. R. tracks (S3, S4), from damper in vent above vacuum cleaner (S5), and floor near center of high bay (S6).

^eNo analysis performed.

^fBiased samples are taken from areas shown to have elevated gamma exposure rates.

^gDust and debris from the floor beside the vacuum cleaner (B1), the cleaner itself (B2), and the roof above the photo lab (B4).

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RECORD OF CONTACT

DATE: 11 May 1988

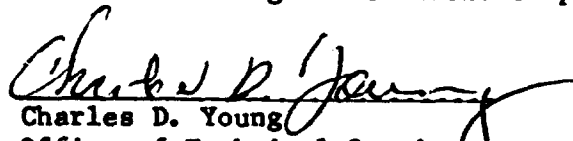
SUBJECT: The Former General Steel Castings Facility
in Granite City, Illinois

PERSONS CONTACTED: William Swanson, V-P and General Manager
Carl Canon, Environmental Department
Doug Stracke, Environmental Department
Granite City Steel Company
1417 State Street
Granite City, Illinois

Initial contact with Granite City Steel Company was Mr. Swanson at (314) 451-3456. After briefing him on the purpose of my call, he indicated that he would have Mr. Canon contact me with whatever information that might be available on the x-ray facility in question.

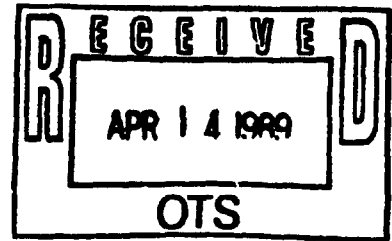
The following is a summary of information received during a subsequent telephone conversation with Mr. Canon and Mr. Stracke.

1. The General Steel Industries, Inc. facility at 1417 State Street was purchased by Granite City Steel some years ago. The facility was vacated before purchase by Granite City Steel. Therefore, the possibility of locating former General Steel employees that might have direct knowledge of the operation of the Betatron facility is remote.
2. Immediately prior to our conversation, Mr. Stracke had been to the building where the Betatron facility is located. He indicated that the building was not in use. All electrical service had been cut, but the Betatron equipment (Allis Chalmers, 25 million volt) was still in place. Specimens to be x-rayed were apparently transported into the building on a rail system. Records (presumably x-ray records and film) were scattered around in boxes and on tables. He indicated that he had done a quick scan of the area with an Eberline, Model 530 counter, with the detector shield closed. Measurements approximately 3 feet away from the wall structure around the outside of the building ranged from 0 to .1 millirem/hour. He indicated that measurements inside the building were perceived to be somewhat lower.
3. Neither Mr. Canon or Mr. Stracke were aware of the history of the facility. The building has apparently not been used since it was vacated by General Steel Industries, Inc. The date the building was vacated by General Steel and the date of purchase by Granite City Steel are unknown.
4. Mr. Canon requested that he be advised concerning DOE's intent to pursue this matter further.


Charles D. Young
Office of Technical Services

7426

IL



APR 12 1989

QWE
NE-23
Wallo
4/11/89

NA-23
Flora
4/11/89

Mr. Carl Cannon
Granite City Steel
EQC Dept.
20th and State Streets
Granite City, Illinois 62040

Dear Mr. Cannon:

As you know, the Department of Energy conducted a radiological survey of the former General Steel Castings Corporation Betatron building at your facility in Granite City, Illinois. The survey involved direct measurements for Gamma, Beta/Gamma and Alpha radiation and the collection of several soil and debris samples. It will be several months before the sample analyses are complete and we are able to complete the analysis of the data.

However, based on our preliminary review of the direct measurements, most of the readings are in the range of normal background for a facility such as yours. The exception is a small area in the east corner of the betatron room near an old government vacuum. It appears this vacuum was used in the cleanup operations following the x-raying of the uranium ingots. The vacuum, its hose and some spots on the floor beneath the vacuum are contaminated with uranium. While the levels of external radiation in the area of the vacuum pose no immediate health hazard, we recommend that the unit not be moved or opened.

A final decision regarding any necessary remediation will be made as soon as the sample results are reviewed. In the interim, if you have any questions regarding the survey, our future activities, or the vacuum and associated contamination, please call me at 301-353-5439.

NE-23 RF
Wallo RF
NEG (4)

Sincerely,

121

bcc:
W. Cottrell, ORNL
D. Kozlowski, OTS

Andrew Wallo III, Designation
and Certification Manager
Division of Facility and Site
Decommissioning Projects
Office of Nuclear Energy

cc:
Mr. T. Mahl
Granite City Steel

NE-23:AWallo:ph:353-5439:4/11/89:IBM:101/70



Department of Energy

Washington, DC 20545

(7/13/90)

Mr. Carl Cannon
Granite City Steel
EQC Department
20th and State Streets
Granite City, Illinois 62040

Dear Mr. Cannon:

The Department of Energy conducted a radiological survey of the former General Steel Casting Corporation Betatron building at your facility in Granite City, Illinois. The survey was performed by Oak Ridge National Laboratory, and the survey report has recently been sent to the printer. We have requested that Oak Ridge National Laboratory furnish you with a copy of the survey report as soon as it is published.

The survey indicates that there are several discrete spots of radioactive contamination in the x-ray building. This contamination is from uranium in dust and debris inside the building, especially in the vicinity of a vacuum cleaner. Elevated levels of radioactivity from uranium and its decay products were found outdoors. These outdoor measurements were apparently not related to the Atomic Energy Commission's activities at the facility, since those activities only involved uranium metal.

We are considering what further action may be appropriate for the low levels of contamination that were measured by the survey. At present we do not believe that the radiation levels are a significant hazard to the public or to your workers. However, it may be appropriate to consider further action to avoid unnecessary radiation exposures or the further spread of activity. After the survey report is published, I will contact you to get your viewpoint.

If you have any questions, please give me a call (301-353-5439), and I will try to answer them.

Sincerely,

A handwritten signature in cursive script, reading "W. Alexander Williams".

W. Alexander Williams, PhD
Designation and Certification Manager
Off-Site Branch
Division of Eastern Area Programs
Office of Environmental Restoration

bcc:
Weston

EM-40 (3)
EM-42 reader
Williams reader
Fiore reader

EM-421:AWilliams:kc:353-3543:7/12/90:cannon.aw

cut
EM-421
Williams
7/13/90

EM-42
Fiore
7/13/90

EM-42
Fulmer & Co.
7/13/90

~~EM-40
Baubitz
7/ /90~~

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Whitfield
7/ /90~~