UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

AUG 25 1982

MEMORANDUM FOR: Thomas F. Dorian, Attorney
Regulations Division, ELD

FROM: R. G. Page, Chief
Uranium Fuel Licensing Branch
Division of Fuel Cycle and Material Safety, NMSS

SUBJECT: CORNING GLASS WORKS' DISPOSAL OF INDUSTRIAL WASTES CONTAINING 0.04% URANIUM AND THORIUM

In reply to your memorandum of August 18, 1982, our Branch Technical Position (BTP) on Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations specifies the following concentrations acceptable for disposal under the four disposal options:

	1	2	3	4
	(concentrations expressed in picocuries per gram of soil)			
Natural Thorium (Th-232 plus Th-228) with daughters in equilibrium	10	50	--	500
Natural Uranium (U-238 plus U-234) with daughters in equilibrium	10	--	40	200

According to our calculations, 0.05 weight percent of natural thorium and natural uranium corresponds to 55 and 340 picocuries per gram, respectively. Thus, 0.05 weight percent of uranium would not, under the BTP, be authorized for disposal under any of the disposal options. Thorium in concentrations of 0.05 weight percent would be considered for disposal only under disposal option 4.

Based on the public comments that we received on the BTP and information received that EPA may change its interim standard for radium 226 permitted in soil at inactive uranium processing sites, we may make some changes in the BTP as follows:

C/

1. The concentration limits for some of the disposal options could be increased depending on what EPA recommends in its final radiation standards for inactive uranium processing sites.

2. We may modify Option #2 to provide that the recorded title documents should state that the specified land contains buried radioactive materials.

3. Some additional institutional controls may be specified for Option #4 and we may restrict the amounts of soluble materials to no more than provided under Option #2. With regard to institution controls, we may permit disposal of Option #4 concentrations only on publicly owned land or require that buried materials remain licensed and thereby be subject to requirements of 10 CFR Part 20.

4. The concentration limits specified in the Branch Technical Position are intended to be average and not maximum concentration levels. This needs to be stated in the Branch Technical Position.

These matters are presently under consideration, but we believe that we should not reach final conclusions until we see the details of EPA's final rule on inactive uranium processing sites. Meanwhile, we are continuing to apply the BTP to applications for disposal of uranium or thorium wastes under options 1, 2 and 3. We have not and would not approve an application to dispose under option 4 until the issues discussed above are finally resolved.

Contrary to your expressed belief, my Branch is not the only Branch which may issue approvals to dispose of uranium or thorium under the provisions of 10 CFR 20.302. These approvals may also be issued by Vandy Miller's and Bernie Singer's Branches.

R. G. Page

R. G. Page, Chief
Uranium Fuel Licensing Branch
Division of Fuel Cycle and
Material Safety, NMSS

cc: B. Singer
E. Wright
V. Miller
D. Smith

ROUTING AND TRANSMITTAL SLIP

8110182

TO: (Name, office symbol, room number, building, Agency/Post)	Initials	Date
1. Tom Dorian		
2. OELD		
3. MNBB 9604		
4.		
5.		

	Action		File		Note and Return
	Approval		For Clearance		Per Conversation
	As Requested		For Correction		Prepare Reply
	Circulate		For Your Information		See Me
	Comment		Investigate		Signature
	Coordination		Justify		

REMARKS

Enclosed is the information we discussed recently in our phone conversation.

Our question is:

Can Corning Glass Works legally dispose of industrial wastes containing 0.04 % uranium + thorium ?

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post)	Room No.—Bldg.
E. Wright	55-396
	Phone No. 4 74240

5041-102
☆ U.S. G.P.O. 1977-241-530/3090

OPTIONAL FORM 41 (Rev. 7-76)
Prescribed by GSA
FPMR (41 CFR) 101-11.206

Phone conversation with Mr. B. Clarke on August 5, 1982 yielded the following (all are High Est):

- After the 1st year (time to get geared up and in full swing)
- The plant will produce 2400 lbs of waste per month, of this 36% would be Baddeleyite ore.
- Therefore, 864 lbs of Baddeleyite ore as waste will be produced each month. Given that the U&Th combined concentration is 0.11%, then ≈ 0.95 lbs of U&Th generated as waste per month.
- 2400 lbs divided into 0.95 lbs ≈ .04% this is slightly less than the exempt percent of 0.05.
- They can provide documentation on uniformity of waste and verification of percent U&Th by assay.

Steven L. Baggett

CORNING GLASS WORKS

SOLON, OHIO

REQUEST FOR

AMENDMENT TO LICENSE STC-1392 TO ALLOW

ROUTINE USE OF BADDELEYITE ORE

11060

FORM NRC-2
(7-77)
10 CFR 40

R0203

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.

1. (Check one)
- ☐ (a) New license
- ☒ (b) Amendment to License No. STC-1392
- ☐ (c) Renewal of License No. ______
- ☐ (d) Previous License No. ______

2. NAME OF APPLICANT
Corning Glass Works
Zircoa Products, Technical Products Division

3. PRINCIPAL BUSINESS ADDRESS
31501 Solon Road
Solon, Ohio 44139

4. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED
31501 Solon Road
Solon, Ohio 44139

5. NAME OF PERSON TO BE CONTACTED CONCERNING THIS APPLICATION
Mr. Garth Austin

6. TELEPHONE NO. OF INDIVIDUAL NAMED IN ITEM 5
(215) 248-0500

7. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED
Receive, store, use, manufacture and distribute refractory type material processed from Baddeleyite concentrates (zirconium oxide) containing small amounts of natural Thorium and Uranium.

This refractory type material will include nozzles for continuous casting of steel, crucibles for investment casting of super alloys, etc.

8. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE

(a) TYPE	(b) CHEMICAL FORM	(c) PHYSICAL FORM (Including % U or Th.)	(d) MAXIMUM AMOUNT AT ANY ONE TIME (kilograms)
NATURAL URANIUM	Uranium	avg. Baddeleyite - 0.07	650
URANIUM DEPLETED IN THE U-235 ISOTOPE			
THORIUM (ISOTOPE)	Thorium	Baddeleyite 0.04	375

(e) MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME (kilograms)
1025

9. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL RADIATION HAZARDS ASSOCIATED WITH EACH STEP OF THOSE PROCESSES.
Zirconium oxide in the form of baddeleyite containing the above noted percentage of U and Th is moved throughout our plant in accordance with the attached process flow diagrams and charts (attached in Item 9 Supplements 1,2,3,4,5,6) which covers approximately 95% of our total operation.

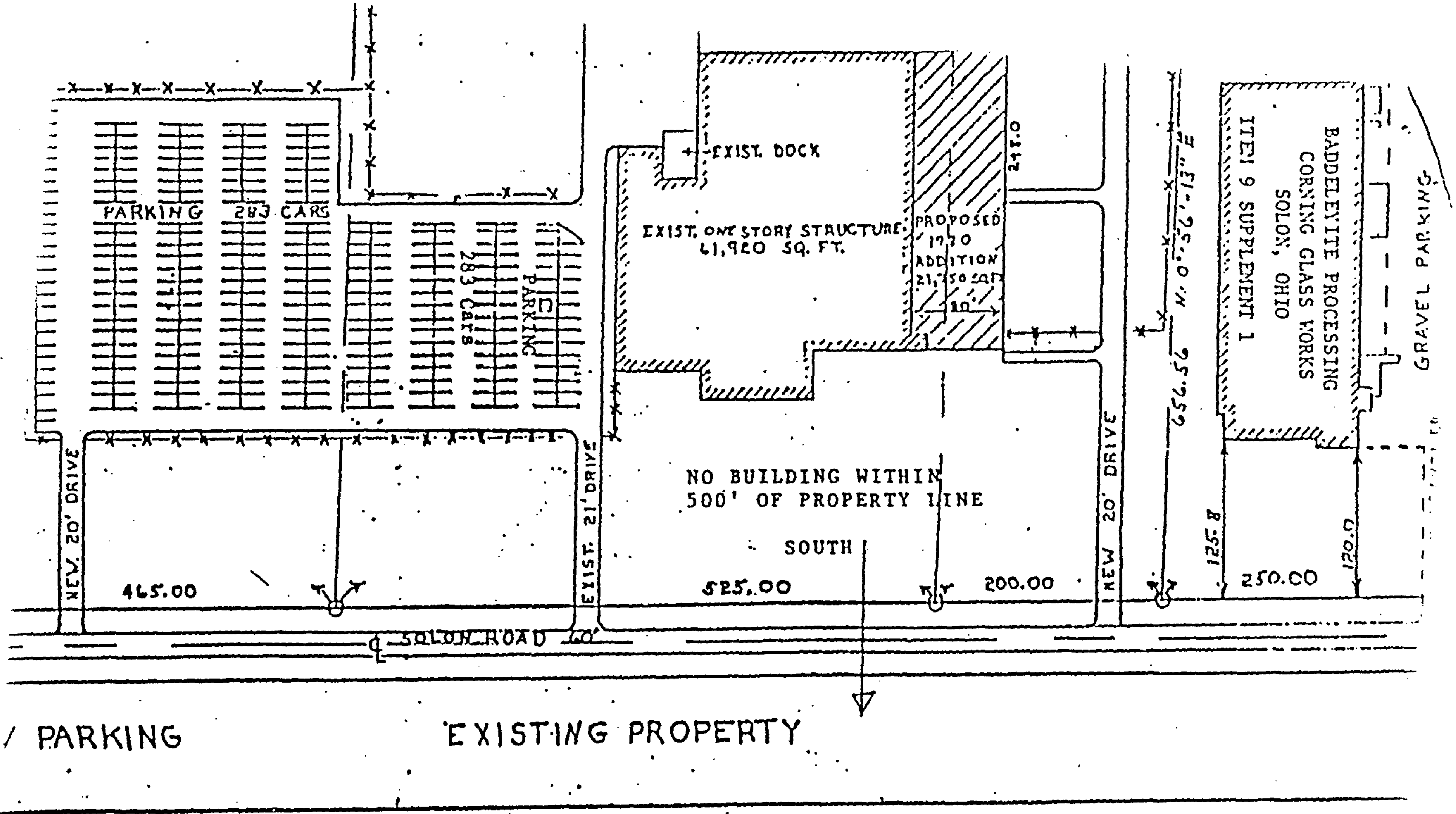
10. LIST THE NAMES AND ATTACH A RESUME OF THE TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE OF APPLICANT'S SUPERVISORY PERSONNEL AND THE PERSON RESPONSIBLE FOR THE RADIATION SAFETY PROGRAM (OR OF APPLICANT IF AN INDIVIDUAL).
The responsibility for the use of all source material at this location has been delegated to the Radiation Safety Committee, Mr. Garth F. Austin, Chairman.
The resume of technical qualifications and training has been included as Item 10 Supplement, attached.

11. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9. INCLUDE (a) RADIATION DETECTION AND RELATED INSTRUMENTS (including film badges, dosimeters, counters, air sampling, and other survey equipment as appropriate. The description of radiation detection instruments should include the instrument characteristics such as type of radiation detected, window thickness, and the range(s) of each instrument).

See attachment 11a.

(b) METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED IN (a) ABOVE, INCLUDING AIR SAMPLING EQUIPMENT (for film badges, specify method of calibrating and processing, or name supplier).
Note 11a above. Units to be calibrated at intervals not to exceed 1 year by manufacturer or other authorized company. Film badges to be supplied by Landauer of Glenwood, Illinois, Or Siemens Gammasonics, Des Plaines, ILL.

1106

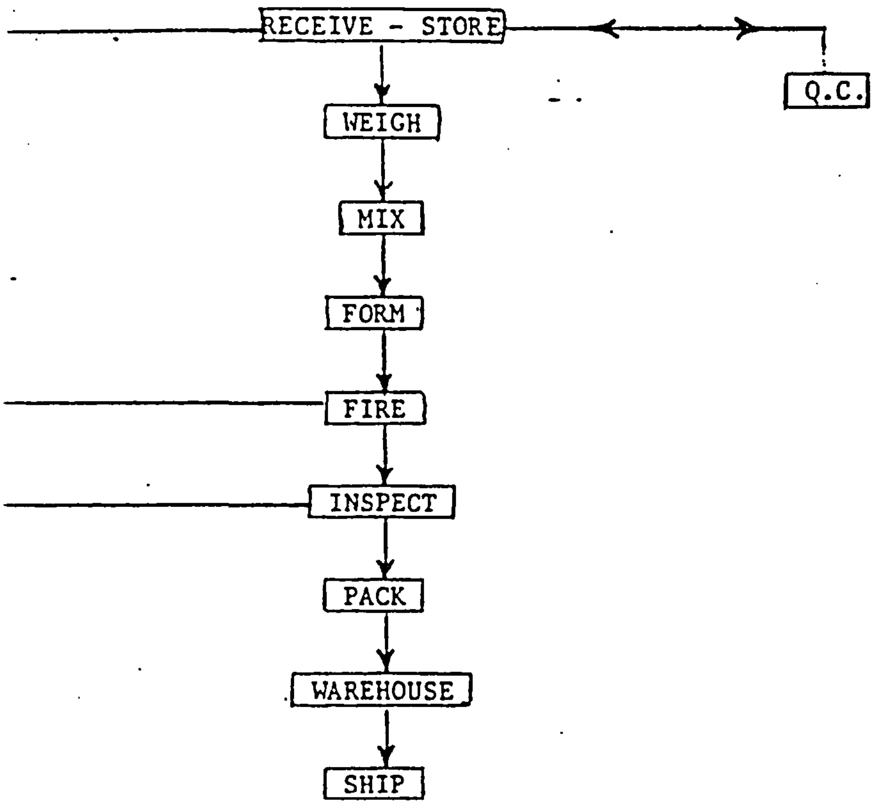

BADDELEYITE PROCESSING
CORNING GLASS WORKS
SOLON, OHIO
ITEM 9 SUPPLEMENT 1
PARKING 283 CARS
PARKING
283 Cars
EXIST. DOCK
EXIST. ONE STORY STRUCTURE
61,920 SQ. FT.
PROPOSED
ADDITION
248.0
NO BUILDING WITHIN
500' OF PROPERTY LINE
SOUTH
NEW 20' DRIVE
EXIST. 21' DRIVE
NEW 20' DRIVE
465.00
525.00
200.00
250.00
125.8
120.0
656.56
GRAVEL PARKING
SOLON ROAD 60'
PARKING
EXISTING PROPERTY

BADDELEYITE PROCESSING
CORNING GLASS WORKS
SOLON, OHIO

ITEM 9 SUPPLEMENT 2

FLOW DIAGRAM

(GENERAL)



DELEYITE PROCESSING
CORNING GLASS WORKS
SOLON, OHIO

ITEM 9 SUPPLEMENT 3

ESS FLOW FOR CRUCIBLES
ZLES AND SPECIAL SHAPES
(SPECIFIC)

1 RECEIVE BY TRUCK
20 TON MAXIMUM
→ INCOMING Q.C.

2 STORE IN WAREHOUSE

3 WEIGH OUT (Full BARRELS) APPROXIMATE MATERIAL REQUIRED FOR NEXT DAY'S OPERATION

4 TRANSPORT BARRELS TO BGM AREA

WEIGH SPECIFIC AMOUNT REQUIRED FOR NEXT DAY'S OPERATION, INTO PLASTIC LINED BARRELS. MAXIMUM 10 BATCHES/SHIFT 2500#/SHIFT

5 [redacted]

E4

6 TRANSPORT BARRELS FROM (4) TO BATCH MIXING AREA. STORE IN MIX AREA ON PALLETS

Continued on
next page

ITEM 9 SUPPLEMENT 3 (CONTINUED)

7 BARRELS FROM (6) ARE EMPTIED INTO A MULLER MIXER, ALONG WITH ALL OTHER INGREDIENTS, USING A SKIP HOIST

↓

8 BATCH IS MIXED, DUMPED, THROUGH A DELUMPER PER, INTO PLASTIC LINED BARRELS, THEN SENT TO FABRICATION DEPARTMENT STAGING AREA.
MAXIMUM 10 BATCHES/SHIFT 2500# EACH

↓

9 INDIVIDUAL BARRELS OF BATCH LOADED INTO WEIGH HOPPERS CAPABLE OF WEIGHING OUT ENOUGH BATCH TO MAKE THE DESIRED ITEM

↓

10 WEIGHED BATCH IS LOADED, MANUALLY, INTO DIE CAVITY. ITEMS ARE PRESSED TO SHAPE, VISUALLY EXAMINED, MEASURED. PLACED ON PRODUCT CARTS.
WT - 2 - 100# PER PIECE
MAX. 3000 PCS./SHIFT
MAX. 3000#/CARTS

→ 10a GREEN RE… ARE FIRE… STORED I… HOUSE

→ To St… Next

↓

11 PRODUCT CARTS ARE STAGED IN FRONT OF DRYER IN FABRICATION AREA

↓

12 [redacted] b4

↓

13 PRODUCT CARTS ARE STAGED IN DRYER STAGING AREA AFTER DRYING

↓

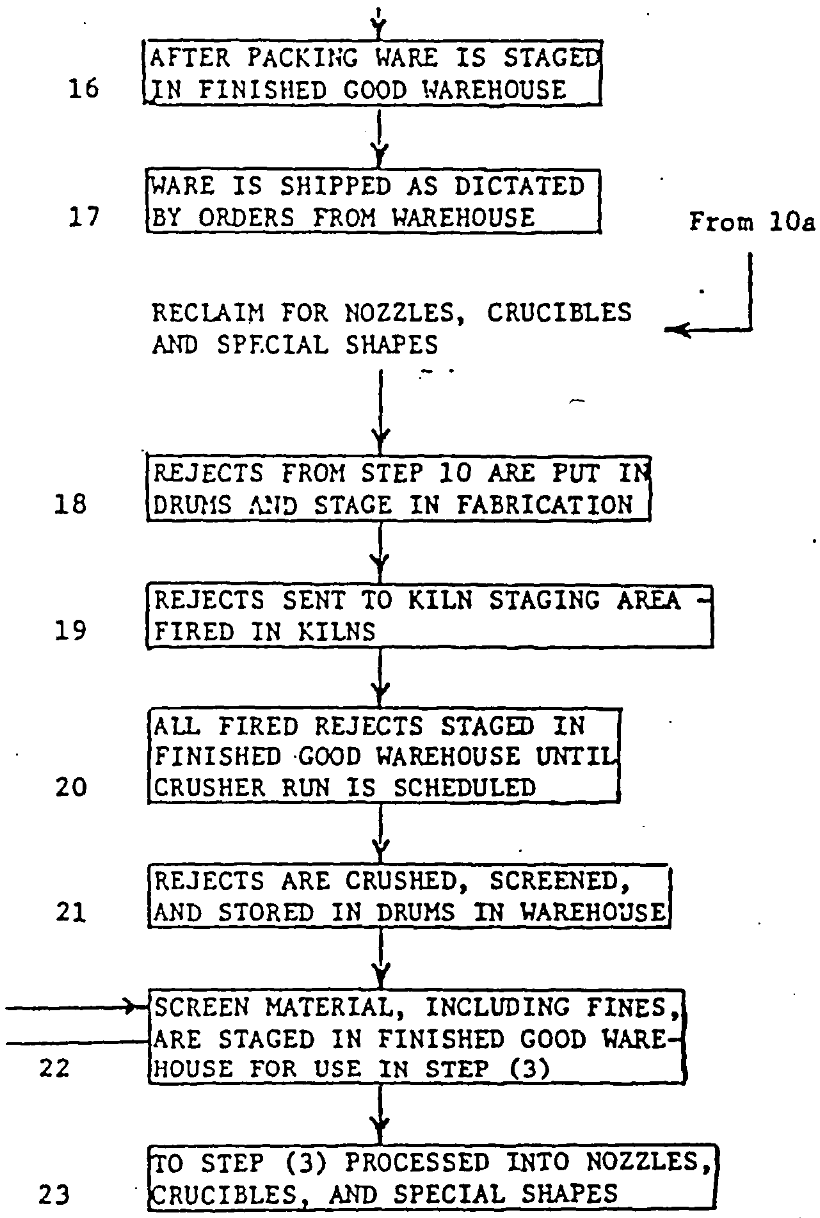
14 PRODUCT CART MOVED TO KILN STAGING AREA - PRODUCT LOADED ON TO KILN CARS FOR FIRING

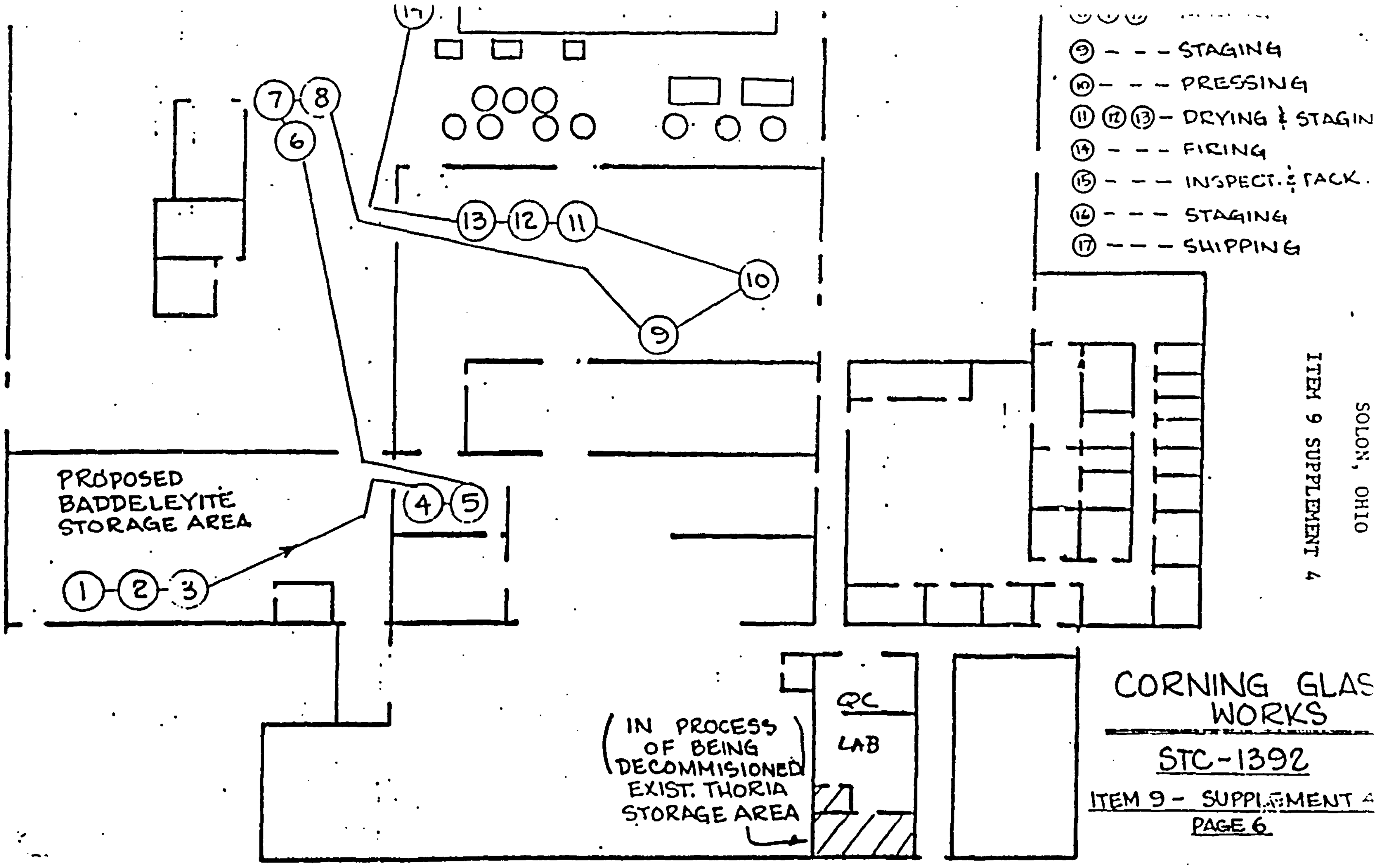
↓

15 AFTER FIRING, WARE IS SENT TO INSPECTION, PACKING, Q.C.

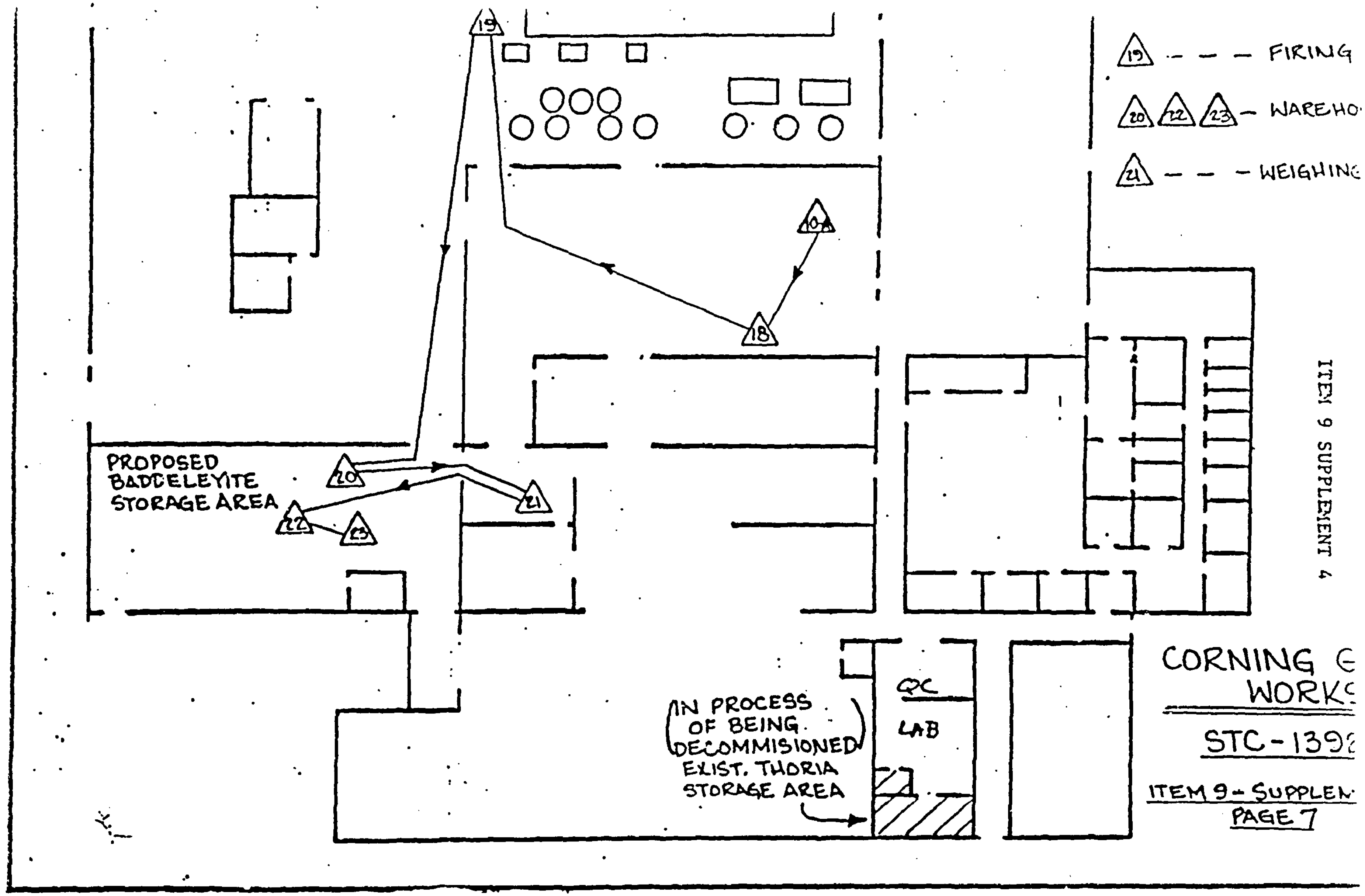
↓

EM 9 SUPPLEMENT 3 (CONTINUED)





⑨ - - - STAGING
⑩ - - - PRESSING
⑪ ⑫ ⑬ - DRYING & STAGIN
⑭ - - - FIRING
⑮ - - - INSPECT. & PACK.
⑯ - - - STAGING
⑰ - - - SHIPPING
PROPOSED BADDELEYITE STORAGE AREA
(IN PROCESS OF BEING DECOMMISIONED) EXIST. THORIA STORAGE AREA
QC LAB
SOLON, OHIO
ITEM 9 SUPPLEMENT 4
CORNING GLAS WORKS
STC-1392
ITEM 9 - SUPPLEMENT 4
PAGE 6



19
FIRING
20
22
23
WAREHO
21
WEIGHING
10
18
PROPOSED
BADDELEYITE
STORAGE AREA
IN PROCESS
OF BEING
DECOMMISIONED
EXIST. THORIA
STORAGE AREA
QC
LAB
ITEM 9 SUPPLEMENT 4
CORNING G
WORKS
STC-139
ITEM 9 - SUPPLEM
PAGE 7

; of Baddeleyite Ore, Lot #43082 (American

U + Th content = 0.13%.
at Louisville, Kentucky, licensed facility

ion: OCDM, Item No. CDV-700, Model No. 6,

;: mR/Hr; All readings include area background mR/Hr.

[redacted]

E4

measurements represent readings obtained within the general rea. The general area contained several hundred drums. were palletized, four drums to the pallet and pallets stacked rs high. The following measurements represent radiation obtained at various distances.

[redacted]

E4

e levels of radiation anticipated to exist within our orage area defined in Item 9 Supplements 4 and 5 will identical with those noted above.

RADIATION SAFETY COMMITTEE

:

pose of the Radiation Safety Committee is to promote the actices in safe handling and use of source material within a of corporate jurisdiction, and to maintain radiation es as low as possible.

ent regulations concerning source material shall be nted by the action of the committee in association with ent heads and individual users.

ation of the Committee:

iation Safety Committee is composed of such persons as an ed RSO (Radiation Safety Officer), representatives of ent and other senior staff officers, as well as other who have specific training and experience in the use of terial.

iation Safety Committee, as the governing body relating safe use of source material, is responsible for the shment of administrative procedures prior to and for the , use, storage, procurement, transfer, disposal and ng of all source material. Specific duties and responsi-s are as follows:

ablish broad policy in the handling and use of rce material and in radiological protection sures.

ablish routine measure of control.

s on new and unusual procurements or s of source material.

ve as an advisory group on company facilities the handling of source material.

ve to centralize in the company information rules, regulations and other requirements which company operations are subject on a ional, state of local level.

ide the qualifications of an individual may supervise the use of source material establish and/or amend the procedures by ch any individual is to handle or use s material.

The RSO (Radiation Safety Officer:

The RSO is the chairman of the Radiation Safety Committee. His responsibilities are as follows:

1. Coordination of the desires of the Radiation Safety Committee and provide such staff as required in the conduct of radiation control.

2. Review staff findings and initiate corrective measures as necessary.

3. Establish exposure standards which are in general agreement with the limits recommended by the National Committee on Radiation Protection and the International Commission on Radiological Protection for processing, handling, shipment and disposal of radioactive materials.

4. Establish plant rules and regulations relating to radiation protection and control.

5. Provide monitoring services to measure and record personnel exposures and to evaluate operational and general environmental hazards.

6. Maintain surveillance of plant facilities and equipment to determine the effectiveness of the measures employed for radiation protection and control.

7. Report known cases of over-exposure and assist in investigating such incidences.

8. Furnish consulting services on all aspects of radiation protection.

9. Review proposed plant modifications or additions for compliance with pertinent plant health and safety standards.

10. Maintain liaison with other participants in the field of Health Physics in order to improve the program whenever possible.

\DDELEYITE PROCESSING
:ORNING GLASS WORKS
SOLON, OHIO

ITEM 10 SUPPLEMENT 2

DIATION SAFETY COMMITTEE

- Plant Manager

- Radiation Safety Officer
Chairman of Radiation Safety Comittee

- Plant Manufacturing Engineer

- Production Superintendent

- Personnel and Safety Director

- Manager Ceramic Technology
Technical Products Division

- Outside Consultant,
Siemens Gammasonics, Inc.

member of Safety Committee is included on
ng pages.

RESUME OF PROFESSIONAL EXPERIENCE

Fred R. Cekella	B.A. Mathmatical Sciences Columbia University
1980 - Current	Plant Manager of Technical Ceramics Plant which produces in all major ceramic manufacturing methods.
1978 - 1980	Division Manufacturing Engineer. Involvement with various processing of refractories which included pressing, melting, slipcasting and extrusion. Responsible for plant compliance to existing environmental and industrial laws.
1974 - 1978	Plant Manager of below facility.
1970 - 1974	Production Superintendent of plant engaged in Mechanical pressing of basic brick and slipcasting of dense refractories. As well as firing and finishing the product.
1969 - 1970	Department supervisor of refractory finishing and inspection operation.
1968 - 1969	Supervisor of Process Engineering of plant working in deposition, sealing and grinding of glass.
1963 - 1968	Various production management jobs from shift supervisor to department supervisor in inspection and finishing, melting of glass, fused silica deposition, glass sealing and glass grinding.
1691 - 1963	Quality Control Engineer with duties in testing and sampling methods, defect analysis and statistical process control.

...ntinued)

RESUME OF PROFESSIONAL EXPERIENCE

B. S. Ceramic Engineering ([redacted]) Ex 6
Alfred University

Corning Glass Works - Solon, Ohio

Plant Manufacturing Engineer - seven years. Responsible for all plant engineering functions including Quality Control, Process and Equipment Engineering, and Radiation Safety Officer for three years over small thoria operation. Currently Supervisor of Plant Projects, Responsible for Pollution Control Program, Radiation Safety Officer and Cost Reduction Control.

Corning Glass Works - Louisville, KY

Project Engineer - Responsible for developing the process to make expanded polystyrene for mold making in a foundry type process.

Corning Glass Works - Buckhannon, W.VA.

Manufacturing Department Head - one year. Supervisied a twenty-four hour/day seven day/week operation of approximately fifty people. Supervisied Quality Control - two years. In charge of a group responsible for incoming and out going quality assurance. Plant Manufacturing Engineer - five years. Responsible for all engineering functions in the plant, including Quality Control, Process and Equipment Engineer.

Corning Glass Works - Corning, NY

Process Engineer - developed process controls and improvements for zircon, chromic oxide and other processes.

RESUME OF PROFESSIONAL EXPERIENCE

David R. McAdoo

B.S. (General Engineering) - [redacted])
United States Military Academy,
West Point, N.Y.

1973 - Current

Corning Glass Works

Plant production supervision experience at Harrodsburg, KY up thru general foreman level with annual budget responsiblities of $3MM+ and 200+ salaried and union workforce. Senior project engineer in corporate engineering division in Corning, NY as the company planner and as an industria engineering project coordinator. Presently, plant manufacturing engineer at Solon, responsible for plant engineering including process, equipment, documentation and quality control.

1967 - 1973

United States Army

Several duty locations including Germany, Vietnam, and Georgia. Jobs included armor unit commander, avaiation combat unit operations officer and unit commande: flight training instructor and unit commonder, and a variety of staff positio:

1 10 SUPPLEMENT 2 (Continued)

ESUME OF PROFESSIONAL EXPERIENCE

B.S. Business Administration - [redacted] E46
University of Kentucy
(Attended University of Kentucky
Law School 1964)

Corning Glass Works - Solon, Ohio.

Production Superintendent - responsible for all plant production activities including productivity, adherence to S.O.P. and adherence to safety and housekeeping standards.

Corning Glass Works - Pascogula, Miss.

Department Supervisor - Melting Department. Responsible for management of the Melting Department which included 15' electric arc furnace operation, mold assembly annealing, billet pulling, and batch raw material handling operations.

Corning Glass Works - Louisville, KY
East Plant

Department Supervisor - Melting Department. Responsibilities same as above.

Corning Glass Works - Louisville, KY

Production Planning Department Supervisor. Responsible for production planning, scheduling, inventory control, and warehousing for the Louisville East and West Plants.

Corning Glass Works - Louisville, KY

Customer Service Supervisor. Responsible for order entry and customer service functions for the East and West Plants.

RESUME OF PROFESSIONAL EXPERIENCE

:o

Pursuing a B.S. Degree in Industrial Relations (Two years completed)

Corning Glass Works - Solon, Ohio

Personnel Supervisor - Administration of Corning Glass Works' Personnel Policies, hirin dismissals or terminations (voluntary and involuntary), plant housekeeping, health and safety administration including record keeping and reporting, programs to maintain and improve morale of all employees, wage and benefit administration, training, EEO and Affirmative Action Plan.

Corning Glass Works - Solon, Ohio

Plant Manager Secretary - Performed secretarial duties, maintained salary records, performed a variety of duties to relieve Plant Manager of administrative routine duties, and handled special projects as assigned.

Indiana University of Pennsylvania - Indiana, Pennsylvania

Secretary - Performed secretarial duties for the Dean of Social Sciences, maintained student records, duplicated tests and other materials, served as co-ordinator of student works, and handled special projects as assigned.

RESUME OF PROFESSIONAL EXPERIENCE

:nberg

B.S. Chemical Engineering
Tennessee Technological University
M.S. work in Chemical Engineering
at Purdue University and University
of Louisville Speed Scientific School.

—.

Manager of Ceramic Technology,
Technical Products Division,
Corning Glass Works. Head group
of technical personnel who work
on the development of new products
and assist plants in specific
technical problems.

Supervisor of Bonded Refractories
Development, Technical Products
Division. Head staff group concerned
mainly with the development of new
products for the various plants in
our Division.

Supervisor of Process Engineering in
refractory plant utilizing almost all
known ceramic processes.

Process Engineering, fused cast
refractory plant.

E.I. DuPont DeNemours & Co.,
Process Engineering, smokeless
gunpowder manufacturing plant.

RESUME OF PROFESSIONAL EXPERIENCE

Ex 6

Clark	B.S. Physics - ([redacted]) University of Tennessee
)52	Oak Ridge National Laboratory Work included research in: Hi vacuum technology; Geiger counter, ionization chamber and proportional counter design. Development of NaI-Tl crystal scintillation counter resolution in gamma-ray spectroscopy.
.955	Radioactive Products, Ferndale, Mich. Project Engineer. Design of ionization chambers and development of specific purpose medical scintillation detector Design of portable neutron detectors. Design of oil well logging equipment using gamma-ray backscatter techniques with a maximum capacity of 200 curies Co-60. Sourcs storage and shield desig Health Physics Officer.
1961	Nuclear Chicago Corporation, Chicago, Il Project Engineer. Research and design of radiation detection instruments for alpha, beta, gamma and neutron radiation, including scintillation counter R/D for medical applications. Design and development of moisture and density measuring devices using neutron detection techniques. Design and develop Hot Cell facility, source design and source loading techniques for Cs137, Co60, Sr90 and H3 targets(activity to 1000 curies). Deputy radiological safety officer anc and outside Health Physics Consultant. Develop and maintain internal Health Physics program.
- 1974	Searle Analytic, Inc. (Formerly Nuclear Chicago Corp.) Health Physicist, Chief RSO; Mgr. Safety, Security and Health Physics. Outside Health Physics Consultant. Corporate licensing responsibility anc Chairman Isotope Committee. Maintain Maintain training program and instruction in applied Health Physics.

30 <u>Searle Diagnostics, Inc.</u>(Formerly Nuclear Chicago Corporation)

Health Physicist, Corporate Radiological Safety Officer, Health Physics Consultant, Mgr. Radioactive Material Analytical and Quality Assurance Labs., Corporate Licensing Responsibility and Chairman Isotope Committee.

:sent <u>Siemens Corporation,</u> (Formerly Nuclear Chicago Corporation)

Same as above.

ITEM 10 SUPPLEMENT 3

RADIATION TRAINING

RESPONSIBLE USERS & SPECIFIC SUPERVISORS

Introduction:

a) Content and Purpose
b) Radiation History

Radioactive Material:

a) Nomenclature
b) Atomic Structure
c) Isotopes
d) Decay

Types of Radiation & Decay: Mechanisms

a) Alpha
b) Beta
c) Gamma
d) X-Ray

Interaction With Matter:

Ionization:

Alpha
Beta
Gamma

Biological Effects:

Classification:

a) Somatic - Genetic
b) Acute & Chronic

Philosophical Concept:

a) Linear Dose Concept
b) Threshold Concept

Mechanisms of Damage:

a) Ionization
b) Chemical

RADIATION TRAINING
RESPONSIBLE USERS & SPECIFIC SUPERVISORS

Radiation Dosimetry:

a) Definitions - Roentgen
Rem
Rad

b) Gamma Exposure Rate
Co^{60}, Ra^{226}, Baddeleyite, Thorium & Uranium

c) Dose Limits

d) Radiation Protection Guides
Time, Distance and Shielding,
Inverse Square Law

e) Personnel Radiation Detection Devices
Film Badges, TLD

Radiation Detection Instruments/Devices:

a) G. M. Survey - Bata & Gamma Detector

b) Mini Monitor - Alpha Detector

Regulatory Control - Federal

a) 10 CFR 19.20

b) Licensing - Specific & General
Use, Procurement, Storage, Protection,
Disposal, Inspection

Internal Control:

a) Radiation Safety - Role

b) Role Radiation Safety Officier

c) Individual - Role
Responsible User
Casual User

d) Procedures/Responsibility

1) General - Procurement
Receiving, Transfer
Storage, Protection
Emergency

2) Specific - Survey
Decontamination
Emergency

[illegible]
CORNING GLASS WORKS
SOLON, OHIO

ITEM 11a SUPPLEMENT 1

RADIATION DETECTION INSTRUMENTS

1. The radiation devices available for continuous use for the purpose of monitoring and general area survey are listed on the next page of this section.

2. Each device will be calibrated at intervals not to exceed one year or at anytime following service or repair. Calibration will be carried out by the manufacturer or other authorized laboratory using sources traceable to the NBS.

3. Film badges, as provided by the R. S. Landauer Company South, Chicago, IL/Siemens Gammasonics, Inc., Des Plaines, IL., will be issued for all individuals who will be working or around any area where they could be exposed to radiation in excess of 25% of the tolerance occupations dense limit as specified in 10 CFR 20.

1 Page

ITEM 11a SUPPLEMENT 2

INSTRUMENTATION

Manufacturer & Model	Purpose	Type of Radiation Detected	Range	Comments
(1) Mini-Inst.Ltd. Reading, England Model 5.40 with Ap-2 Probe	Routine Monitoring & Surveying	Alpha	0-2000 d/sec.	Portable Batter Powered
(2) Victoreen Instruments Model 490	Routine Monitoring & Surveying	Beta & Gamma	0 - 0.2 mr/Hr 0 - 2.0 mr/Hr 0 - 20 mr/Hr 0 - 200 mr/Hr	Portable Batter Powered
(3) Gravimetrk Dust Sampling Kit Part No. 456241 with Model G Portable Pump Part No. 456059 Mine Safety Appliances Company Pittsburg, PA 15208	Routine Monitoring & Surveying	Respirable Dust to be analyzed by Siemens Gammasonics per description shown on pages 3,4 this secion	2 Micron	Portable

SAMPLE EVALUATION & INSTRUMENTATION INFORMATION

Alpha Smear Test Samples - Mode No. 1

All alpha emission samples will be evaluated, unless otherwise requested, using a Searle Analytic, Inc., Model 1152 low background, 2", 2 ~~π~~ gas flow proportional counter system connected to a teletype readout printer. This system has an alpha background 0.03 c/m, a beta background 7 c/m and a proven detection efficiency for amount of activity less than 1 x 10^{-5} uCi. Calibrations of this device are performed using N.B.S. supplied calibration reference sources.

Beta Smear Test Samples - Mode No. 2

All beta, alpha plus beta samples, unless otherwise requested will be evaluated using the above noted proportional counting system. This system contains dual channel analyzers which discriminate between alpha and beta radiation and provides for separate readout. Calibration for betas are made using N.B.S. supplied Ra D and [illegible]ard reference sources or other type nuclides as required.

Weak Beta Smear Test Samples - Mode No. 3

Weak betas, H^3, Ni^{63}, C^{14}, may be evaluated using a Searle Analytic, Model Mark III liquid scintillation counting system. This system has a proven efficiency greater than 65% detection for H3 and 95% for C^{14} and will reliably detect 1 x 10^{-5} uCi at any required confidence level.

Gamma Smear Test Samples - Mode No. 4

Gamma samples are evaluated using a Searle Analytic Model 1185, 3", thinwall, well type, 200 sample, automatic Nal-Tl scintillation counting system. This system can detect gamma photons reliable with a minimum of 30 KeV and sensitivity for amounts less than 1 x 10^{-5} uCi. Calibrations are performed using standards directly or indirectly traceable to the N.B.S.

SIEMENS GAMMASONICS, INC.
Health Physics Services
2000 Nuclear Drive • Des Plaines, IL 60018 • Telephone (800) 323-6015 • (312) 635-3387

Air Samples - Mode 5

Air samples are evaluated by digesting the samples in a proper solvent, evaporating the residual contamination to dryness on platinum discs and counting as noted in Mode No. 1 above. The confidence level of 95% has been established for this evaluation.

Qualitative Analysis (Gamma Emission) - Mode 6

In any case, where a qualitative analysis is required (or desired) measurements are made using a R.I.D.L. gamma-ray spectrometer, Model 24-2, 400 channel connected to a 2" NaI-Tl scintillation crystal and direct drive Franklin printout system. A CRT attachment shows visual spectrum for "Poloroid" photo retrieval. This system has an identification range from 25 KeV to 4 MeV with a system linearity better than 0.5%.

BADDELEYITE PROCESSING
CORNING GLASS WORKS
SOLON, OHIO

ITEM 11c SUPPLEMENT

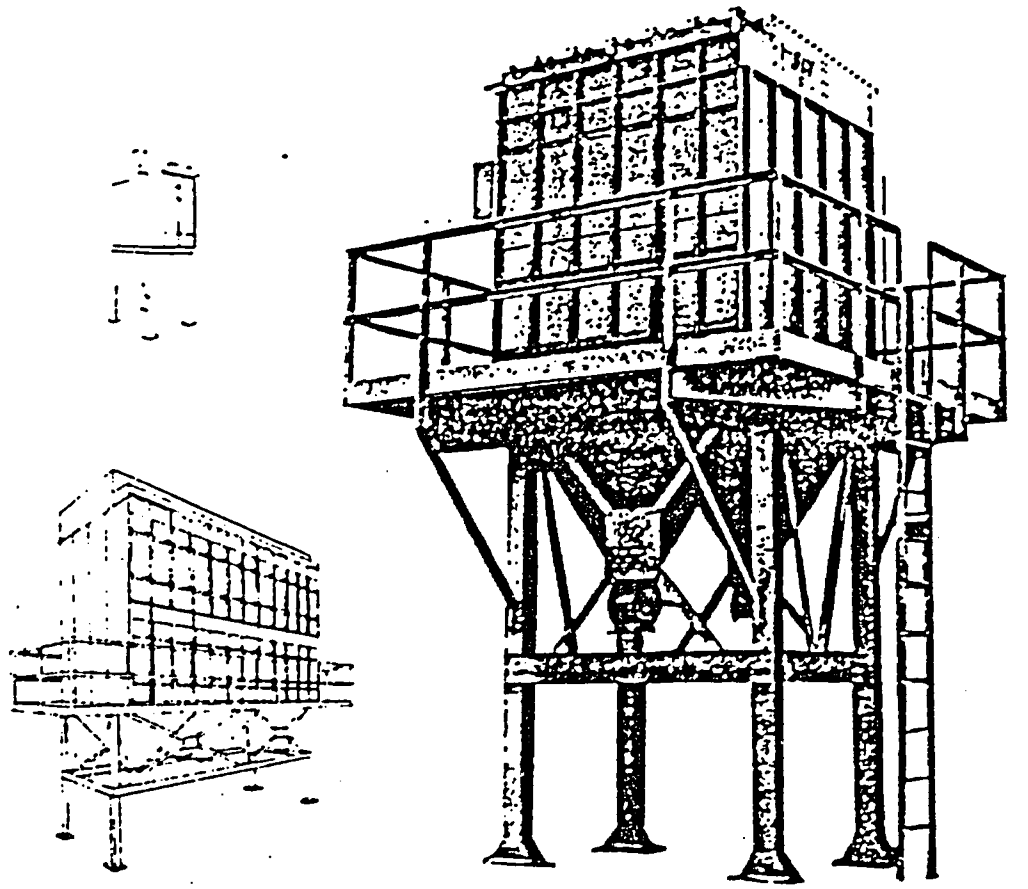
CONTAMINMENT SYSTEM

A DUST COLLECTOR SYSTEM IS INCLUDED AS AN INTERGAL PART OF OUR RECLAIM SIZING PROCESS. THE MATERIAL FROM THE DUST COLLECTOR IS COMPLETELY RETURNED TO THE SYSTEM AND USED IN SUBSEQUENT BATCH FORMULATIONS.

THE UNIT WAS MANUFACTURED BY WHEELABRATOR - SLY CORPORATION AND IDENTIFIED AS MODEL PC8. (SEE ATTACHED LITERATURE)

Item 11 C SUPPLEMENT (CONT'D)

SINCE 1874

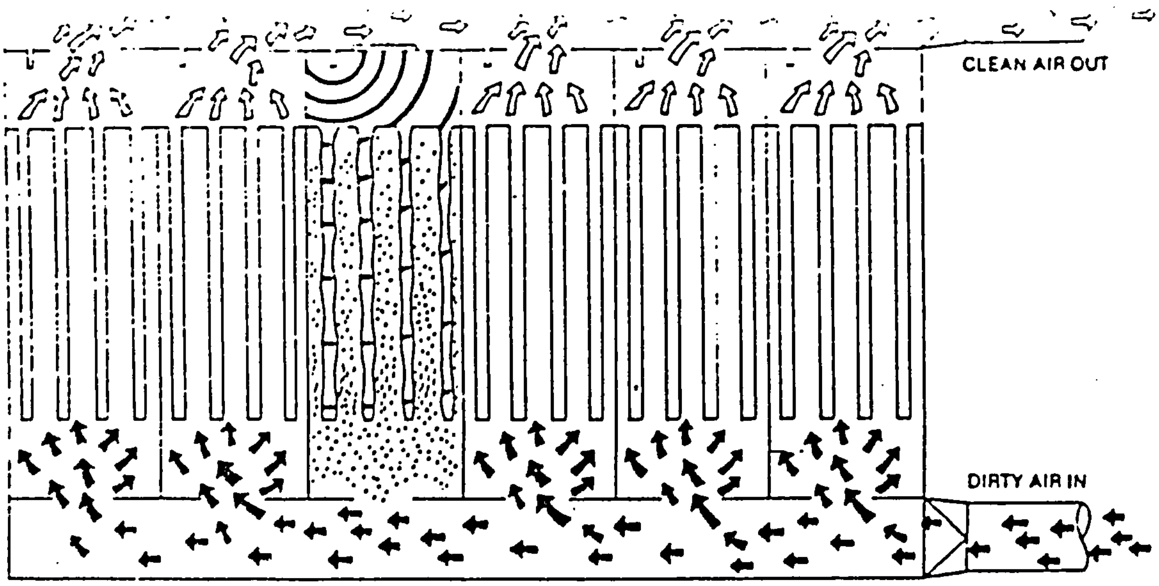


PACTECON®

Model PC

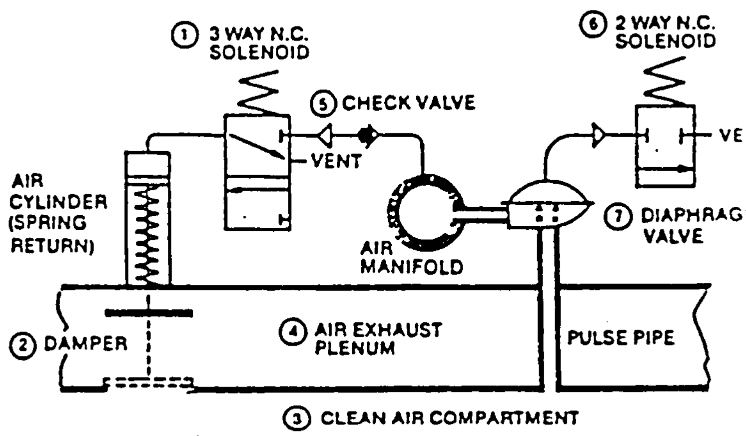
Pulse-cleaned Filters to 25,000 CFM

- Safe
- Efficient
- Compact
- Economical
- Quick Delivery
- Delivered Assembled



How PACTECON Model PC Operates

The basic filter consists of a number of modules or sections, the number being determined by the gas volume to be handled. Each section contains four (PC-100) or eight (PC-200) envelope-type filter bags. The sections are cleaned individually, off-line, in a sequence controlled by a solid state timer.
The cleaning cycle operates continuously, beginning with the first cell. The timer energizes a 3-way solenoid (1), closing the damper (2), to isolate the cell (3), from the air exhaust chamber (4), stopping the air flow to the cell. A check valve (5), functions as a safety feature in the system to prevent an unprogrammed damper opening. After a 5-second dwell, a 2-way solenoid (6), is energized to vent the diaphragm valve (7), allowing it to open suddenly and send a shock wave of compressed air into the clean air compartment. The shock wave travels into the filter bags, breaks the dust cake and allows the dust to fall into the hopper below. Duration of the initial pulse is adjustable from 50 to 150 milliseconds. After a 5-second dwell, a second pulse is initiated (adjustable from 1 to 10 pulses per cell). A final 5-second dwell allows dislodged dust to settle to the hopper before the 3-way solenoid is de-energized, opening the damper and returning the cleaned cell to service. After an adjustable 2-12 minute pause, the next cell is removed from service for cleaning. The cleaning cycle is repeated continuously, returning to the first cell after the last cell has been cleaned.
Maximum air usage is 8.5 SCFM @ 90 PSI for the PC-100 Series; 17 SCFM for PC-205 thru PC-212 and 34 SCFM for PC-213 thru PC-224. Actual air consumption is typically about ¼ of these air rates.



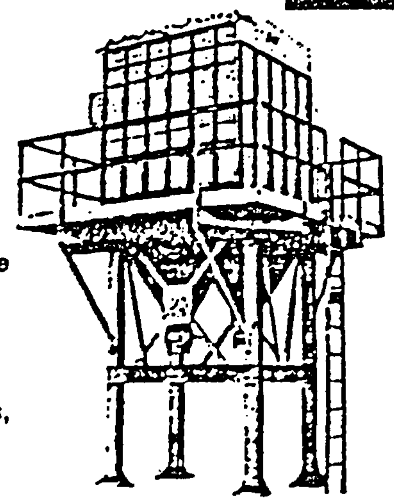
Air pollution control advantages

EFFICIENCY: Guaranteed to be 99.9% collection of all dust over ½ micron size, from cement to carbon black.
LOW MAINTENANCE: A minimum number of moving parts means long, trouble-free service.
SAFE, EASY ACCESSIBILITY: All inspection, adjustments or repairs, including bag changes, are made from walkways outside the filter case — not from inside or on top.
ADAPTABILITY: Conservative air-to-cloth ratios and high technology felt bags make PACTECON suitable for all dry dust applications.
LOW COST: PACTECON sells for less per CFM than other comparable dust filters. This is possible because PACTECON is made from standard off-the-shelf parts.
COMPACTNESS: Sly filters have always been the most compact in the industry. The PACTECON requires still less cubic feet of space per unit capacity than our already compact line.
SHOP ASSEMBLY: PACTECON filters leave our plant assembled, with bags installed. You only have to mount PACTECON on our supports or your base, and bolt on hoppers when required. Fans can be shipped installed when truck size permits. Your installation time and costs are reduced by ⅓.
FAST DELIVERY: Assembly of your PACTECON from standard in-stock parts means delivery from our shop in as little as two weeks.

PACTECON Model PC-200

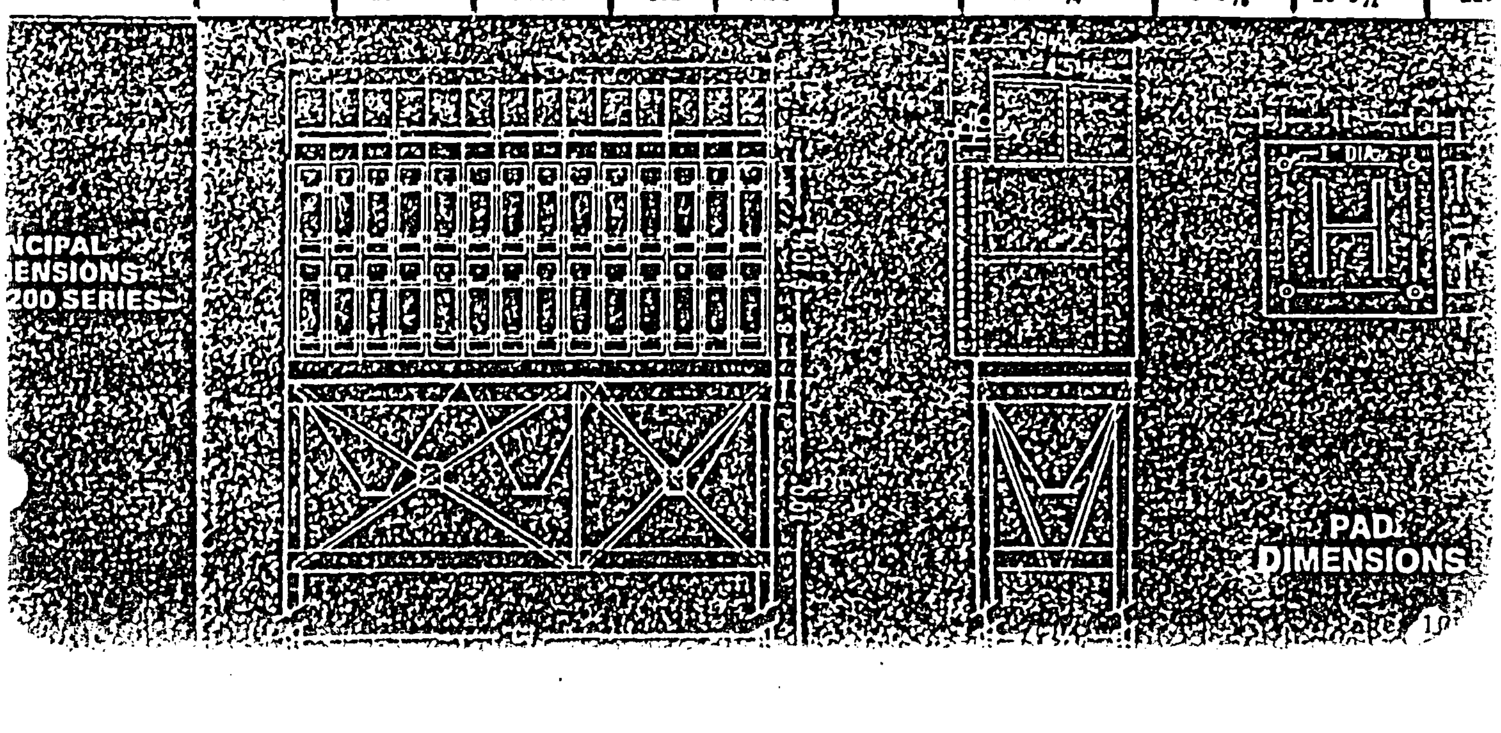
PC-200 Optional Equipment

Fan platform.
Fan house.
Classifier.
Higher supports.
Walkways, rails, grating.
Ladders, cages, stairways.
Shop assembled support.
Special inlets and outlets.
Galvanized case and hoppers.
Special paint.
Solenoid valve enclosures.
Special motors and drives.
Control panels.
Special fans.
Grounded bags.
Explosion-proof electricals.
Explosion-relief doors.
Sprinkler adapters.
Special dampers.
Trough hoppers.
Screw conveyors.
Continuous valves and drives.
Dust valve options (Cast Iron, Slide Gate, Double Flap, Sheet Iron).
Hopper rappers or vibrators.
Manometer or Magnehelic gauge.
Differential pressure alarm.
Air compressor packages (Compressor, Filters, Regulators, Dryers, etc.)



PC-200 SPECIFICATIONS

Model PC Size	Capacity (CFM) At: 5:1 Ratio	6:1 Ratio	No. of Bags	Cloth Area Sq. Ft.	No. of Hoppers	Length of Filter Case Dimension "A"	"B" Plenum Height	"C" ℄ Col.	Wei… (L…
205	4440	5328	40	888	1	5'-10 3/16"	1'-7 1/8"	5'-5 15/16"	69
206	5328	6394	48	1066		6'-11 3/8"	1'-7 1/8"	6'-7 1/8"	77
207	6216	7460	56	1243		8'-0 9/16"	1'-7 1/8"	7'-8 5/16"	85
208	7104	8525	64	1421	2	9'-1 3/4"	2'-8 1/8"	8'-9 1/2"	95
209	7992	9591	72	1598		10'-2 15/16"	2'-8 1/8"	9'-10 11/16"	103
210	8880	10656	80	1776		11'-4 1/8"	2'-8 1/8"	10'-11 7/8"	110
211	9768	11722	88	1954		12'-5 5/16"	2'-8 1/8"	12'-1 1/16"	119
212	10656	12788	96	2131		13'-6 1/2"	2'-8 1/8"	13'-2 1/4"	127
213	11544	13853	104	2309	3	14'-7 11/16"	2'-8 1/8"	14'-3 7/16"	135
214	12432	14919	112	2486		15'-8 7/8"	2'-8 1/8"	15'-4 5/8"	142
215	13320	15984	120	2664		16'-10 1/16"	2'-8 1/8"	16'-5 13/16"	150
216	14208	17050	128	2842		17'-11 1/4"	3'-9 1/8"	17'-7"	162
217	15096	18115	136	3019		19'-0 7/16"	3'-9 1/8"	18'-8 3/16"	170
218	15984	19181	144	3197	4	20'-1 5/8"	3'-9 1/8"	19'-9 3/8"	178
219	16872	20247	152	3374		21'-2 13/16"	3'-9 1/8"	20'-10 9/16"	186
220	17760	21312	160	3552		22'-4"	3'-9 1/8"	21'-11 3/4"	193
221	18648	22378	168	3730		23'-5 3/16"	3'-9 1/8"	23'-0 15/16"	202
222	19536	23444	176	3907		24'-6 3/8"	3'-9 1/8"	24'-6 1/8"	210
223	20424	24509	184	4085	5	25'-7 9/16"	3'-9 1/8"	25'-3 5/16"	218
224	21312	25575	192	4262		26'-8 3/4"	3'-9 1/8"	26'-8 1/2"	226



Applications, Uses and Typical Dusts Collected

Representative List of Pactecon Users

Birds Eye Food, Inc. Div. of General Foods
Burke Rubber Co., Inc.
Thatcher Glass Mfg. Co.
Flint Ink Co.
E. I. Dupont
Meriam Weld, Inc.
Lafarge Cement Co. of North America
Alcoa (Aluminum Co. of America)
Corning Glass Works
Commercial Stone Corp.
Belden Brick Co.
Universal Chemical Corp.
Hooker Chemical Corp.
Reynolds Aluminum Co.
Elcor Chemical Corp.
Medusa Portland Cement Co.
Westinghouse Electric Corp.
Metal Improvement Co.
McGean Chemical Co. (Div. of Chemtron Corp.)
M & T Chemical, Inc.
Horsburgh & Scott Co.
Schlegel Mfg. Co.
Goodyear Tire & Rubber Co.
Philip Morris, Inc.
Dow Chemical Co.
B.F.Goodrich Co.
Kearney Industries
Du-Co Ceramics Co.
Electrostatic Equip. Corp.
Occidental Chem. Co.
Jack Daniel Distillery
Barber Colman Co.
Morton Salt Co.
Eggo Foods Div., Fern International, Inc.
City of Buffalo
Reichhold Chemicals, Ltd.
National Gypsum Co.
Chrysler Canada, Ltd.
Polymer Corp., Ltd.
United States Gypsum Co.
Molded Products Div. of Amerace Corp.
Texas Industries, Inc.
Best Block Co.
Union Carbide Corp.
Plymouth Rubber Co., Inc.
Frito-Lay, Inc.
Red-D-Mix Concrete Co.
Hilltop Concrete Co.
Fruehauf Corporation
Procter & Gamble Co.
Gates Rubber Co.
Bethlehem Steel
Monsanto Corporation
Exxon Chemical Corp.

Typical Kinds of Dusts Collected

Alumina
Aluminum
Aluminum Oxide
Alundum
Arsenic
Asbestos
Bakelite
Baking Powder
Bauxite
Beryllium
Bone
Bone Char
Bronze Powder
Brunswick Clay
Calcined Diaspore
Calcium Arsenate
Carbon
Carbon Black
Carbonizing Compound
Carborundum
Cellulose Powder
Cement
Charcoal
Chocolate
Chrome Ore
Clam Shell
Clay
Cleanser
Coal
Cocoa
Coke
Copper
Copperus
Cork
Corn Hulls
Cotton
Cottonseed Meal
Cryolite
Derris
Detergent
Dextrine
Diatomaceous Earth
Emery
Enamel
Feed
Feldspar
Fertilizer
Flour
Fly Ash
Fuller's Earth
Gold Ore
Grain
Graphite
Granite
Grinder
Gypsum
Hard Rubber
Insecticides
Iron Borings
Iron Ore
Iron Oxide
Lamp Black
Lead
Lead Arsenate
Lead Oxide
Leather
Lime
Limestone
Linoleum Mix
Magnesite
Manganese
Mazein
Mica
Mineral Ore
Nepheline Syenite
Oxides
Oyster Shell
Paint Pigment
Paper
Paris Green
Pearl Button
Perlite
Petroleum Coke
Plaster
Plastic
Porphyry
Pumice
Pyretheum
Quartz
Refractory
Rice Hulls
Rosin
Rubber
Salt
Sand
Sea Coal
Silica
Silicon Carbide
Slag
Slate
Snuff
Soap Powder
Soapstone
Soda Ash
Soya Bean
Spinach Powder
Starch
Stone
Sugar
Sulphur
Talc
Talcum Powder
Tannin Bark
Tartaric Acid
Titanium
Tobacco
Tooth Powder
Trisodium Phosphate
Uranium Ore
Vermiculite
Welding Flux
Whiting
Wood Flour
Yeast
Zinc Carbonate
Zinc Oxide
Zircon
Zirconium Oxide

BADDELEYITE PROCESSING
CORNING GLASS WORKS
SOLON, OHIO

ITEM 12a SUPPLEMENT

BADDELEYITE SAFETY PROGRAM

PROCESS STEP*	PROCEDURE	RESPONSIBILITY
(1), (2), (3)	Repack any open drums. Take grab sample for chemistry at Louisville, KY and PSD (Particle Size Distribution) at Solon. Sweep up Baddeleyite at end of each shift. Replace in drums and stored for future use.	Paul Woodard - Warehouse Supervisor
(4), (6), (7), (8)	Consideration will be given to the use of protective masks based on the results of air sampling analysis. If required either of the following (or equivalent) will be used while bulk baddeleyite is handled style wilson 1212 or 3M #8710.	Garth Austin - Radiation Safety Officer Glenn Bogusz - BGM Department Foreman
(8)	If mixer is cleaned out, clean out material will be diluted to less than 15% and send to Municipal Sanitary Landfill.	Scott Abel - Fabrication Department Foreman
(9), (10)	Batch will not be dusty (approximately 4.0% H_2O). Protective equipment will not be required. Area will be swept at end of each shift and material reprocessed.	Scott Abel - Fabrication Department Foreman

* Process steps are described in process flow diagram Item 9 page 2-4.

PROCESS STEP	PROCEDURE	RESPONSIBILITY
(11) thru (20)	No radiation safety precautionary steps required.	
(21)	Consideration will be given to the use of protective masks based on the results of air sampling analysis. If required either of the following (or equivalent) will be used while bulk baddeleyite is handled systle wilson 1212 or 3M #8710.	Garth Austin - Radiation Safety Officer Scott Abel - Fabrication Department Foreman
(22), (23)	No radiation safety precautionary steps required.	
General Health - Physics Procedures	To guard against long term radiation buildup, employee protection and compliance with regulations the following survey will be made on a periodic basis and test results promptly submitted to the Radiation Safety Officer and reviewed by the Radiation Safety Committee. Air Survey Air Sampling Smear Tests Note: See attached listing of instruments and procedures that will be used for these tests.	

BADDELEYITE PROCESSING
CORNING GLASS WORKS
SOLON, OHIO

ITEM 12b SUPPLEMENT

EMERGENCIES

Plant storage and manufacturing area. In the event of an accident involving the breakage of a drum or spillage of a dry batch lot of baddeleyite in excess of 600 pounds or more the following action will be taken.

* Immediately leave the specific area and warn other individuals within a radius of 10' that a spill has occurred and they should temporarily leave the area.

* Immediately inform the Supervisor that a spill has occurred.

* Immediately turn off any fans, blowers that could cause excessive dust movement.

* As soon as practical, inform the Radiation Safety Officer that an accident has occurred.

* The specific effected area is to be isolated by rope or specified personnel until such time as is required for the spill to be removed and an area survey made.

* Cleanup is to be initiated as soon as possible following release by the Radiation Safety Officer or his approinted deputy. Face dust masks will be worn during cleanup and vacuuming operations.

* Following the removal of the spill the Radiation Safety Officer will investigate the accident, determine the cause and issue such instuctions as to preclude further incidents. The Radiation Safety Officer will issue a report for review by the Radiation Safety Committee for their review or subsequent action

BADDELEYITE PROCESSING
CORNING GLASS WORKS
SOLON, OHIO

ITEM 12c SUPPLEMENT

RADIATION SURVEY PROGRAM AND PROCEDURES

Full scale operations involving 70% mixtures of baddeleyite ore is not anticipated prior to November - December 1982. The use of materials involving 100% baddeleyite ore will probably not be initiated prior to mid 1983. In the interim period radiation surveys will be conducted to determine specific areas of hazard concern. The type of surveys to be made will include the following:

Air Samples

Air samples will be taken at strategic locations throughout the plant site and working areas wheverever a dusting location is anticipated or likely to occur. The instrumentation and sample analysis is noted in Item 12a Supplement and Item 11a, No. 1(page 2).

Preliminary air samples will be obtained in order to establish background levels. The information obtained by sample analysis will be presented in micro Ci/cc air for direct comparison of specified levels as noted in 10 CFR 20, appendix B.

Air sampling will initially be conducted on a quarterly basis, or more often if the needs so dictate. Ultimately, air sampling will be conducted at intervals not to exceed six (6) calendar months.

Smear Sampling (Wipe Tests)

Wipe tests for removable surface contamination will be made at strategic locations throughout the plant, on a routine basis.

Wipe tests will be performed at specific locations as noted for floors, settled dust and working surfaces. Wipe tests will be made using No. 1 Whatman Filter Paper and cover an area of approximately $100 cm^2$. Until such time as required for us to obtain our own instrumentation, all smear samples will be analyzed by Siemens Gammasonics, Inc. Health Physics Service. Analysis will include alpha, beta and gamma results.

ITEM 12c SUPPLEMENT (Continued)

Physical Surveys

1. Alpha Radiation

Physical surveys will be conducted at routine intervals for alpha radiation monitoring. For this purpose, a mini-monitor, manufactured by Mini Instruments, England, Model M-540 connected to a AP/2 probe, will be used. This device has a micro-mill window with an open face area of 100 cm2. The efficiency of this instrument is approximately 30% for alpha particles with energy levels above 3.5 mer. Federal specified limits for restricted and unrestricted areas will be used for control.

2. Gamma Radiation

Physical radiation surveys will be conducted for the measurement of gamma radiation fields per 10 CRF 20, 20.101 and 20.105. Also, for the purpose of Quality Control all measurements will be made using a Victoreen Inst. Co. G.M. Survey Meter Model No. 490.

For quality control purposes of incoming new materials gamma radiation measurements will be made on the side surface of a representative number of each shipment of baddeleyite ore drums. In the event that the radiation field is statistically higher than the drums containing 0.1% U+Th content all drums within the shipment will be surveyed. In the event that the content exhibits a reading 25% higher than the allowable limits the material will either be returned to the supplier or blended with low value material presently in storage.

Records of all surveys will be filed for future use, reference or inspection by any regulatory agency.

BADDELEYITE PROCESSING
CORNING GLASS WORKS
SOLON, OHIO

ITEM 14 SUPPLEMENT 1

PRODUCT DESCRIPTION

The products to be made from the baddeleyite ore and distributed to the general public are illustrated in the attached product brochures.

Our major product line at present (representing approximately 80% on a weight basis) is tundish nozzles used in the continuous casting of steel.

a. The percent source material is the same in all of the products and is approximately .1% in the form of a homogenous mixture (baddeleyite ore). As outlined in item 8.

b. These products are sintered at high temperature (+3000°F) and form a dense, tightly bonded ceramic body that is very resistant to dusting and will not have loose particles that might be separated from the product.

c. The beta and beta plus gamma radiation levels have been determined on typical tundish nozzles by Siemens Gammasonics, Inc. as outlined in the attached report (item 14, Supplement 3) from Mr. Robert L. Clark, their Health Physicist.

   It should be noted that the pieces referred to as "UNFIRED" represents items in process before sintering.

   A "FIRED" piece is indicative of the form in which products will be shipped to customers.

d. The source material cannot be disassociated from the product since it is a homogenous constituent of the almost theoretically dense baddeleyite grain and is bonded so tightly together that diamond tipped tools are required to cut, grind, or remove particles from its surface.

[illegible]
Solon Ohio 44139
Tel 216-248-0500
Telex 98-5403
STC-1392

[illegible]

February, 1980

PRODUCT DESCRIPTION

ZIRCOA® ZIRCONIUM OXIDE TUNDISH NOZZLES

A tundish nozzle is a molten metal flow control device that supplies a constant flow of steel from the tundish to the water-cooled mold in a billet or bloom continuous casting machine. The molten metal flow rate is a function of the steel level in the tundish and the nozzle bore diameter.

Material

The tundish nozzle must survive exposure to extremely high temperatures (2750°F to 3200°F), severe thermal gradients (from room temperature to 2800°F+), and contact with a wide variety of molten steel compositions. Through all this, the bore diameter (inside diameter) of the nozzle must remain constant from start to finish of one or a series of casts. Sixty to 80 tons of steel are typically poured through a single nozzle without any measurable change in the bore diameter.

The material best suited for tundish nozzles is stabilized zirconium oxide. Zirconium oxide does not require silicate additions so it can be used with added safety at steel pouring temperatures without sacrificing thermal shock and erosion/corrosion resistance.

Small cross-section zirconium oxide nozzles are replacing the more massive zircon (zirconium silicate) nozzles based on improved performance and reduced nozzle cost per ton of steel cast.

Process Control

As an integrated producer of zirconium oxide refractories, the Ceramic Products Division, Corning Glass Works controls the complete manufacturing process for Zircoa nozzles. Selected lots of zirconium oxide grain from our in-house extraction plant are used to insure consistent, reproducible properties in Zircoa nozzles. (Typical properties for Zircoa zirconium oxide tundish nozzles are shown on page 4

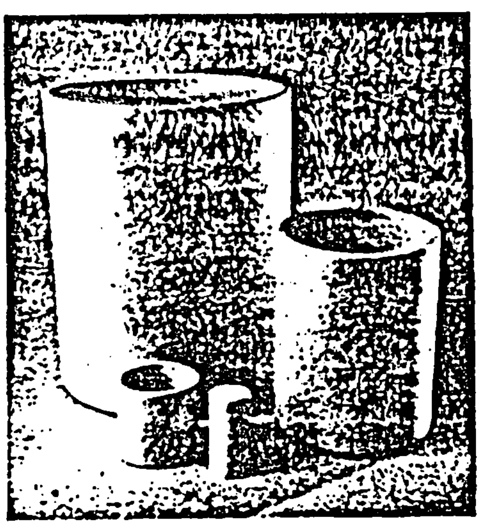
Nozzle Design

A wide variety of nozzle designs have been developed over a period of years to meet specific operating conditions in individual steel plants. A few of the more common designs are shown on the next two pages. We are always ready to work with a customer to develop designs to meet specific needs.

Continuous Casting Nozzles. Zircoa zirconia tundish nozzles for continuous casting of steel have survived twelve hours of continuous operation, handling over 850 tons of steel through a six nozzle tundish. After 140 tons of steel pass through each Zircoa nozzle, the bore diameters remain round and show no evidence of erosion. After the most severe testing, Zircoa nozzles emerge "ready for more".

In multiple-heat casting operations, zirconia nozzles can be expected to survive four or more heats when cleaned with an oxygen lance between heats. Zirconia nozzles reduce downtime, labor costs for nozzle installation, capital investment in stand-by tundishes, and provide lower nozzle cost per ton of metal poured.

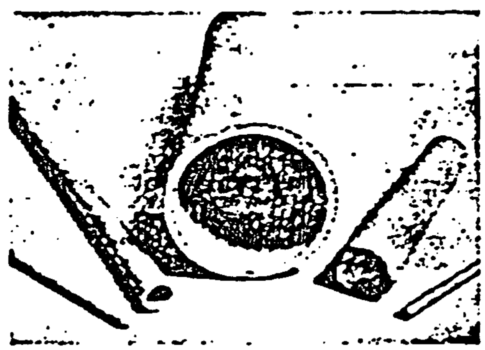
Zircoa tundish nozzles are available in a wide iety of standard designs to meet individual requirements.



Crucibles. Zircoa zirconium oxide crucibles are manufactured as coarse grain pressed parts and as fine grain slip cast parts. Pressed crucibles are produced in both foundry and laboratory sizes using coarse dense grain. They have heavy walls with good thermal shock resistance and porosity of 10-30%. Metal penetration is minimized by the non-wetting characteristics of the zirconia raw materials • the dense grain structure. Zircoa crucibles vide erosion and spall resistant liners for vacuum melting aircraft alloys that minimize pick-up of foreign matter by the melt.

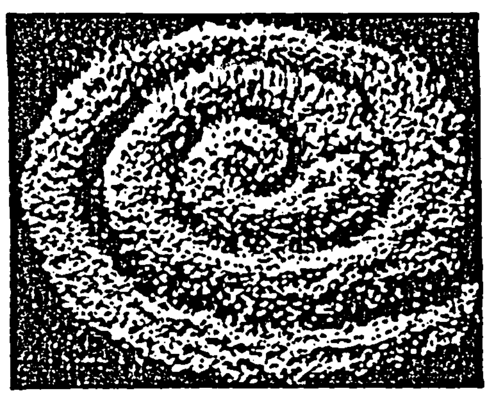
Slip cast zirconia crucibles are available in laboratory sizes with 0% water absorption to minimize the rate of metal penetration and reaction.

Setter Plates. Zircoa zirconia setter plates are used to support barium titanate capacitors, thermistors and lead zirconate titanate piezoelectrics during the firing process. At temperatures above 1288°C only, zirconium oxide will prevent reaction of the material being fired and the setter plate.



Tubes. Zircoa zirconium oxide tubes are made as coarse grain pressed parts and as fine grain impervious slip cast parts. Coarse grain tubes are used as furnace liners, burner port liners and pouring spouts for molten metals. Slip cast tubes are used as furnace liners, protection tubes, and solid electrolytes for oxygen measurement and fuel cells.

Bricks. Zircoa manufactures zirconium oxide brick shapes, including tongue and groove brick for use in lining large furnaces and high temperature reaction vessels.



Milling Media. Dense, fine grain, impervious, abrasion resistant zirconia milling media are produced as small beads for use in dispersion mills and as radius end cylinders for ball mills and vibratory mills. Zirconia's high density can increase mill output by 100-200% when replacing low density media.

Extrusion Die Inserts. Zircoa fine grain, abrasion resistant, zirconia die inserts provide long life, improved surface finish and improved dimensional control in the hot extrusion of steel, copper, brass, and refractory metals.

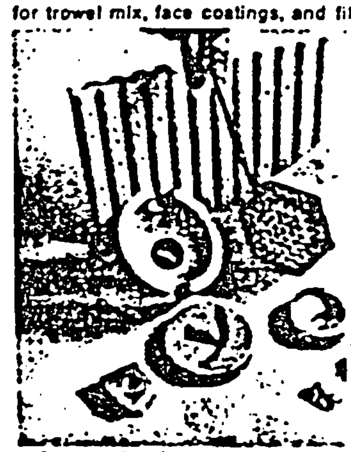
Oxygen Sensors. Zircoa pla... oxide oxygen sensor cells are ava... types: one for temperatures in the ... 800°C; the other for use directly in ... spheres at temperatures up to 1550°...

CASTABLES, RAM MIXES AND CEMENTS

Zircoa-Cast® zirconia castable is ... refractory that hardens hydraulically ... mold. When completely cured, or fir... it has a 2315-2540°C use temperatur... can be placed in service after cur... making it suitable for "on the job" ... refractory shapes.

Zircoa Ram Mixes consist of sp... zirconium oxide for building, repairi... ing refractory structures on-the-job.

Zircoa-Set zirconium oxide non... ments can be used at temperatures ... for trowel mix, face coatings, and fil...



Custom Fabrication and Specia... nozzles for abrasive and corrosive ... trical insulators for high temperatur... ments, linings for ultra-high temper... and process equipment, and supp... power sources in spacecraft are ... hundreds of "special" applicatio... we've been involved in during c... zirconium oxide specialists.

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April 12, 1982

Mr. Garth Austin
Corning Glass Works
Ceramic Product Division
Zircoa Products
31501 Solon Road
Solon, Ohio 44139

ITEM 14 SUPPLEMENT 3

Dear Mr. Austin:

This is a narrative type report made in accordance with and pursuant to your P.O. No. 17,400. The purpose of the report is to show the degree of beta and gamma radiation emission as well as removable contamination, if any, from sample Tundish type nozzles manufactured using 100% Baddeleyite which contains, by weight, a mixture of $\cong$ 0.1% U^{238} and th^{232}.

For the above noted purpose, our company was supplied with two Tundish nozzles. The nozzles were identified as "fired" (yellow in color) and "unfired" (off black color), each bearing the numeral "#18", and the material of construction is Baddeleyite - 100%. With only a slight diameter variation, the nozzles are similar in design, construction and dimension as noted in the attached literature sheet, as type S-736. The weight of the samples is as follows:

Fired - 680.2 gms.
Unfired - 694.7 gms.

Radiation Emission

Radiation emission measurements were taken using 46 TLD (LiFl) crystals, manufactured and supplied by Harshaw Chemical Co. The crystals were new, unused and have a manufacturer's accuracy guarantee of $\pm$4%.

Radiation emission measurements were obtained individually from each nozzle. The information obtained from each, for the same paramaters, was statistically identical and combined for accuracy. The TLD exposure time was 212 hours. TLD processing was done by the Siemens Gammasonics, Inc., Film Badge Department. The results of the survey are noted below.

Mr. Garth Austin
Corning Glass Works
Solon, Ohio

[redacted]

E4

RADIOACTIVE MATERIAL REMOVAL

For this purpose, the conventional technique of smearing a surface area of $\cong$ 100 Cm^2 with No. 1 Whatman filter paper was used. Each unit was treated identically. Each unit was smeared using $\cong$ 3 lb. psi and each unit was again rubbed vigorously using a heavy pressure of $\cong$ 10 psi.

The samples were then counted and evaluated using a 2", 2π, gas flow proportional counter, manufactured by Searle Analytic, Inc., Model No. 1152. This unit is calibrated on a daily basis using radioactive material standards obtained directly from the NBS. For statistical purposes overnight collection periods were used.

ITEM 14 SUPPLEMENT 3 (Continued)

Mr. Garth Austin
Corning Glass Works
Solon, Ohio

The results of this test are as follows:

Tundish Nozzle	Normal Pressure	Vigorous and Severe Pressure

E4 [redacted] E4

Mr. Austin, this report may also be included with the material which you submit to the NRC relative to your source material licensing program.

Respectfully yours,

Robert L. Clark
Health Physicist