West Valley Demonstration Project

Safety Analysis Report

Volume IV

Rev. 2

Low-Level Class B and Class C Radioactive Waste
Handling and Storage Operations for
the Radwaste Treatment System Drum Cell

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SAFETY ANALYSIS

FOR LOW-LEVEL CLASS B AND CLASS C RADIOACTIVE WASTE HANDLING AND STORAGE OPERATIONS FOR THE RADWASTE TREATMENT SYSTEM DRUM CELL

West Valley Demonstration Project
Safety Analysis Report, Volume IV, C

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WEST VALLEY DEMONSTRATION PROJECT

SAFETY ANALYSIS REPORT

LOW-LEVEL CLASS B AND CLASS C RADIOACTIVE WASTE HANDLING AND STORAGE OPERATIONS FOR THE RADWASTE TREATMENT SYSTEM DRUM CELL

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k.2.0 SUMMARY SAFETY ANALYSIS

This Safety Analysis Report (SAR) was prepared to address safety issues associated with handling, transportation to the drum cell and storage of Class B/C radioactive waste produced as a result of Project activities. Retrievability and disposal of Class B/C waste and drum cell closure and post closure activities will be addressed in the Environmental Impact Statement (EIS) for final decontamination, decommissioning, and site closure.

k.2.1 SITE ANALYSIS

k.2.1.1 NATURAL PHENOMENA

See Section A.2.1.1 of Volume I.

k.2.1.2 OTHER SITE CHARACTERISTICS AFFECTING THE SAFETY ANALYSIS

The RTS Drum Cell base pad for Class B/C waste is located in the disposal area such that it is sufficiently removed from erosion areas to preclude any potential gully erosion without having to place the waste directly on or immediately above the bedrock. Site characteristics for the tumulus are discussed in detail in the Environmental Assessment for Disposal of Project Low-Level Waste (DOE/EA-0295) and will not be repeated here.

k.2.2 RADIOLOGICAL IMPACT OF NORMAL OPERATIONS

The Environmental Assessment (DOE/EA-0295) estimates that the occupational dose due to routine handling, transport and disposal of Class B/C waste into the RTS Drum Cell will be approximately 46 person-rem. No measurable airborne or liquid releases are expected from these waste forms during routine handling, transport, storage, and disposal operations.

k.2.3 RADIOLOCICAL IMPACT FOR ABNORMAL OPERATIONS

Most of the Class B/C waste will be stabilized in cement and placed in WVNS approved waste containers. A small volume of Class B/C waste will be placed in high integrity containers (HICs certified to maintain their integrity for 300 years) or steel boxes.

Because of the waste form (cement) or container integrity (HICs), there will be no detectable off-site impacts from abnormal events and relatively minor effects on site. Any abnormal operations which create additional waste handling will not significantly increase occupational doses because facilities and equipment will be available for remote handling if necessary.

k.2.4 ACCIDENTS

Five accidents were analyzed for this SAR (See Section k.9.2). Accidents considered for Class B/C waste disposed of in the drum cell include a design basis tornado, a transport accident where a high integrity container (HIC) falls off the transport vehicle, a container collision accident, a drum rupture accident, and the dose to an intruder who enters the RTS Drum Cell.

k.2.5 CONCLUSIONS

The analysis contained herein supports the conclusion that no doses of consequence to either on-site or off-site individuals will result from normal operations or abnormal events. The doses to the maximally exposed off-site individual for all accident cases considered are well within the requirements of DOE Order 5480.1 as modified by DOE/HQ guidance contained in DW:86:0147. Credible accidents could, however, increase occupational doses to workers because of cleanup operations.

REFERENCES FOR SECTION k.2.0

Memo DW:86:0147, W. H. Hannum to J. E. Krauss, New Radiation Standards for the Protection of the Public in the Vicinity of DOE Facilities, dated March 20, 1986.

U. S. Department of Energy, DOE/EA-0295, Environmental Assessment for Disposal of Project Low-Level Waste, dated April 1986.

U. S. Department of Energy, DOE Order 5480.1, Chapter XI, "Requirements for Radiation Protection."

k.4.0 PRINCIPAL DESIGN CRITERIA

k.4.1 PURPOSE OF FACILITIES

The purpose of the RTS Drum Cell is to provide a shielded secure area for placement of Class B/C waste (>100 mR/hr average surface exposure rate). Shield walls are sufficiently thick such that the exposure levels will be less than 2.5 mR/hr in potentially accessible areas. The Temporary Weather Structure (TWS) is a Butler building that encloses the RTS Drum Cell and waste handling equipment so that waste handling and placement operations can continue without regard to weather conditions. The TWS will also provide for an additional level of security around the drum cell by limiting personnel access through the control room.

The drum cell will serve as the storage facility for all Class B/C waste generated as a result of Project activities pending approval of the EIS for final site closure. Figure k.4.1-1 shows a schematic of the drum cell after conversion to the proposed final configuration as a permanent above grade disposal unit. It should be noted that the final tumulus will be graded so that it blends into current topography of the disposal area.

k.4.1.1 FUNCTIONS OF THE RTS DRUM CELL

The primary function of the completed tumulus is to provide long-term isolation of Project Class B/C waste. Intermediate functions of the Drum Cell prior to construction of the cap and final closure include:

a) Provide a receiving area to accept Class B and C waste containers including drums and overpacks from the drum transporter,

b) Provide a curing area for cement filled drums produced by CSS operations,

c) Provide sufficient shielding of the control room, drum load-in, curing and storage areas to maintain radiation exposure levels as low as reasonably achievable and within federal and WVNS guidelines,

d) Provide sufficient space to accommodate up to 17,700 71-gallon drums of cement solidified waste.

e) Prevent personnel from inadvertently entering the cell where waste is located.

f) A separate Temporary Weather Structure (TWS) is built over the base pad, shield walls, and drum load-in area to protect the waste from weather conditions prior to final closure.

g) Provide a remote viewing system for the drum load-in operation for the facility.

k.4.1.1.1 FUNCTIONS OF THE RTS DRUM CELL BASE PAD

The RTS Drum Cell base pad is required to perform the following specific functions:

a) Support the drum cell foundations,

b) Support the cement filled drums and other waste containers placed in the cell and the overlying cover and intruder barrier layers of the tumulus,

c) Provide drainage beneath the waste containers so as to prevent water buildup which could contact the waste during the postclosure period.

d) Provide the means to monitor and thus verify the geomechanical performance of the foundation of the tumulus.

k.4.1.1.2 **FUNCTIONS OF THE TWS**

The TWS (Butler building) is required . . perform the following specific functions:

a) Provide a receiving area to accept drums and overpacks from the drum transporter.

b) Protect all waste from external weather conditions.

c) Provide a means to prevent personnel from inadvertently entering the areas where waste and cement drums will be located.

k.4.1.1.3 **FUNCTIONS OF THE RTS DRUM TRANSPORTER**

The RTS drum transport vehicle is required to perform the following functions:

a) Provide the ability to safely transport eight 71-gallon drums containing cemented Class B/C waste.

b) Provide adequate shielding such that if each drum were to contain one curie of Cs-137 both the driver and all areas around the truck will be protected to ALARA levels.

k.4.1.2 **FEEDS TO THE RTS DRUM CELL**

Table k.8.1-1 shows the source, type and amount of Class B/C waste which is scheduled to be received by the RTS Drum Cell.

k.4.1.3 **FACILITY PRODUCTS AND BY-PRODUCTS**

Not applicable to this SAR

k.4.2 STRUCTURAL AND MECHANICAL SAFETY CRITERIA

Separate structural and mechanical safety criteria have been developed for the drum cell base pad, the drum cell shield walls and the temporary weather structure, which includes the control room. The criteria for each are discussed under the subheadings below.

k.4.2.1 WIND LOADINGS

The temporary weather structure is designed to withstand wind loadings of 77 mph (100 year recurrence) with peak gusts of 87 mph (McDonald, 1981). Wind loadings are not applicable to the base pad.

k.4.2.2 TORNADO LOADING

The temporary weather structure, base pad and shield walls are not constructed to withstand a design basis tornado. This is based upon the tornado analysis (see Section k.9.2.1) which demonstrates that a design basis tornado (DBT) would not make a significant contribution to off-site dose should it pass over the RTS Drum Cell.

k.4.2.3 WATER LEVEL (FLOOD) DESIGN

No flood data or history for the site are available. The probable maximum flood elevation of the streams which drain the site is 417 metres (mean sea level) (see A.3.4.2.1 of Volume I). The nominal site elevation is 421 metres; therefore, no potential for flooding exists. The highest dam crest elevation upstream of the site is 414.5 metres, so dam failure does not pose a potential flood hazard.

k.4.2.4 MISSILE PROTECTION

Missiles can be generated by a DBT; however, due to the relatively high stability of the waste form, the consequences of missile penetration are minimal.

k.4.2.5 SEISMIC DESIGN

The temporary weather structure and the RTS Drum Cell shield walls are not designed to withstand an earthquake. The base pad will withstand 0.35 g horizontal acceleration under dynamic conditions.

Two approaches were used to estimate a design basis earthquake for the disposal facility. The first method consisted of using the seismic risk data from the Uniform Building Code (UBC). The location of the WVDP is on the border between zones No. 2 and 3 on the UBC seismic risk map. In the interests of conservatism, zone 3 was assumed. The UBC risk map indicates that MMI VIII earthquakes are possible in the region. If average foundation conditions are assumed, a lateral acceleration on the order of 0.3 g (Coulter, et al, 1973) can be postulated for a MMI VIII earthquake.

The second approach was to use the evaluation of earthquake return periods made for the design of the HLW solidification system. This study is presented in Section A.3.6.2 of the WVDP SAR (WVNSC, 1985). The seismic hazard curves from the SAR study were used to estimate a design basis earthquake for the low-level waste disposal facility, as follows. A typical nuclear power plant has a potential operational lifetime of 40 years, whereas the stability of the Class B/C disposal facility must be maintained for a 1,000 year lifetime. Thus, an inverse ratio of 4 E-02 is computed. All other factors being equal, it is thus reasonable that an acceptable annual risk for the disposal area would be about 0.04 times the acceptable annual risk at a conventional nuclear power plant. Current seismic hazard analysis for conventional nuclear power plants indicates an annual probability of exceedance for the design seismic event (SSE) acceleration of between 1 E-03 and 1 E-04. Since the environmental consequences of a failure of a low-level waste disposal facility would obviously be less than the consequences of a reactor containment failure, the 1 E-03 value was used. Applying the operation lifetime inverse ratio of 4 E-02 to this exceedance probability as representative of the scaled "time exposure" between WVDP and a conventional nuclear power plant to seismic hazard yields an annual exceedance probability in the range of 4 E-05 as a scaled comparison of design acceleration for the West Valley facility. Examining Figure A.3.6-E-6, of WVNSC 1985, at this level of exceedance shows that the corresponding peak acceleration would be less than 0.35 g even at the 84 percent fractile level on the aggregate seismic hazard curves.

Because the second method yielded a higher value than the first method, it was used. Hence a design basis earthquake of 0.35 g was postulated.

k.4.2.6 SNOW LOADING

The temporary weather structure is designed to withstand snow loads of 40 lb/ft^2. Snow load considerations are not applicable to the drum cell base pad and shield walls.

k.4.2.7 DESIGN LOADINGS

Design loads and stresses from waste and overlying cover materials were estimated using the following unit weights:

Soil and clay cover	130 lb/ft^3
Intruder barrier	140 lb/ft^3
Waste Mass	150 lb/ft^3
Gravel Underdrain	140 lb/ft^3

k.4.3 SAFETY PROTECTION SYSTEMS

The RTS Drum Cell and the temporary weather structure employ no active safety protection systems. For radiation protection of workers and the general public, concrete shield walls have been constructed on the perimeter of the drum cell base pad and the waste load-in area. These shield walls are of sufficient thickness to meet the exposure rate requirements of the Radiological Controls Manual (WVDP-010) for anticipated occupancy conditions in accessible areas outside the temporary weather structure and the waste load-in area. Other interim shielding such as shuffling cold drums may be used to reduce skyshine from the waste mass. The control room will also be sufficiently shielded to meet the DOE design criteria of 0.1 mR/hr. All Class B/C waste will be remotely handled and placed in the drum cell using an overhead crane and CCTV monitors operated from the control room. This method of waste handling will assure occupational exposures are maintained ALARA.

The temporary weather structure will assure that the waste remains dry and is protected from all climatic conditions.

The overall safety of workers and the general public is assured by adherence to the Radiological Controls Manual and the Industrial Hygiene and Safety Manual (WVDP-011).

K.4.4 CLASSIFICATION OF STRUCTURES, COMPONENTS & SYSTEMS

Safety Classes, Service Classes and Quality Levels for important structures, equipment, and components of the RTS Drum Cell are shown in Table K.4.4-1.

REFERENCES FOR SECTION k.4.0

Coulter, H. W., Waldron, H. H. and Devine, J. F., 1983. Seismic and Geologic Siting Considerations for Nuclear Facilities, Fifth World Conference on Earthquake Engineering, Rome.

McDonald, James R., 1981. Assessment of Tornado and Straight Wind Hazard Probabilities at the Western New York Nuclear Service Center, West Valley, New York.

Uniform Building Code of the International Council of Building Officials.

West Valley Nuclear Services Company (WVNSC), 1985. West Valley Demonstration Project - Safety Analysis Report. Volume I, Project Overview and General Information.

WVDP-010, Radiological Controls Manual.

WVDP-011, Industrial Hygiene and Safety Manual.

TABLE K.4.1-1

WVDP CLASS B/C LOW-LEVEL RADIOACTIVE WASTE SUMMARY

Waste Source and Type	Class	Estimated Volume (m^3)	Container Type	Estimated Number of Containers	Average Surface Dose Rate (mrem/hr)	Estimated Total Fission & Corrosion Products (Curies)	Estimated Total Actinides (Curies)*
Existing Systems Operations							
FRS filter precoat and resin	B/C*	43	HIC	13	6,300	1.4 E+03	1.7
RTS Secondary Waste							
Spent zeolite slurry	B/C	6	71 gal. drum	21	300	3.2 E+01	4.7 E-02
Spent organic IX resin	B/C	24	71 gal. drum	87	300	9.6 E+01	1.5 E-01
Filter backwash slurries	B/C	390	71 gal. drum	1450	180	5.0 E+01	7.7 E-02
Presolidification Decon.							
Trash	B/C	15	HIC	4	30	7.1	4.8 E-02
Trash	B/C	34	HIC	10	10	2.7	1.0
Uranyl Nitrate	B/C	57	55 gal. drum	247	2	1.2	3.2
Vitrification Secondary Waste							
Trash	B/C	42	HIC	13	50	2.0 E+01	1.4 E-01
Trash	B/C	93	HIC	28	10	7.3	2.8
Failed equipment	B/C	37	Steel box	12	90	3.6 E+02	2.5
Decontaminated supernatant	B/C	3,000	71 gal. drum	11,080	710	2.3 E+04	1.7 E+03
First sludge wash	B/C	145	71 gal. drum	535	770	2.2 E+03	1.7 E+02
Second sludge wash	B/C	80	71 gal. drum	295	750	1.2 E+03	9.3 E+01
Third sludge wash	B/C	32	71 gal. drum	115	750	4.8 E+02	3.6 E+01
Remote Decon. and Size Reduction Facility							
Evaporator bottoms via LWTS	B/C	873	71 gal. drum	3,233	3,230	2.8 E+04	1.9 E+02
TOTALS		4,871				5.7 E+04	2.2 E+03

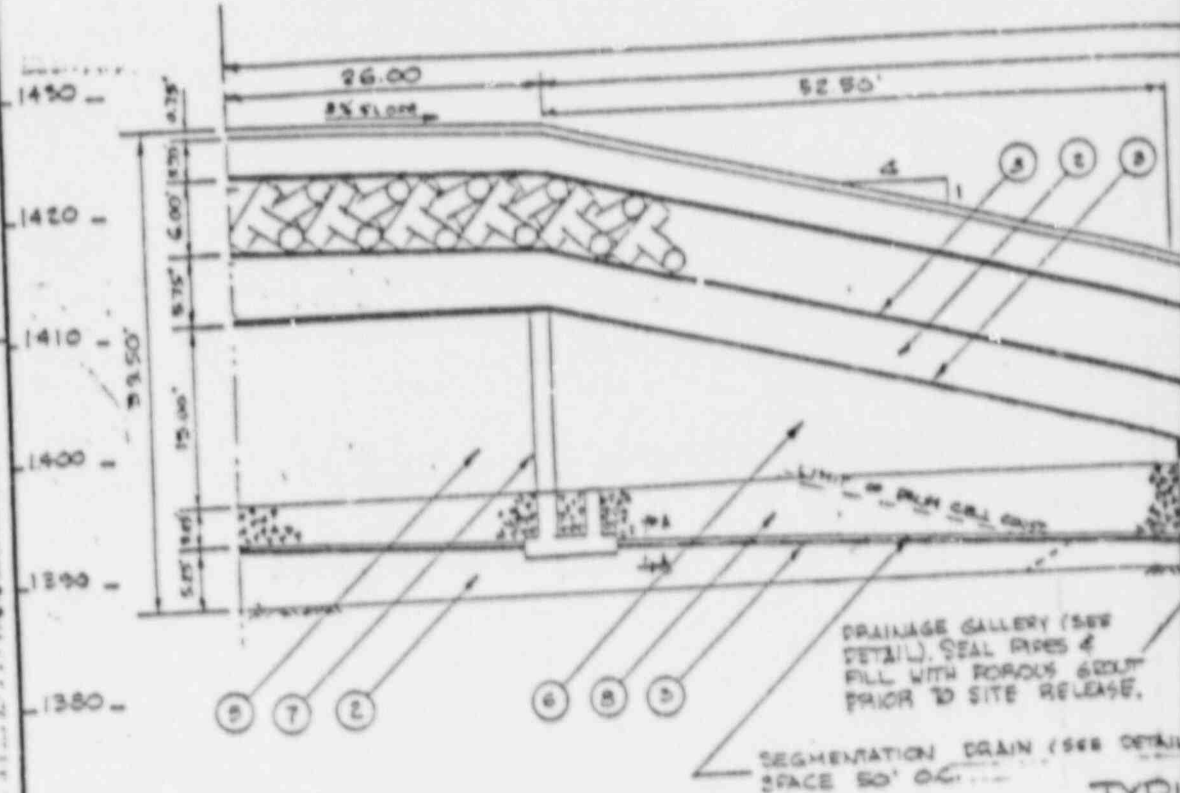
*NOTES: - Class B and C wastes are considered together as they will be disposed of in a similar manner.

- Actinide total includes 1900 curies of Pu-241 which is not a significant alpha emitter, but which decays to approximately 60 curies of Am-241 which is an alpha emitter with a half-life of 430 years.

TABLE k.4.4-1

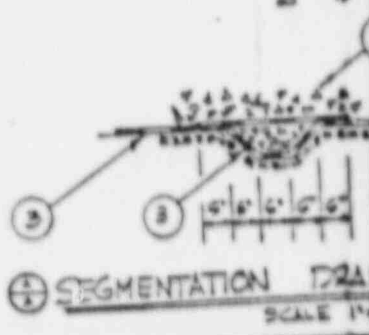
SAFETY CLASS, SERVICE CLASS, AND QUALITY LEVEL OF IMPORTANT STRUCTURES, EQUIPMENT AND COMPONENTS ASSOCIATED WITH THE RTS DRUM CELL

Component or Equipment	Safety Class	Service Class	Quality Level
Building Structure	N	IV	N
Shield Walls	C	III	C
Overhead Crane	N	IV	C
Drum Load-in Station	N	IV	N
Monitoring Equipment Electronic Instrumentation and Controls	N	III	N
CCTV	N	IV	C
RTS Drum Cell Base Pad	N	IV	C



LIST of MATERIALS

1. TOPSOIL
2. COMPACTED CLAY
3. GEOTEXTILE SEPARATOR
4. DOLOS & RIPRAP DRAIN/ INTRUDER BARRIER
5. NON CONTACT HANDLEABLE WASTE
6. CONTACT HANDLEABLE WASTE OR COMPACTED FILL
7. REINF. CONCR. SHIELD WALL
8. Nº1 (HYSPOT) CRUSHED STONE
9. 36Ø PRECAST MANHOLE ACCESS SHAFT, SPACED 200 FT. O.C. ALONG DRAINAGE GALLERY
10. 9" Ø SCH. 80 PVC DRAIN PIPE
11. VALVE TO DRAIN PIPE
12. VALVE TO SAMPLE TAP
13. REINFORCED CONCRETE
14. STEEL STEP
15. SEGMENTATION DRAIN PENETRATION
16. PERMANENT DRAINS PLUGGED THROUGHOUT INSTITUTIONAL CONTROL PERIOD.



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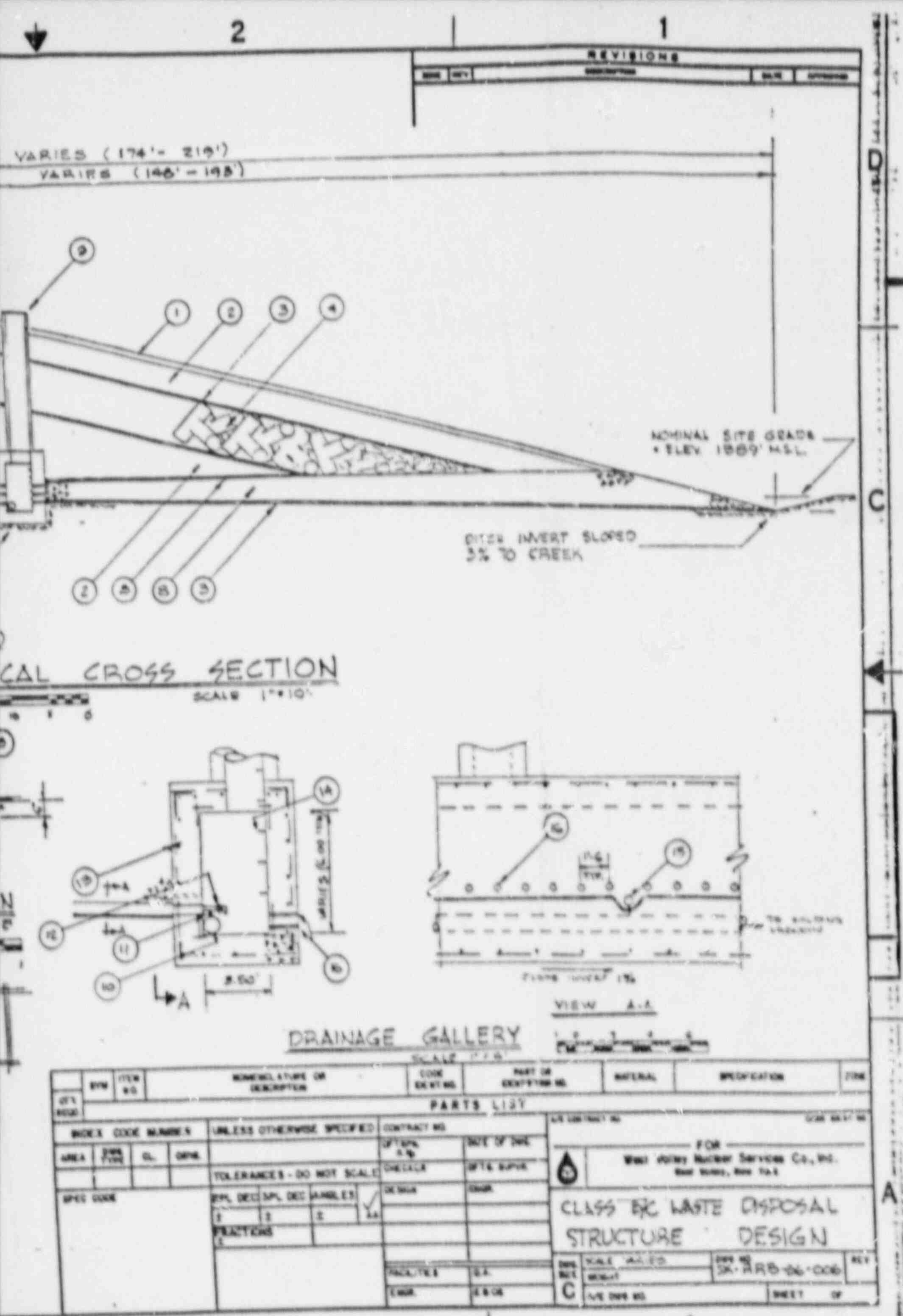

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Figure K.4.1-1

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k.5.0 FACILITIES DESIGN

k.5.1 SUMMARY DESCRIPTION

k.5.1.1 LOCATION AND FACILITY LAYOUT

The West Valley Demonstration Project is located in western New York State (Figure k.5.1-1). The RTS Drum Cell is located approximately 500 meters to the southeast of the former NFS reprocessing plant (Figure k.5.1-2). A detailed drawing of the RTS Drum Cell is shown in Figure k.5.1-3. Additional drawings showing roads, fences, grading and section details are included in Figures k.5.1-4 through k.5.1-6. The Drum Cell Loadout Conveyor plan is shown in Figures k.5.1-7 and k.5.1-8.

k.5.1.2 PRINCIPAL FEATURES

The proposed design of the above grade disposal unit is adapted from the tumulus design used for disposal of low-level waste by the CEA-ANDRA (Commissariat a L'Energie Atomique-Agence Natural pour la Gestation des Déchets Radioactive) in France. A tumulus is an artificial hillock or mound designed to perform a specific function. In this case, the tumulus is designed to exclude precipitation and surface water from the waste and to enhance drainage of any water that does enter the tumulus in the event that the barriers fail.

In order to provide adequate disposal capacity within the constraints of available land, a regular geometric tumulus layout will be used. In its final form, the reference layout, which is illustrated on Figure k.5.1-9, has a minimum width of 120 m and a length of approximately 200 m. The tumulus will cover an area of approximately 14,000 m^2 and will be rectangular in shape. The maximum height of the tumulus will be 13 m above the current surface. The crest of the tumulus will be 12 m wide and the side slopes will not be greater than 4:1 (horizontal:vertical). The waste core will be 48 m wide at the base and 5 m high.

For the initial phase only the drum cell (including the base pad, foundations, shield walls and temporary weather structure) has been built.

Prior to beginning construction of the drum cell, topsoil and vegetation were stripped and stockpiled for reclamation purposes at the time of facility closure. A 1 m thick drainage blanket was placed over the entire site. The drainage blanket consists of compacted crushed stone and serves two purposes. First, it will provide a working surface which is easily leveled and not subject to major disturbance from traffic during waste placement. Second, the drainage blanket will provide a controlled pathway for infiltrating water to be drained from the waste to the perimeter drain system.

The design of the completed tumulus is illustrated in cross-section on Figure K.4.1-1. The waste is placed on a gravel pad (base pad) which forms an underdrain. The voids within the waste mass will be filled with pea gravel and zeolites or a clay grout to minimize settlement and leachate generation. The waste mass will be covered with geotextile separators and compacted clay which will sandwich a layer of precast concrete dolos units and stone. The clay will prevent meteoric water from infiltrating into the waste. The dolos/stone layer will act as a diversion drain in the event that the upper clay layer is breached and will also serve as an intruder barrier. A dolos unit is a heavy precast concrete element frequently used in breakwater construction (see Figure K.5.[illegible]-10). The weight and interlock of the dolos units would preclude excavation by individuals and institutions with limited resources. The current reference design is a dolos having a maximum dimension of approximately 1.7 m which results in a weight of about 1.8 tonnes per unit. Such a unit when randomly placed two layers thick, would have an average thickness of 1.5 m and require 770 units per 1,000 m^2. In final design, further study will determine the optimum size. These units have been constructed in sizes ranging from 0.5 tonnes to 40 tonnes each.

A filter fabric will be placed over the dolos/stone and the final soil cover will be placed over the tumulus. This soil cover will be 1.1 m in thickness and will consist of clay placed in 0.2 m lifts (loose) and compacted to 95 percent of optimum density. When the final cover is completed, 0.2 m of topsoil will be placed over it and the entire facility will be seeded and mulched with shallow rooting vegetation.

As part of the closure operations, settlement plates and monuments will be installed at various locations. These devices will permit the monitoring of waste and cap settlement throughout the active institutional control period. These data will be used to verify the satisfactory performance of the facility and/or permit repairs and remedial action to be made on a timely basis.

k.5.2 FACILITY BUILDING

A temporary weather structure has been built to house the RTS Drum Cell. The structure will prevent rain water intrusion, provide for equipment handling and operation during drum load-in and storage, and will house the drums for up to 20 years prior to final closure of the tumulus. While the TWS is in place, the Drum Cell will be heated to a temperature of 50°F as necessary and will also have passive ventilation (side louvers in the TWS) to provide cooling in summer months.

k.5.2.1 STRUCTURAL SPECIFICATIONS

The temporary weather structure will provide adequate support for the following design loads:

- o snow 40 lb/ft^2
- o wind 100 yr wind 77 mph
  peak gust 87 mph

The structure is not designed to withstand a tornado or an earthquake.

k.5.2.2 FACILITY LAYOUT

Figure k.5.2-1 shows the RTS Drum Cell temporary weather structure building arrangement consisting of common preengineered building construction.

k.5.3 SUPPORT SYSTEMS

To direct placement of the waste in the drum cell, an operator room has been built outside the pad area (see Figures k.5.1-3 and k.5.2-1). Operators will be able to remotely operate cranes and conveyor equipment with the aid of CCTV. Prior to removing the TWS, sumps will be placed at equal intervals around the facility for collection, sampling and removal of any water accumulated by the perimeter drain system. Twenty inch concrete shield walls are constructed at the perimeter of the drum cell to provide the necessary protection to allow Disposal Operations personnel and other employes to work around the RTS Drum Cell in accordance with the Radiological Control Manual (WVDP-010). The RTS Drum Cell shield wall details and sections are shown in Figures k.5.2-2 and k.5.2-3. A specially shielded drum load-in area is provided to maintain the transport vehicle driver/operator exposure within Radiological Control Manual guidelines (see Figures K.5.1-7, k.5.1-8, and k.5.2-1).

k.5.4 DESCRIPTION OF SERVICE AND UTILITY SYSTEMS

k.5.4.1 FACILITY VENTILATION

The TWS building will be ventilated via a passive system of wall louvers.

k.5.4.2 ELECTRICAL

Electrical service is supplied to operate control room equipment and building lighting (115V,1 phase) and heavy duty equipment (480V, 3 phase).

k.5.4.3 FIRE PROTECTION

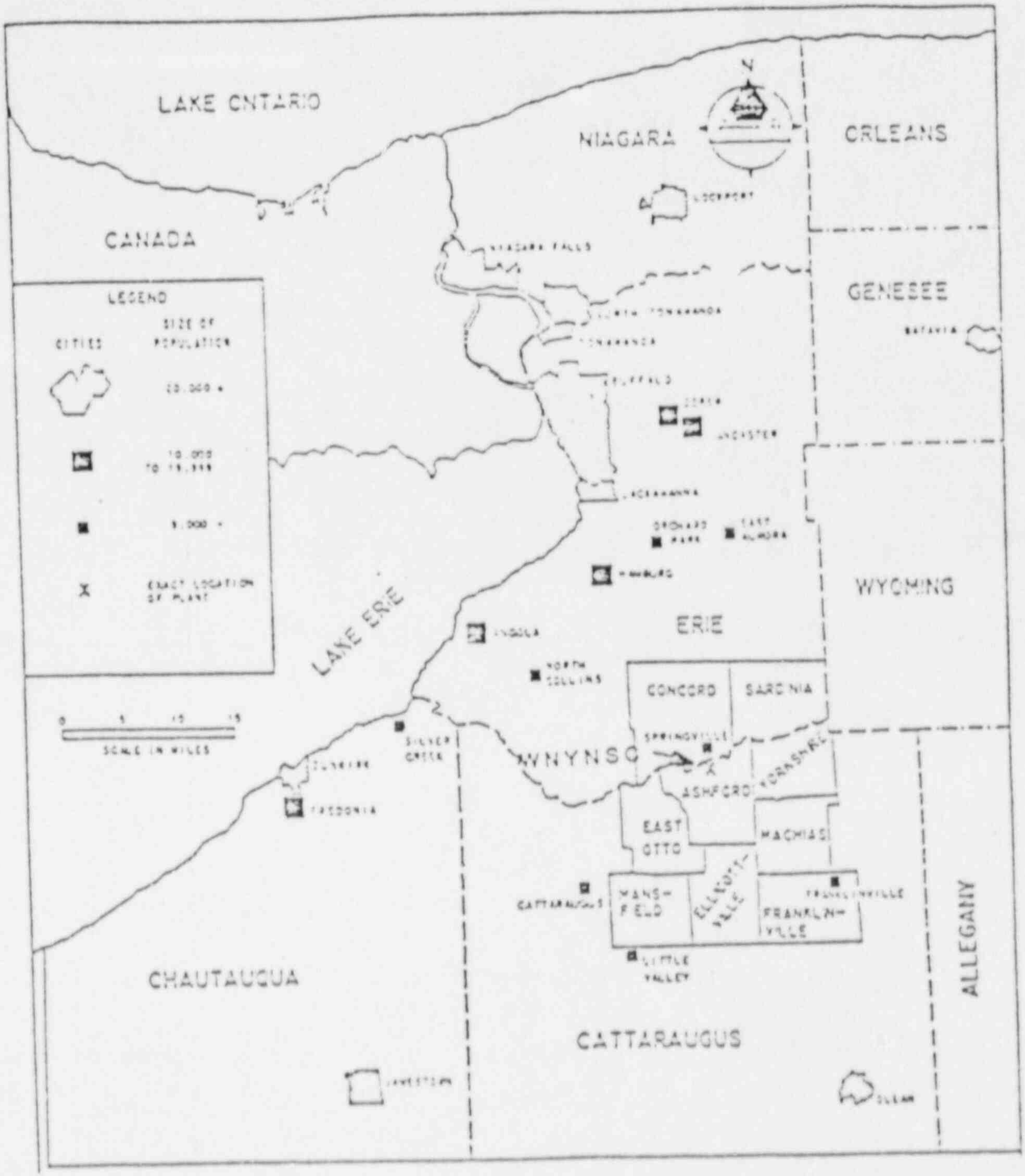
Fire protection and detection are in compliance with ID-12044.

Fire protection and fire detection equipment have been installed in the RTS Drum Cell control room.

REFERENCES FOR SECTION k.5.0

U. S. Department of Energy DOE-ID Order 12044, "Operational Safety Design Criteria Manual."

WVDP-010, Radiological Controls Manual.



REGIONAL MAP SHOWING SITE LOCATION AND

MAJOR POPULATION CENTERS

FIGURE K.5.1-1

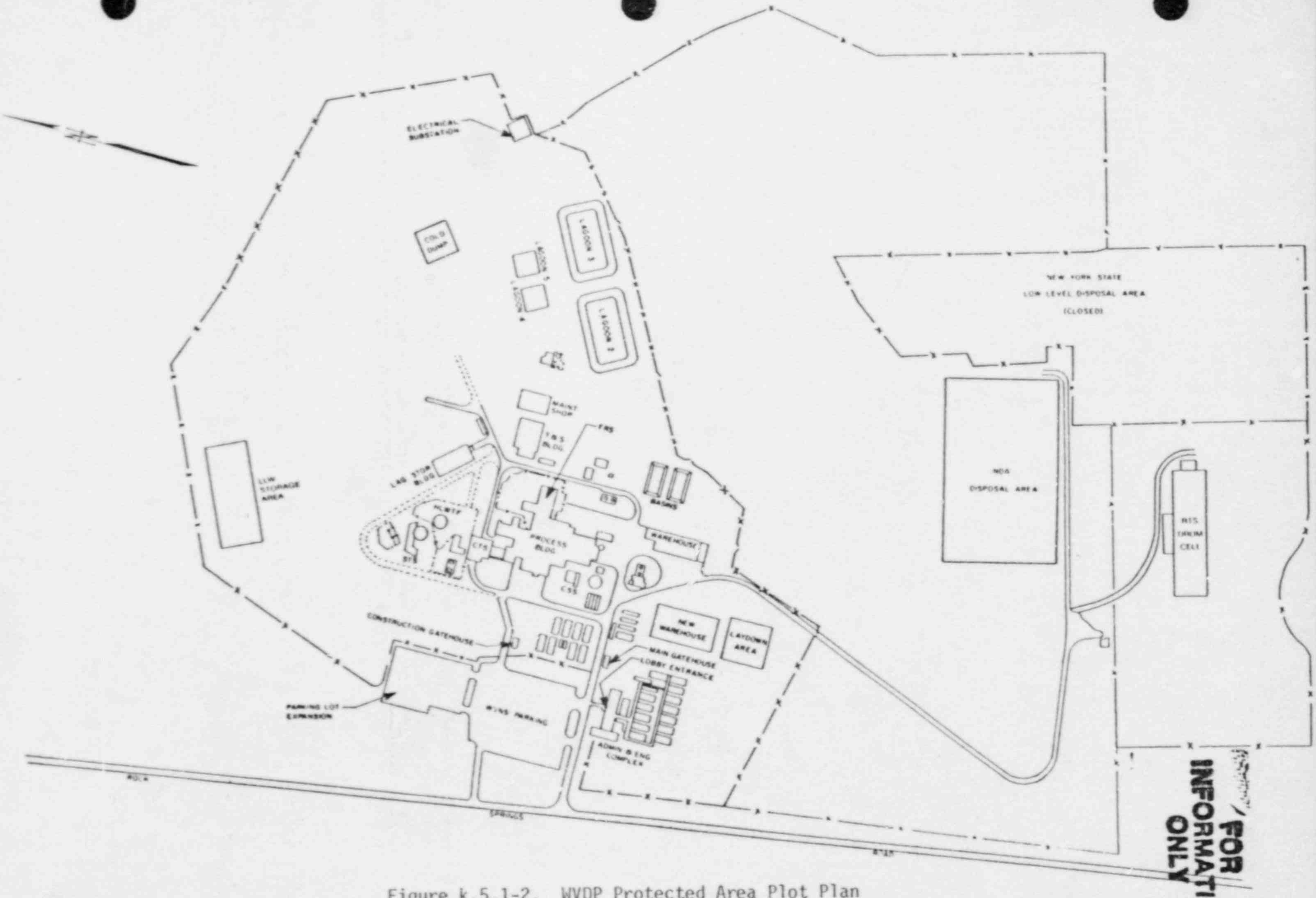


Figure k.5.1-2. WVDP Protected Area Plot Plan

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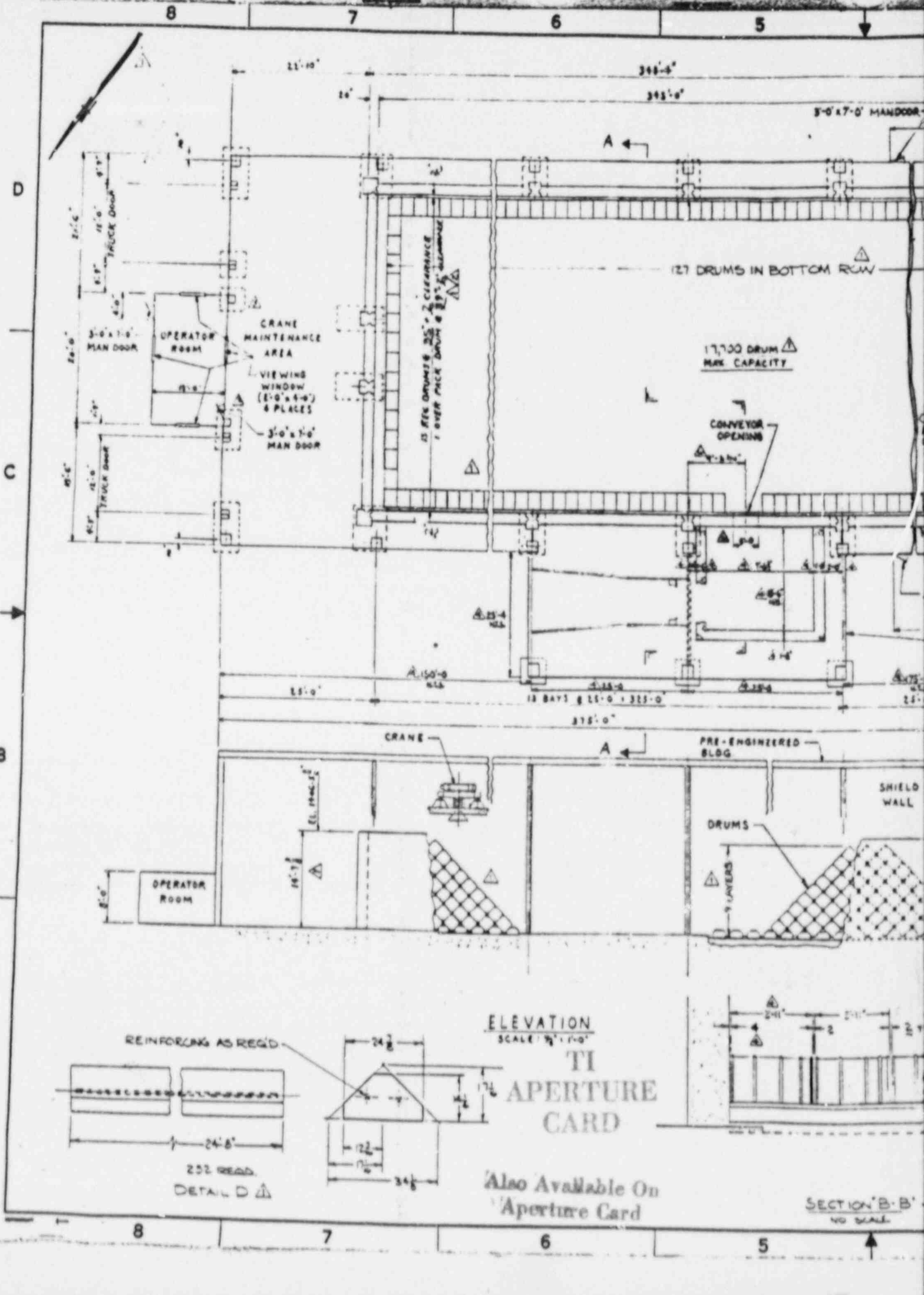
3'-0" x 7'-0" MANDOOR
127 DRUMS IN BOTTOM ROW
17,700 DRUM MAX. CAPACITY
CONVEYOR OPENING
OPERATOR ROOM
CRANE MAINTENANCE AREA
VIEWING WINDOW
6 PLACES
3'-0" x 7'-0" MAN DOOR
TRUCK DOOR
13 BAYS @ 25'-0" = 325'-0"
375'-0"
CRANE
PRE-ENGINEERED BLDG.
SHIELD WALL
DRUMS
OPERATOR ROOM
ELEVATION
REINFORCING AS REQ'D
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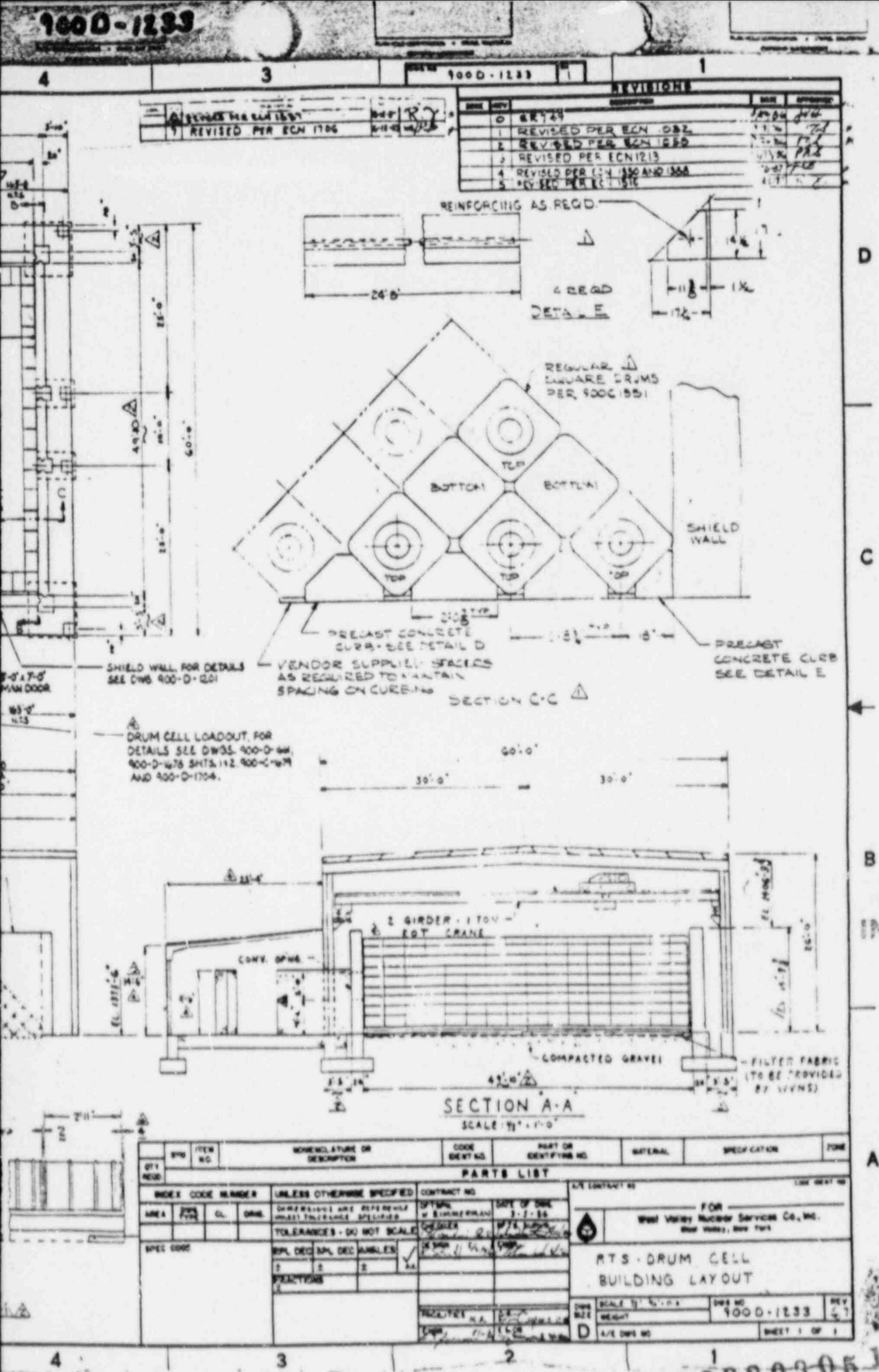

Figure k.5.1-3

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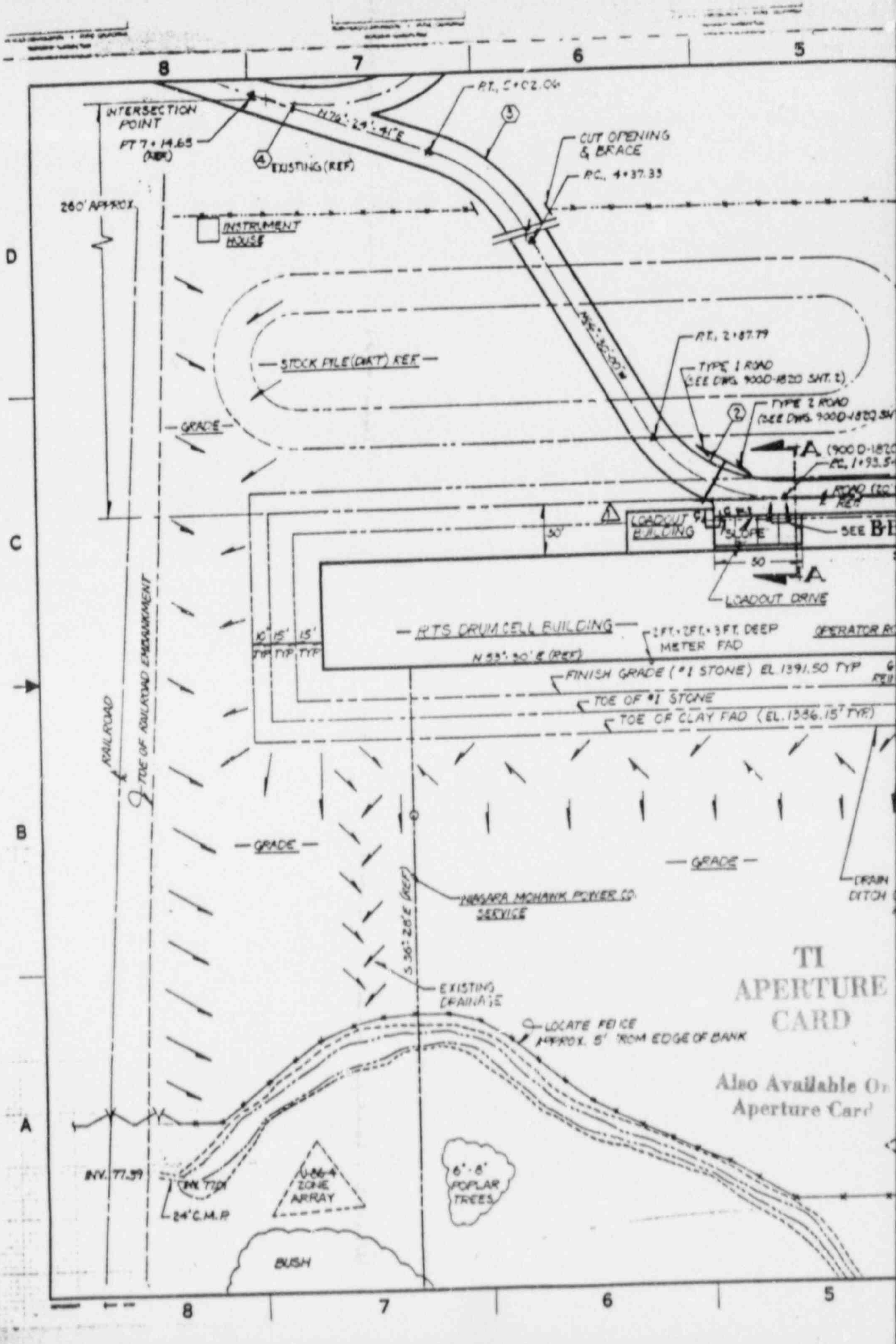

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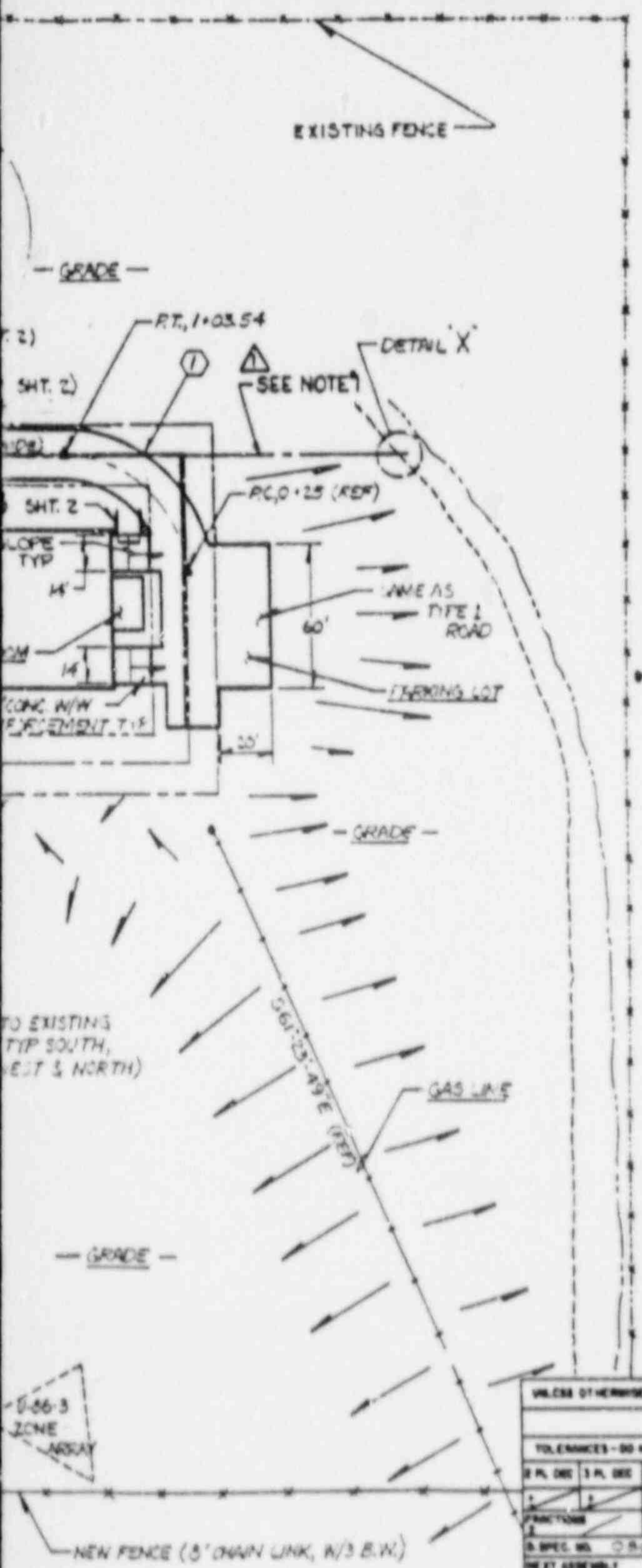
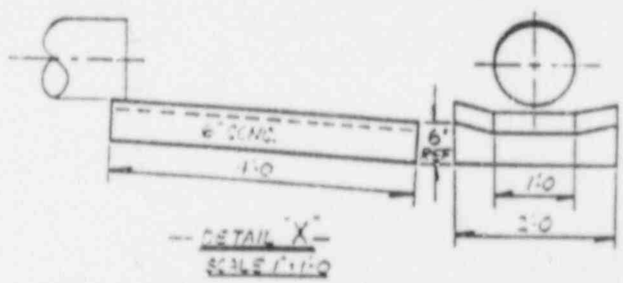
2	REV. PER ECN 1842	CCG	3-7-[illegible]	[illegible]



CURVE NO.	R	D	Δ	L	T
①	50.00'	114°35'30"	90°00'00"	78.54'	50.00'
②	90.00'	63°39'43"	60°00'00"	94.25'	51.96'
③	100.00'	57°17'45"	37°05'19"	64.73'	33.55'
④	120.00'	47°44'47"	108°45'47"	227.49'	167.50'



— DETAIL 'X' —
SCALE 1" = 1'-0

NOTES:

1. DRAIN LINE SHALL END APPROXIMATELY 3' WEST OF ROAD ON NORTH SIDE OF STRUCTURE.
2. SEE 900D-1820 SH.3 FOR FENCE DETAIL.

1" = 30'-0

FOR INFORMATION ONLY

QTY REQD	ITEM NO.	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR SPEC

PARTS LIST

UNLESS OTHERWISE SPECIFIED — TOLERANCES - DO NOT SCALE

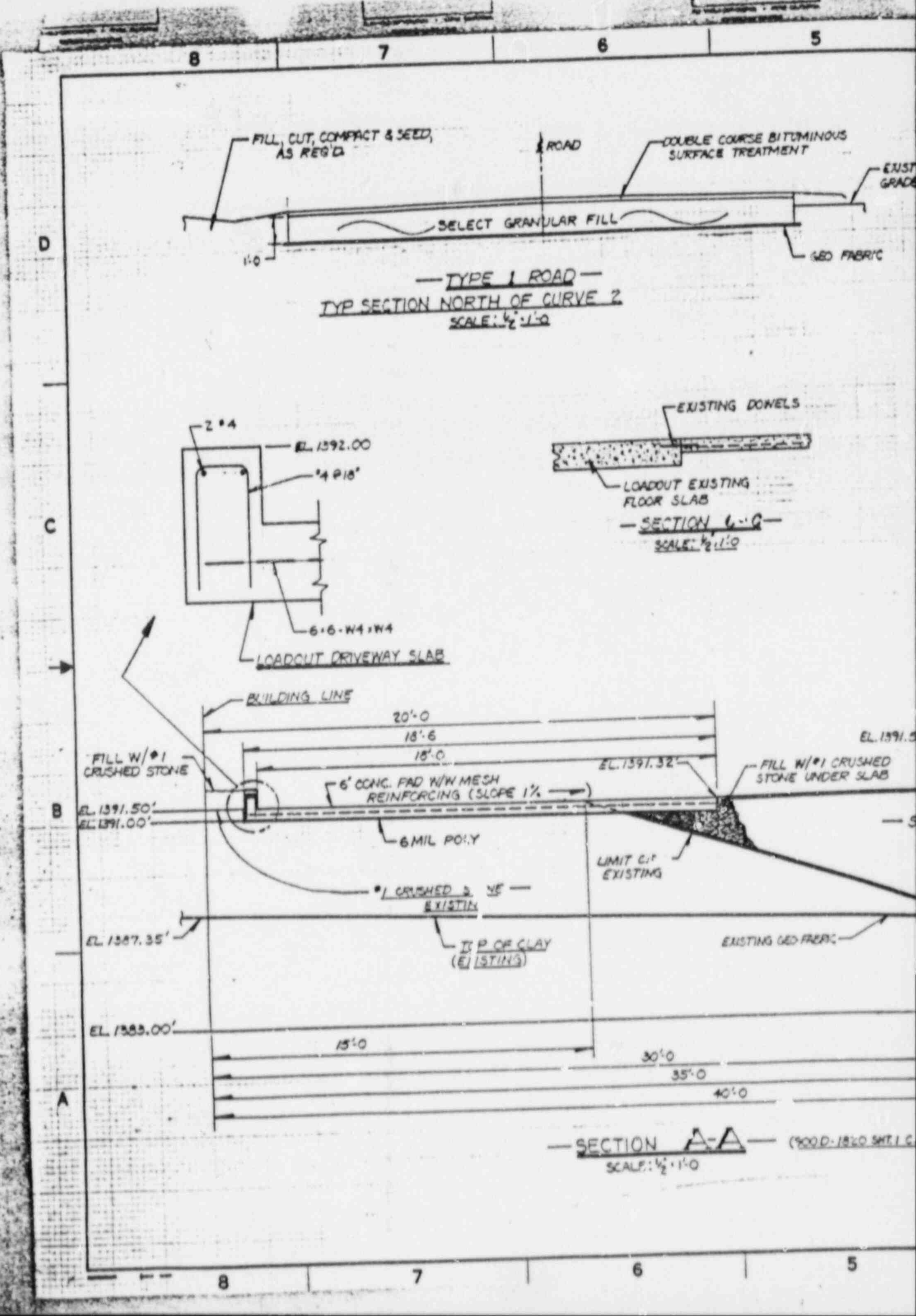
Drafter: C. GERWITZ
For West Valley Nuclear Services Co., Inc., West Valley, New York

RTS DRUM CELL
ROADS, FENCES, SLABS & GRADING

Size D — Dwg. No. 900D-1820 — Rev. 2 — Sheet 1 of 3

Figure K.5.1-4

8802030514-03


8
7
6
5
D
C
B
A
FILL, CUT, COMPACT & SEED, AS REQ'D.
℄ ROAD
DOUBLE COURSE BITUMINOUS SURFACE TREATMENT
SELECT GRANULAR FILL
GEO FABRIC
1'-0
— TYPE 1 ROAD —
TYP SECTION NORTH OF CURVE 2
SCALE: ½"-1'-0
2 #4
EL. 1392.00
#4 @ 18"
6-6-W4xW4
LOADOUT DRIVEWAY SLAB
EXISTING DOWELS
LOADOUT EXISTING FLOOR SLAB
— SECTION C-C —
SCALE: ½"-1'-0
BUILDING LINE
20'-0
18'-6
18'-0
FILL W/#1 CRUSHED STONE
6" CONC. PAD W/W MESH REINFORCING (SLOPE 1%)
EL. 1391.32'
FILL W/#1 CRUSHED STONE UNDER SLAB
EL. 1391.50'
EL. 1391.00'
6 MIL POLY
LIMIT OF EXISTING
EL. 1387.35'
EXISTING GEO FABRIC
EL. 1383.00'
15'-0
30'-0
35'-0
40'-0
— SECTION A-A —
SCALE: ½"-1'-0
8
7
6
5

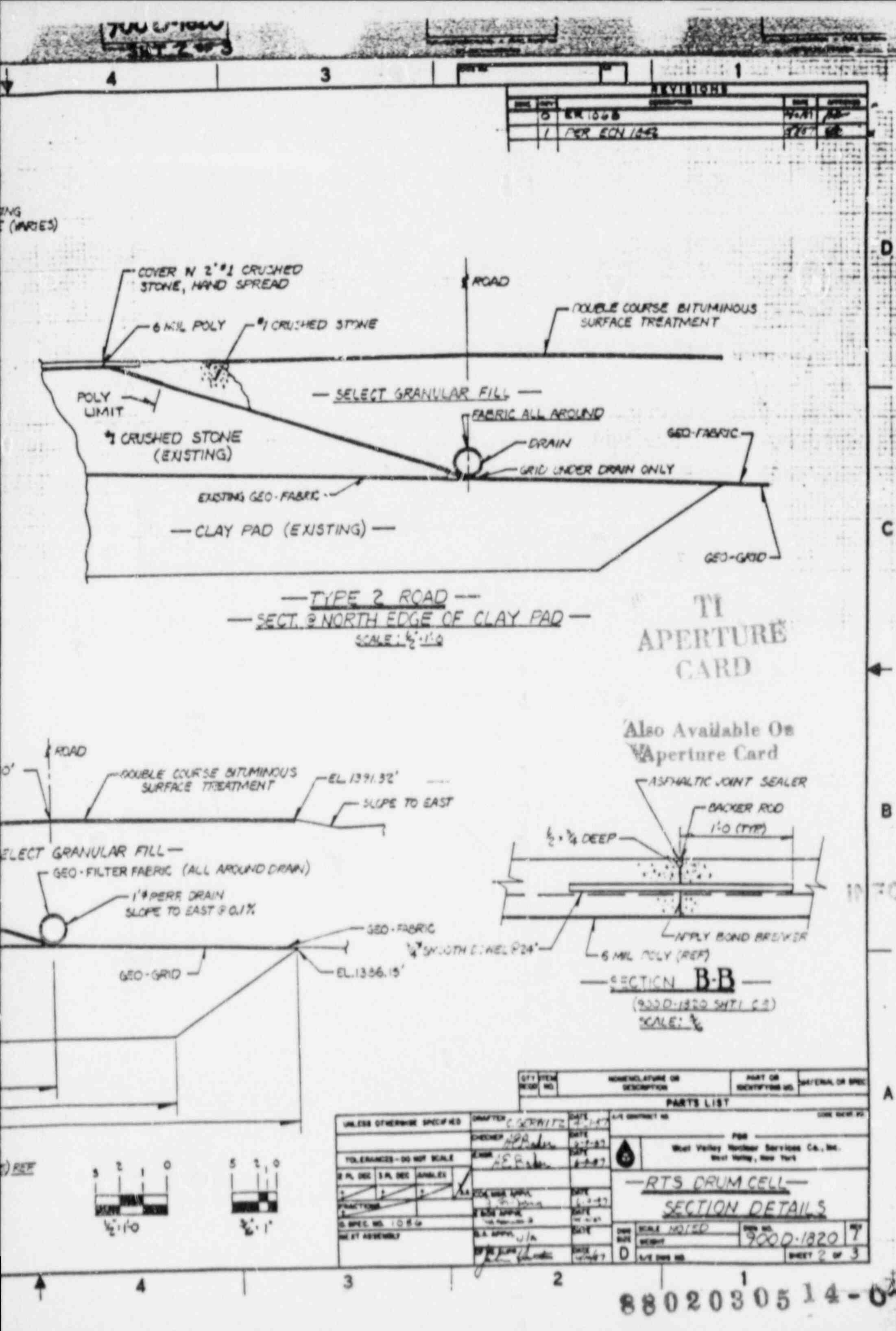
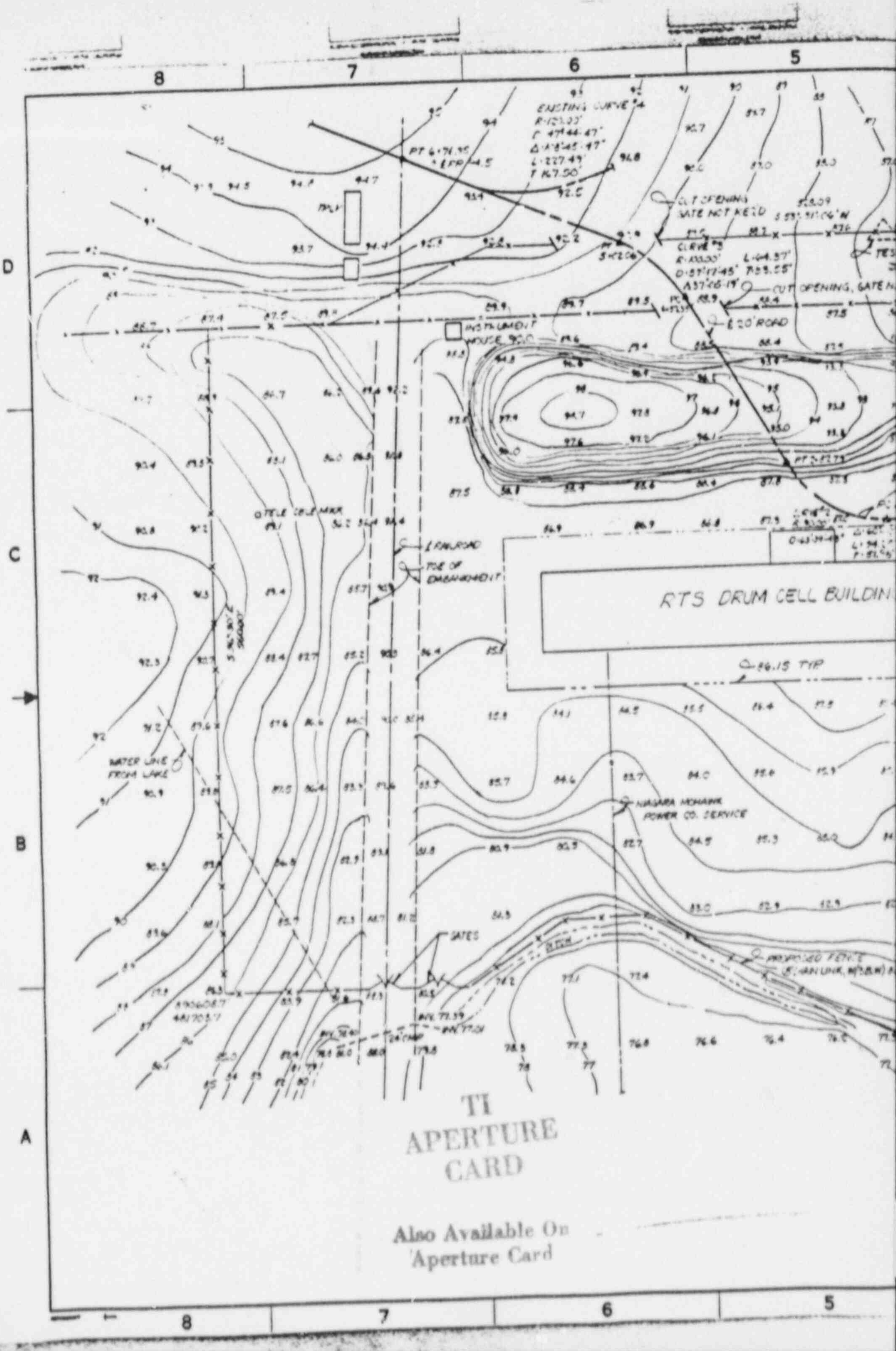

REVISIONS
0 ER 1068
1 PER ECN 1242
COVER W 2" #1 CRUSHED STONE, HAND SPREAD
℄ ROAD
DOUBLE COURSE BITUMINOUS SURFACE TREATMENT
6 MIL POLY
#1 CRUSHED STONE
POLY LIMIT
SELECT GRANULAR FILL
FABRIC ALL AROUND
#1 CRUSHED STONE (EXISTING)
DRAIN
GEO-FABRIC
GRID UNDER DRAIN ONLY
EXISTING GEO-FABRIC
CLAY PAD (EXISTING)
GEO-GRID
TYPE 2 ROAD
SECT. @ NORTH EDGE OF CLAY PAD
SCALE: ½"=1'-0
℄ ROAD
DOUBLE COURSE BITUMINOUS SURFACE TREATMENT
EL. 1391.32'
SLOPE TO EAST
SELECT GRANULAR FILL
GEO-FILTER FABRIC (ALL AROUND DRAIN)
1"Ø PERF. DRAIN SLOPE TO EAST @ 0.1%
GEO-FABRIC
GEO-GRID
EL. 1386.15'
ASPHALTIC JOINT SEALER
BACKER ROD
1'-0 (TYP)
½ x ¾ DEEP
¾"Ø SMOOTH DOWEL @ 24"
6 MIL POLY (REF)
SECTION B-B
(900D-1820 SHT1 C-8)
SCALE: ¾
PARTS LIST
UNLESS OTHERWISE SPECIFIED
TOLERANCES - DO NOT SCALE
DRAFTER C. GERWITZ
West Valley Nuclear Services Co., Inc.
West Valley, New York
RTS DRUM CELL
SECTION DETAILS
SCALE NOTED
900D-1820
SHEET 2 OF 3
D
½"=1'-0
¾"=1'

Figure K.5.1-5



TI APERTURE CARD

Also Available On Aperture Card

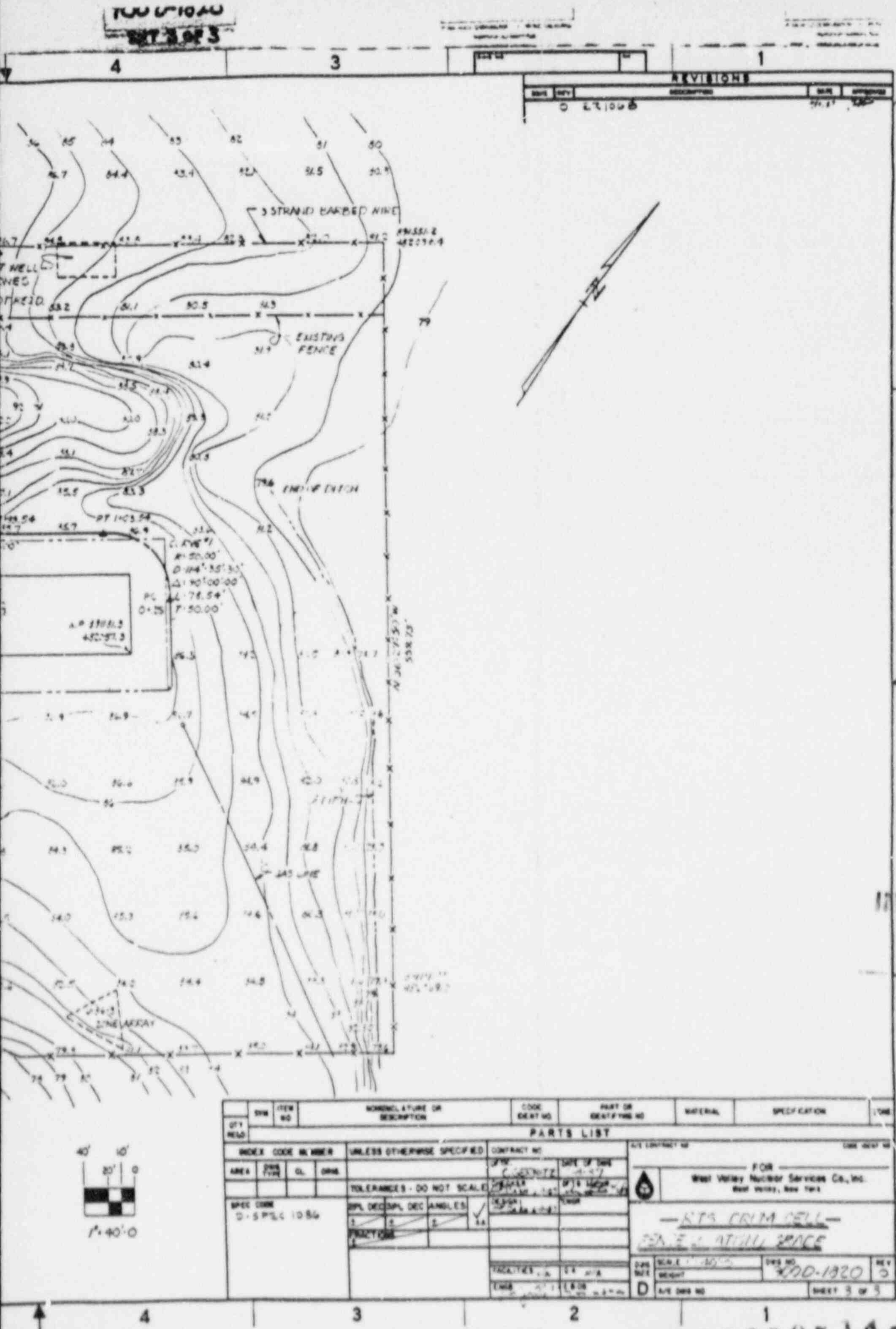
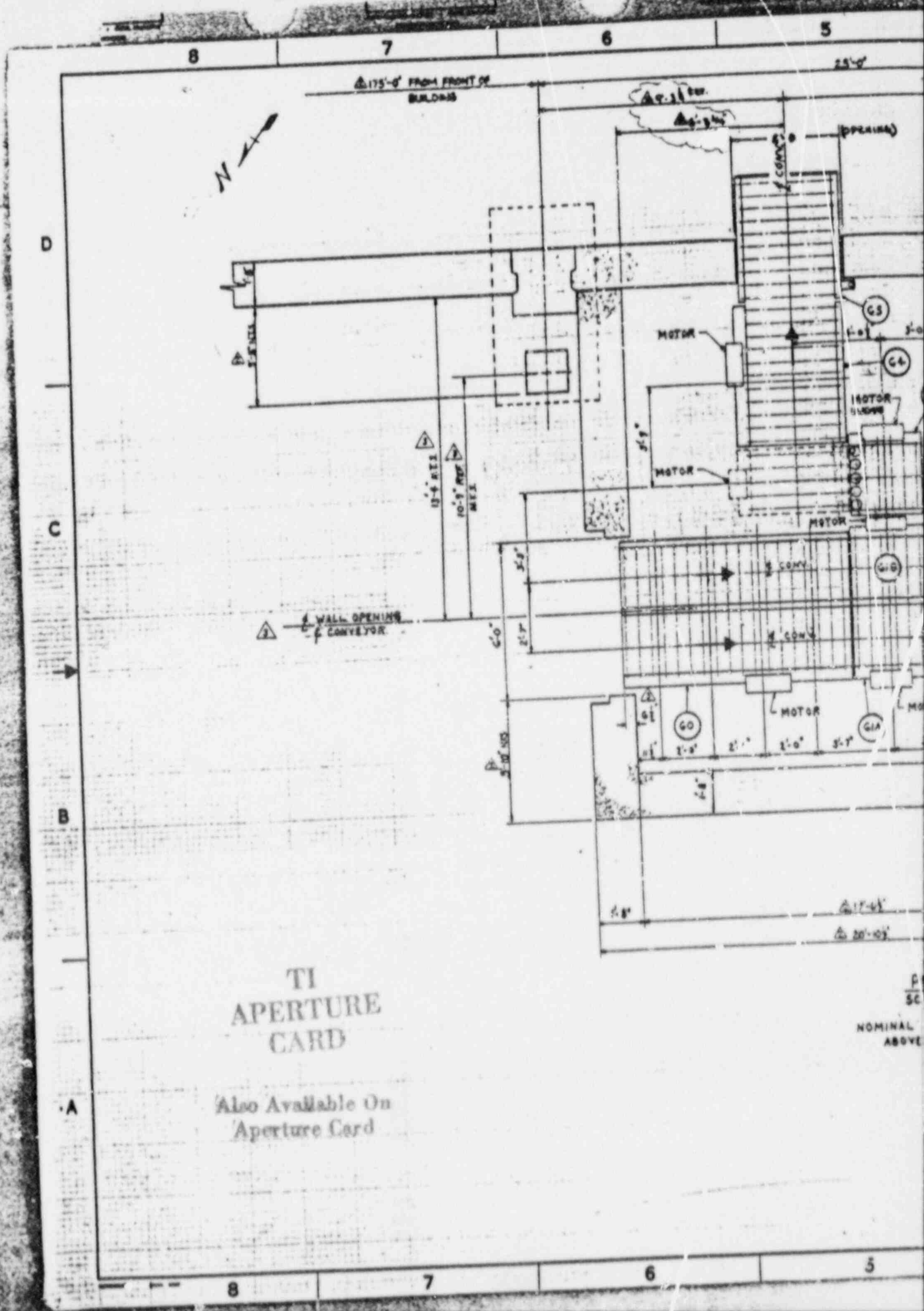


Figure k.5.1-6

FOR INFORMATION ONLY

8802030514-05



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CARD

Also Available On
Aperture Card

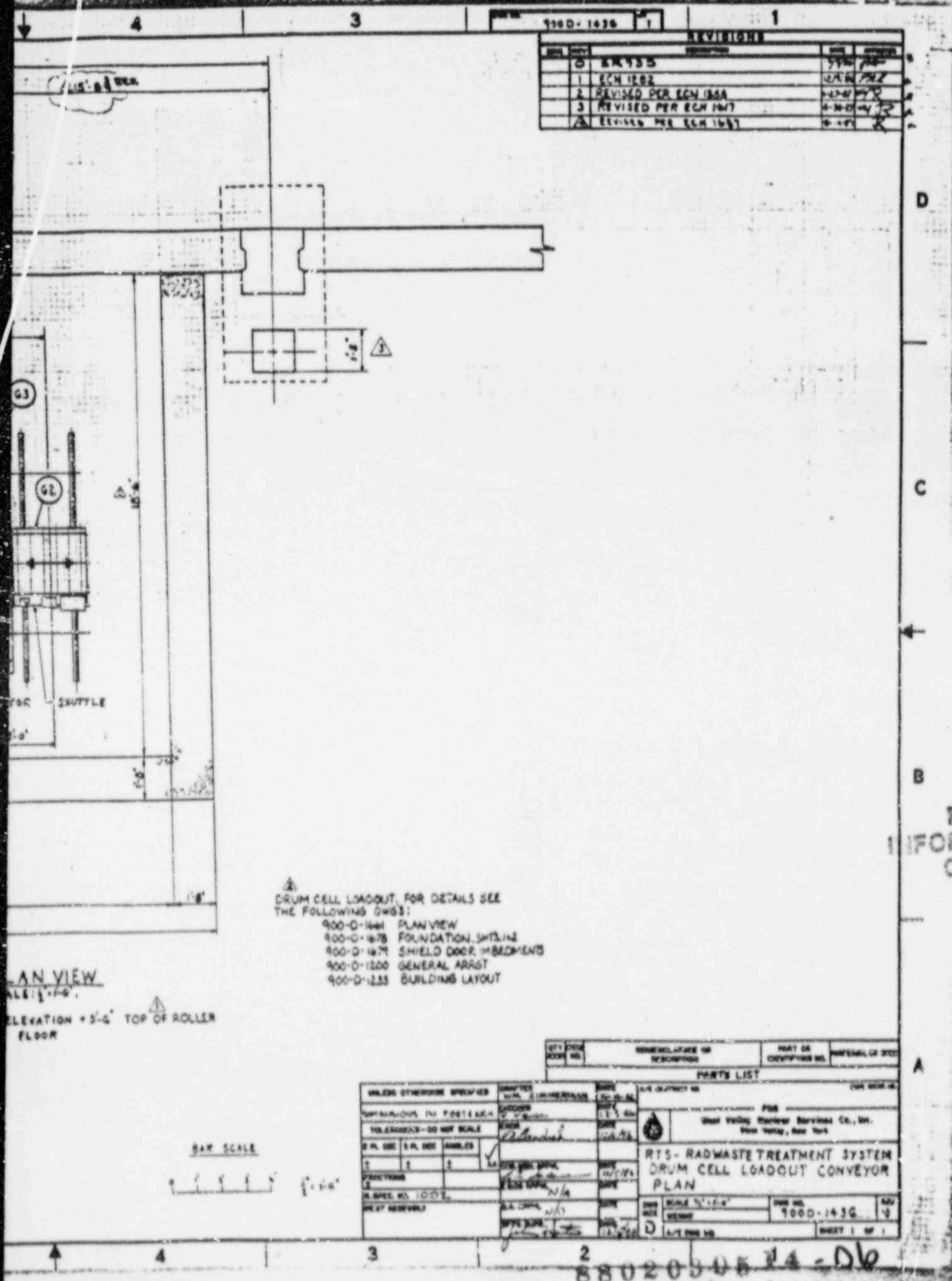
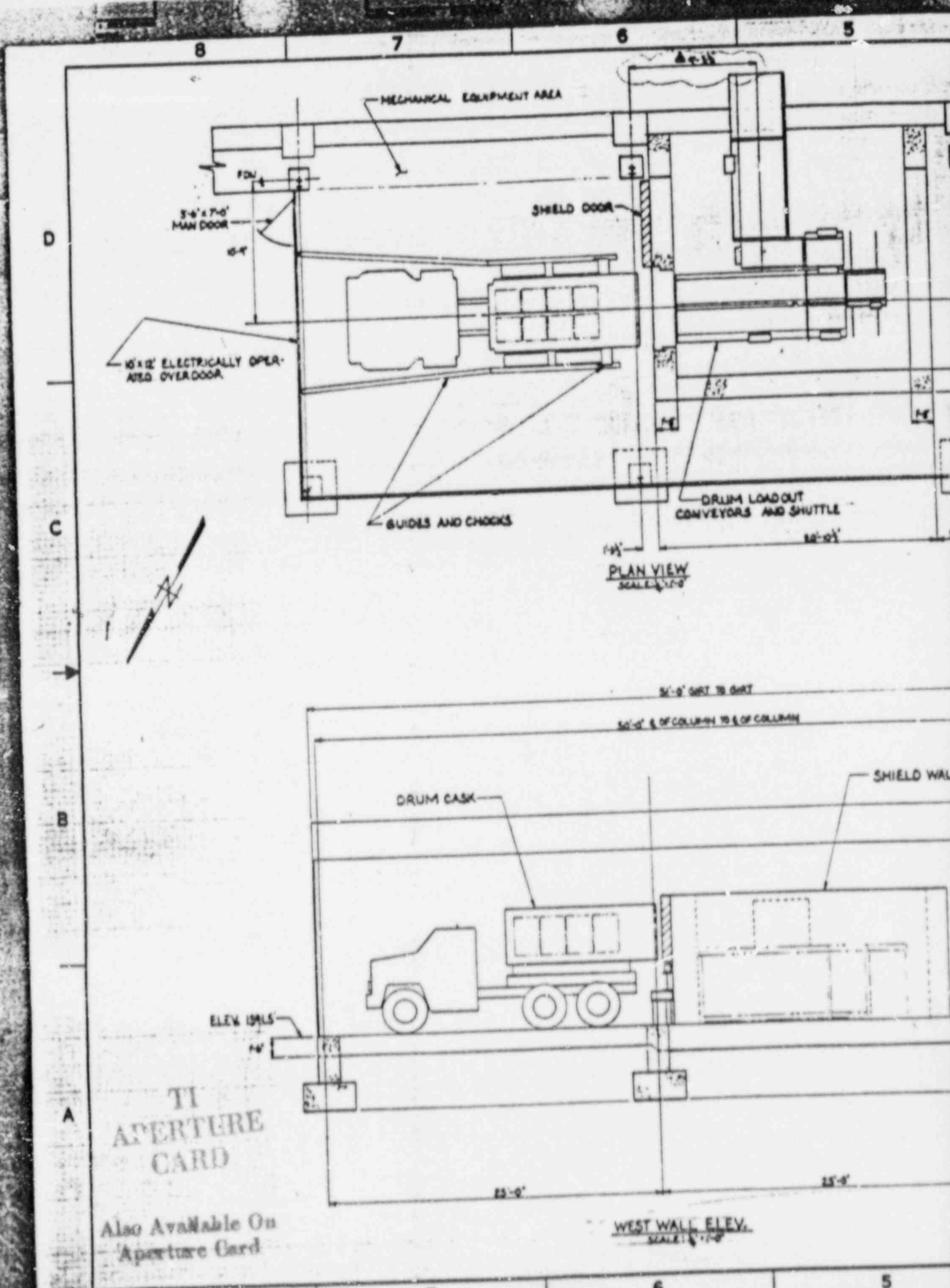
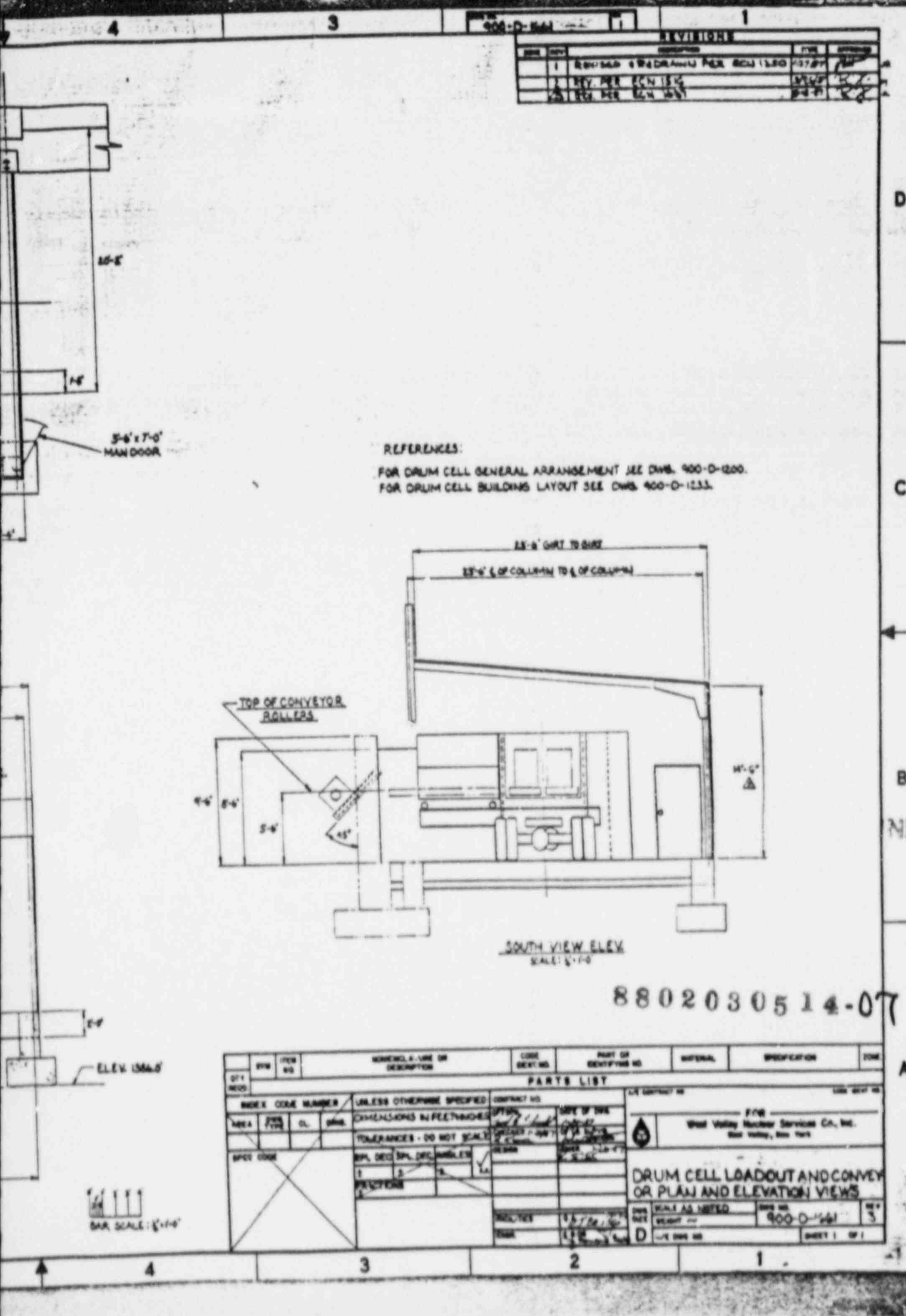


Figure K.5.1-7

FOR INFORMATION ONLY



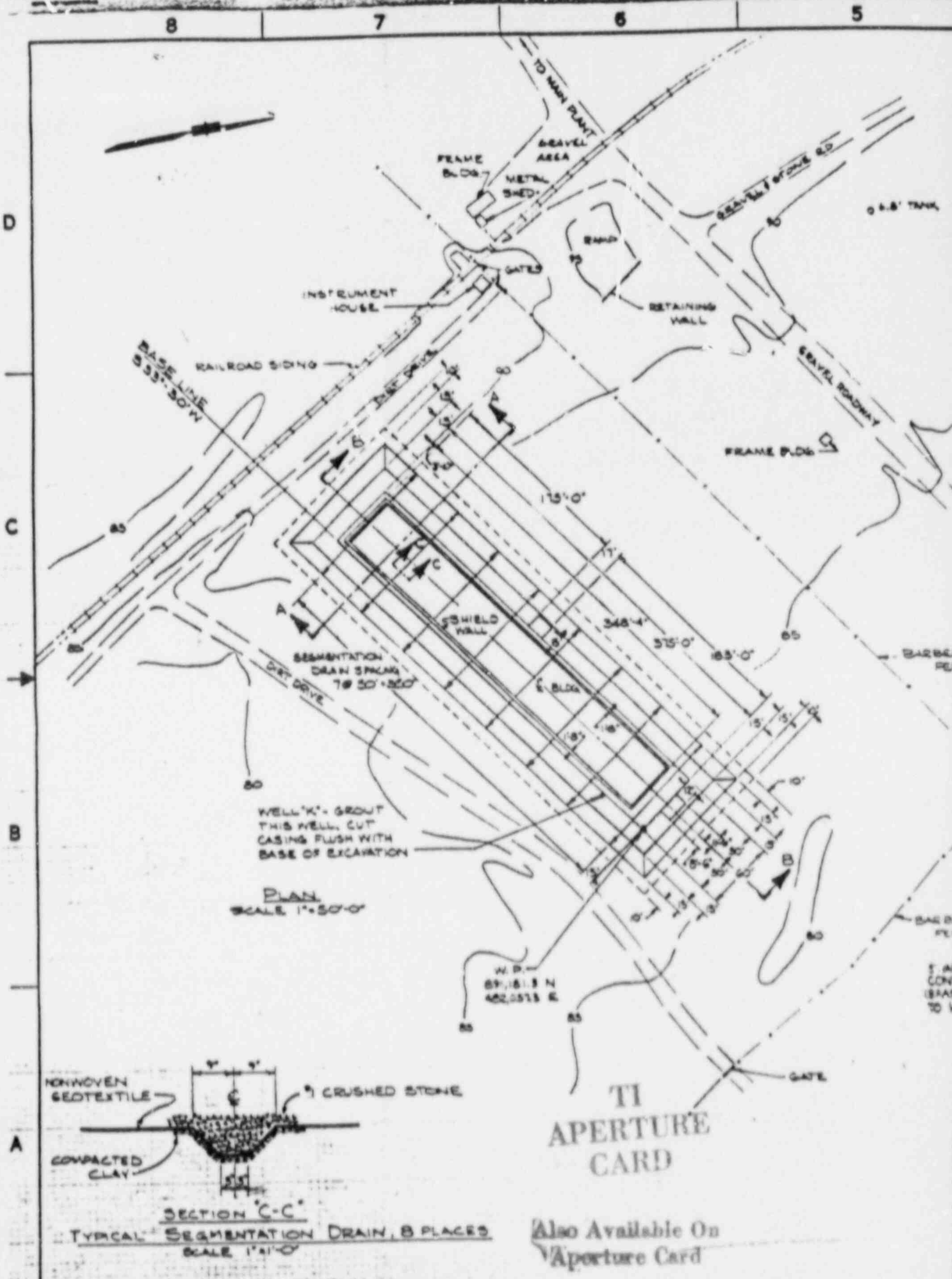
MECHANICAL EQUIPMENT AREA
3'-6" x 7'-0" MAN DOOR
SHIELD DOOR
10'x12' ELECTRICALLY OPERATED OVERDOOR
GUIDES AND CHOCKS
DRUM LOADOUT CONVEYORS AND SHUTTLE
PLAN VIEW
51'-0" GIRT TO GIRT
50'-0" ℄ OF COLUMN TO ℄ OF COLUMN
DRUM CASK
SHIELD WAL
25'-0"
25'-0"
WEST WALL ELEV.



8802030514-07

FOR INFORMATION ONLY

Figure K.5.1-8



TI APERTURE CARD

Also Available On Aperture Card

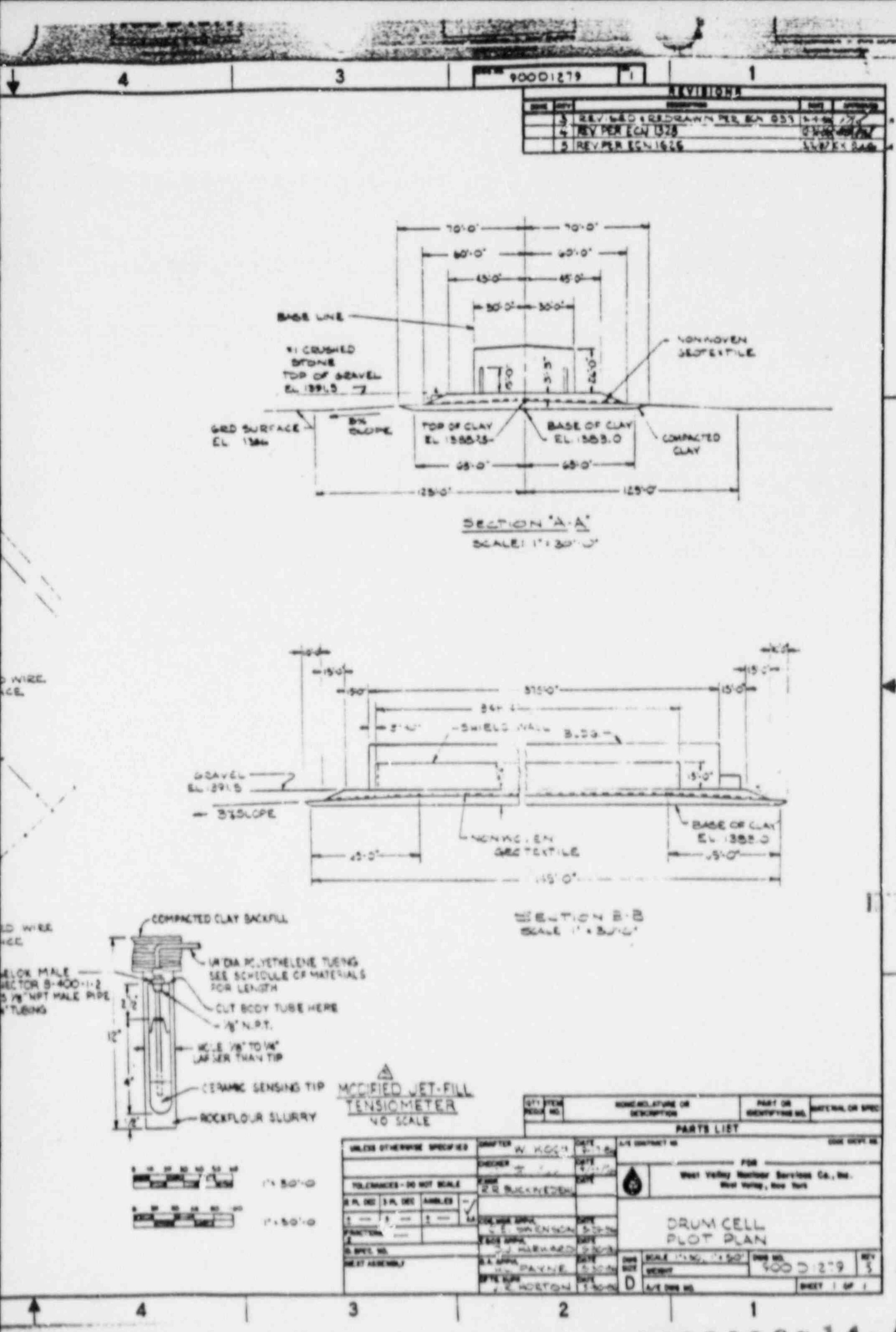
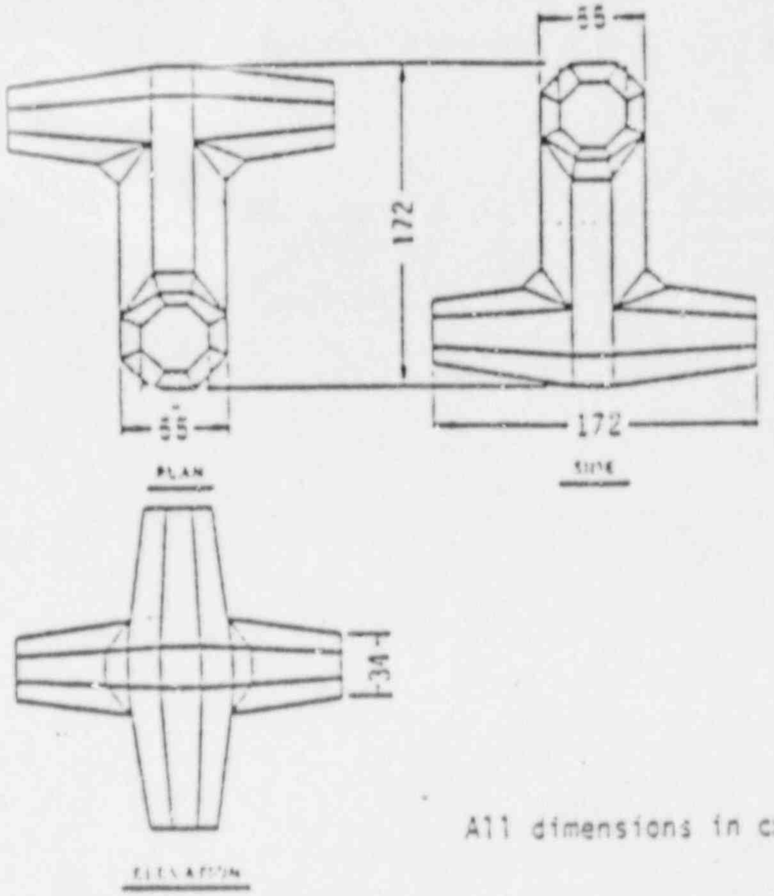


Figure K.5.1-9

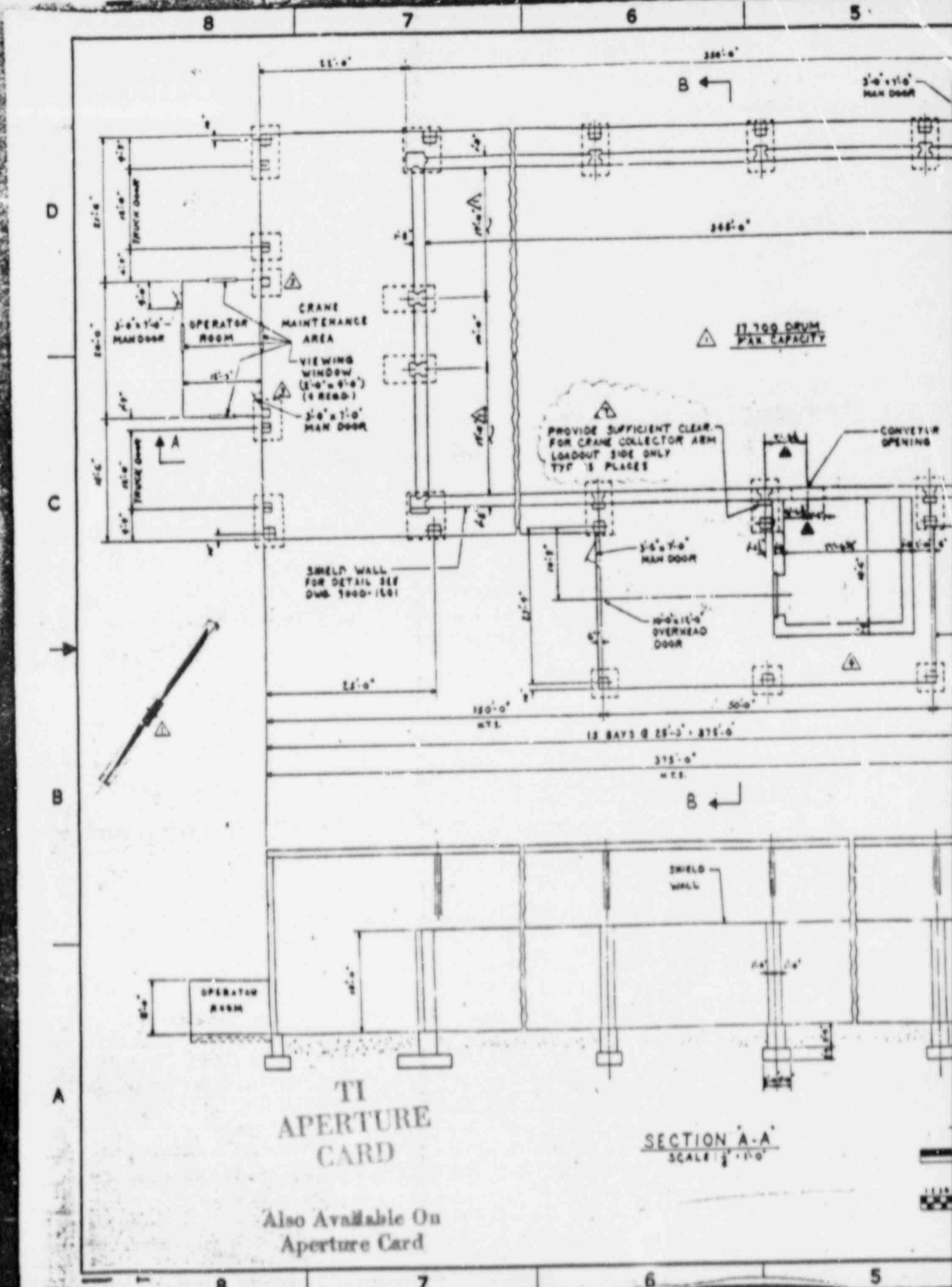
8802030514-08



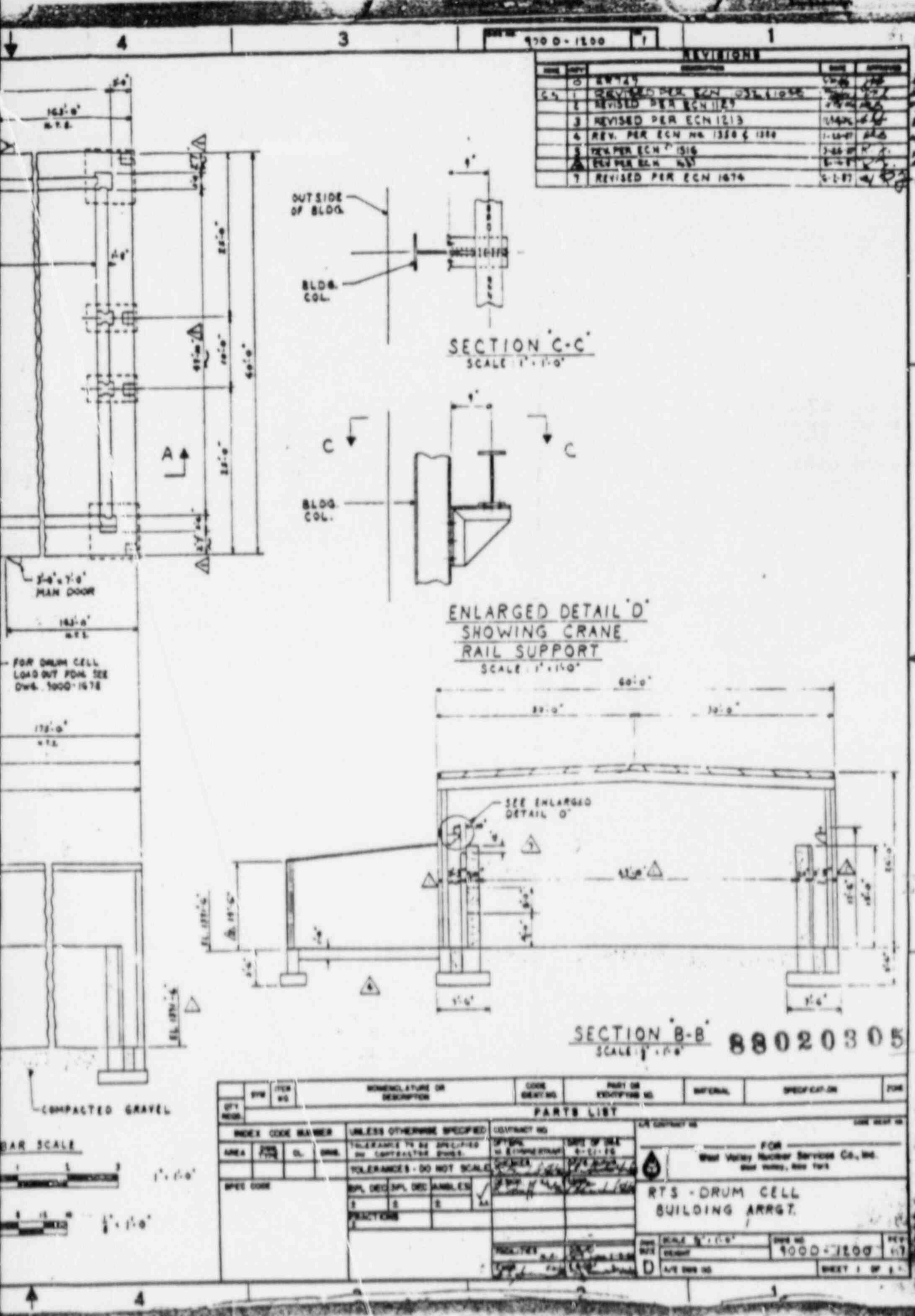
All dimensions in cm.

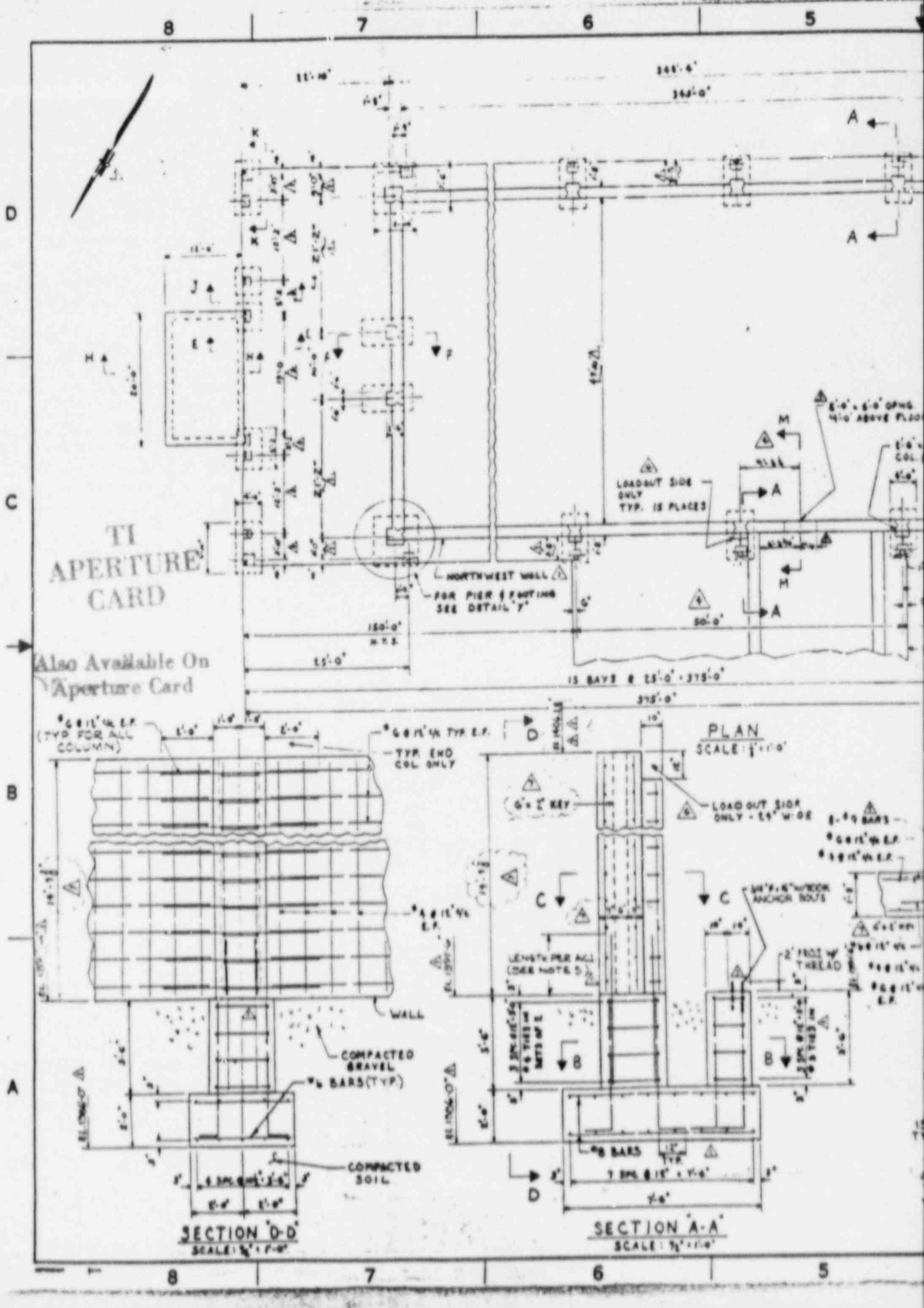
DOLOS UNIT INTRUDER BARRIER ELEMENT

Figure k.5.1-10



CRANE MAINTENANCE AREA
OPERATOR ROOM
3'-0" x 7'-0" MAN DOOR
VIEWING WINDOW
(4 REQD.)
17,700 DRUM MAX CAPACITY
PROVIDE SUFFICIENT CLEAR. FOR CRANE COLLECTOR ARM LOADOUT SIDE ONLY TYP 3 PLACES
CONVEYOR OPENING
SHIELD WALL FOR DETAIL SEE DWG 7000-1501
OVERHEAD DOOR
13 BAYS @ 25'-0" = 375'-0"
SHIELD WALL
OPERATOR ROOM
SECTION A-A


9000-1200
REVISIONS
REVISED PER ECN 1213
REV. PER ECN No. 1350 & 1351
REV PER ECN 1316
REVISED PER ECN 1674
OUTSIDE OF BLDG.
BLDG. COL.
SECTION "C-C"
SCALE: 1" = 1'-0"
ENLARGED DETAIL "D" SHOWING CRANE RAIL SUPPORT
SCALE: 1" = 1'-0"
SEE ENLARGED DETAIL "D"
SECTION "B-B"
3'-0" x 7'-0" MAN DOOR
FOR DRUM CELL LOAD OUT FDN. SEE DWG. 9000-1678
COMPACTED GRAVEL
BAR SCALE
PARTS LIST
UNLESS OTHERWISE SPECIFIED
TOLERANCES - DO NOT SCALE
FRACTIONS
FOR
West Valley Nuclear Services Co., Inc.
RTS - DRUM CELL
BUILDING ARRGT.
9000-1200
8802030514-09
FOR INFORMATION ONLY
Figure K.5.2-1


8
7
6
5
D
C
B
A
NORTHWEST WALL
FOR PIER & FOOTING
SEE DETAIL 'Y'
LOADOUT SIDE
ONLY
TYP. 15 PLACES
150'-0"
N.T.S.
25'-0"
50'-0"
15 BAYS @ 25'-0" = 375'-0"
375'-0"
PLAN
TYP. END
COL ONLY
6" x 2" KEY
LOADOUT SIDE
ONLY - 24" WIDE
LENGTH PER ACI
(SEE NOTE 5)
WALL
COMPACTED
GRAVEL
#6 BARS (TYP.)
COMPACTED
SOIL
#6 BARS
SECTION "D-D"
SECTION "A-A"

9000-1201 7

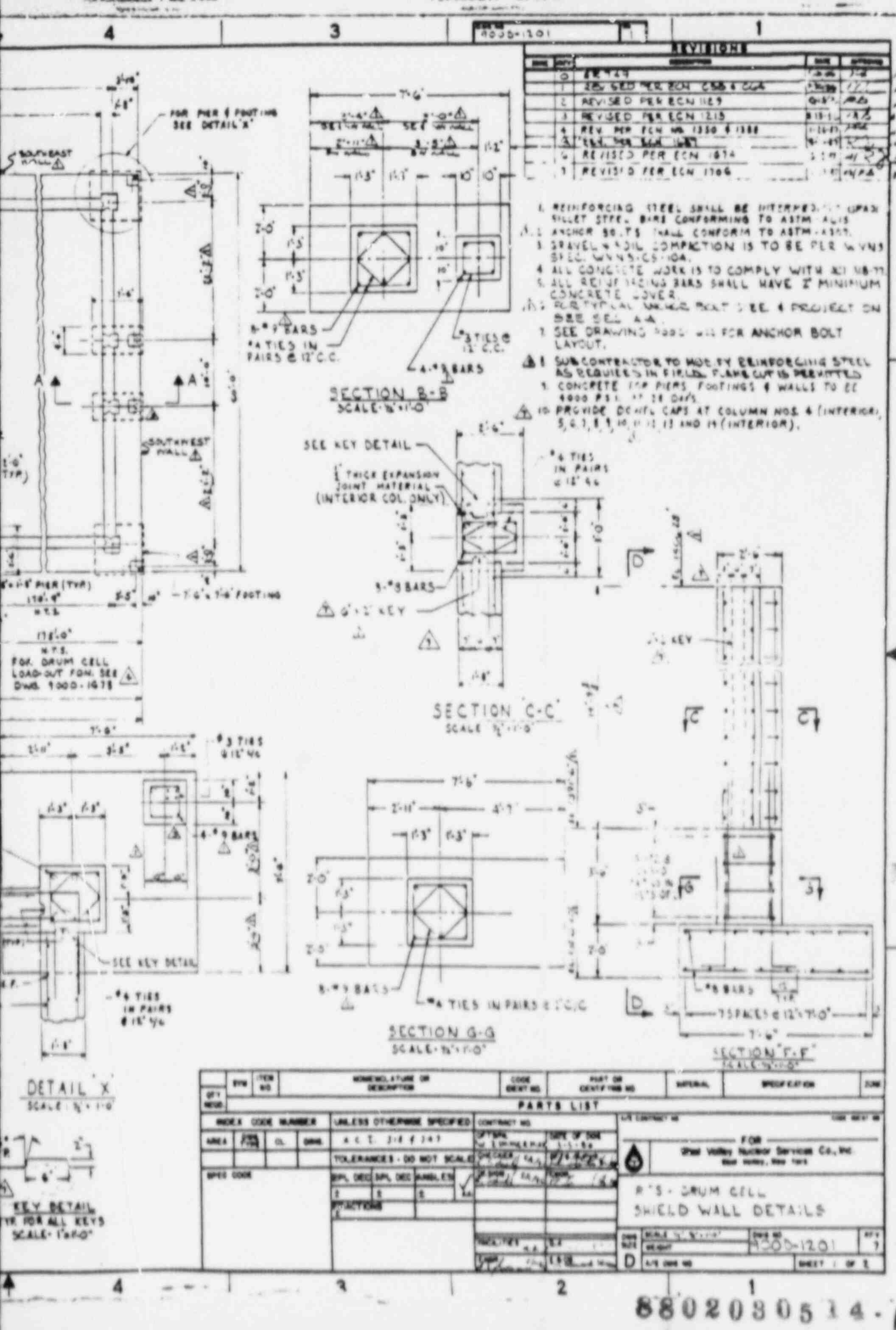
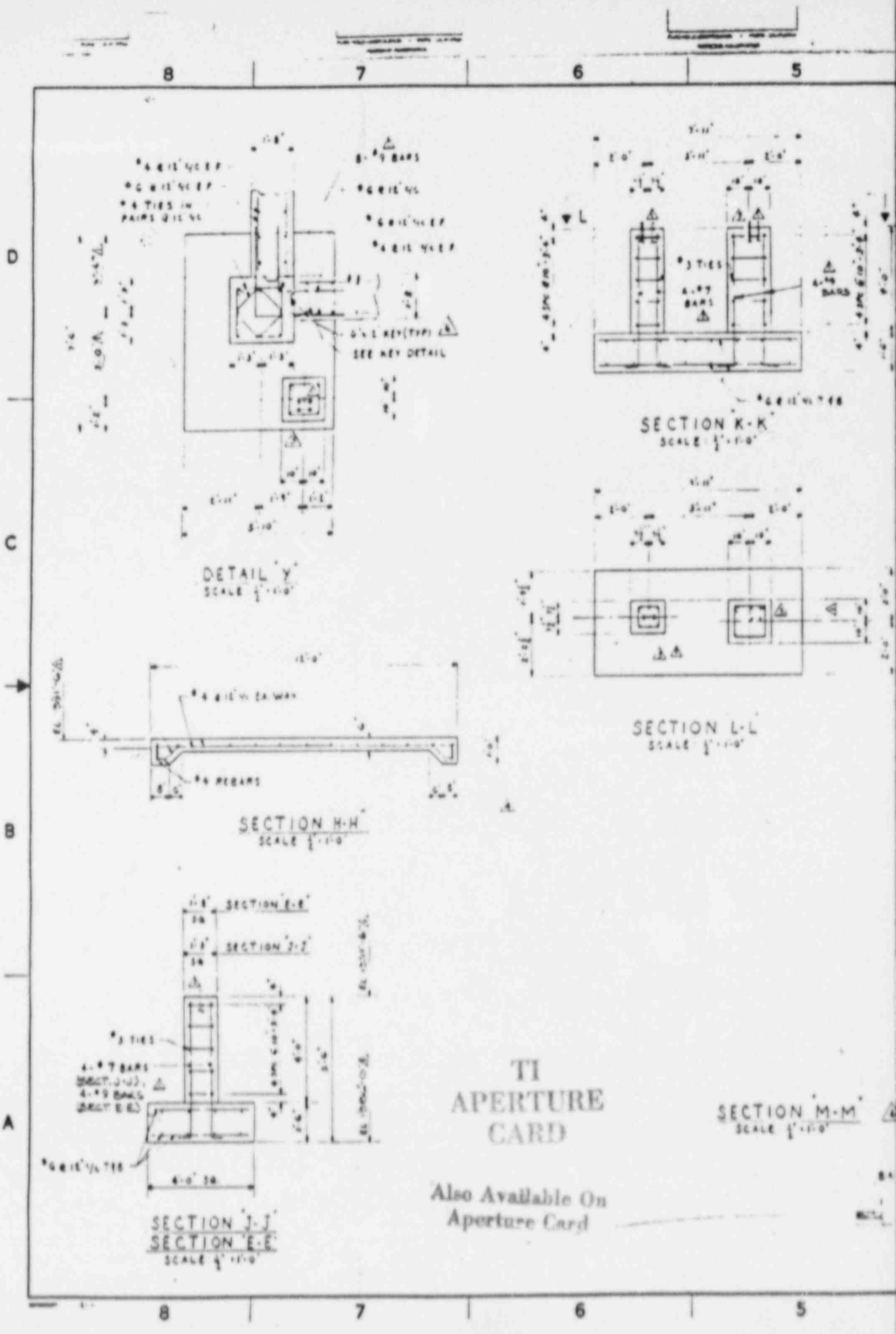


Figure k.5.2-2

FOR INFORMATION ONLY

8802030514-10



TI
APERTURE
CARD

Also Available On
Aperture Card

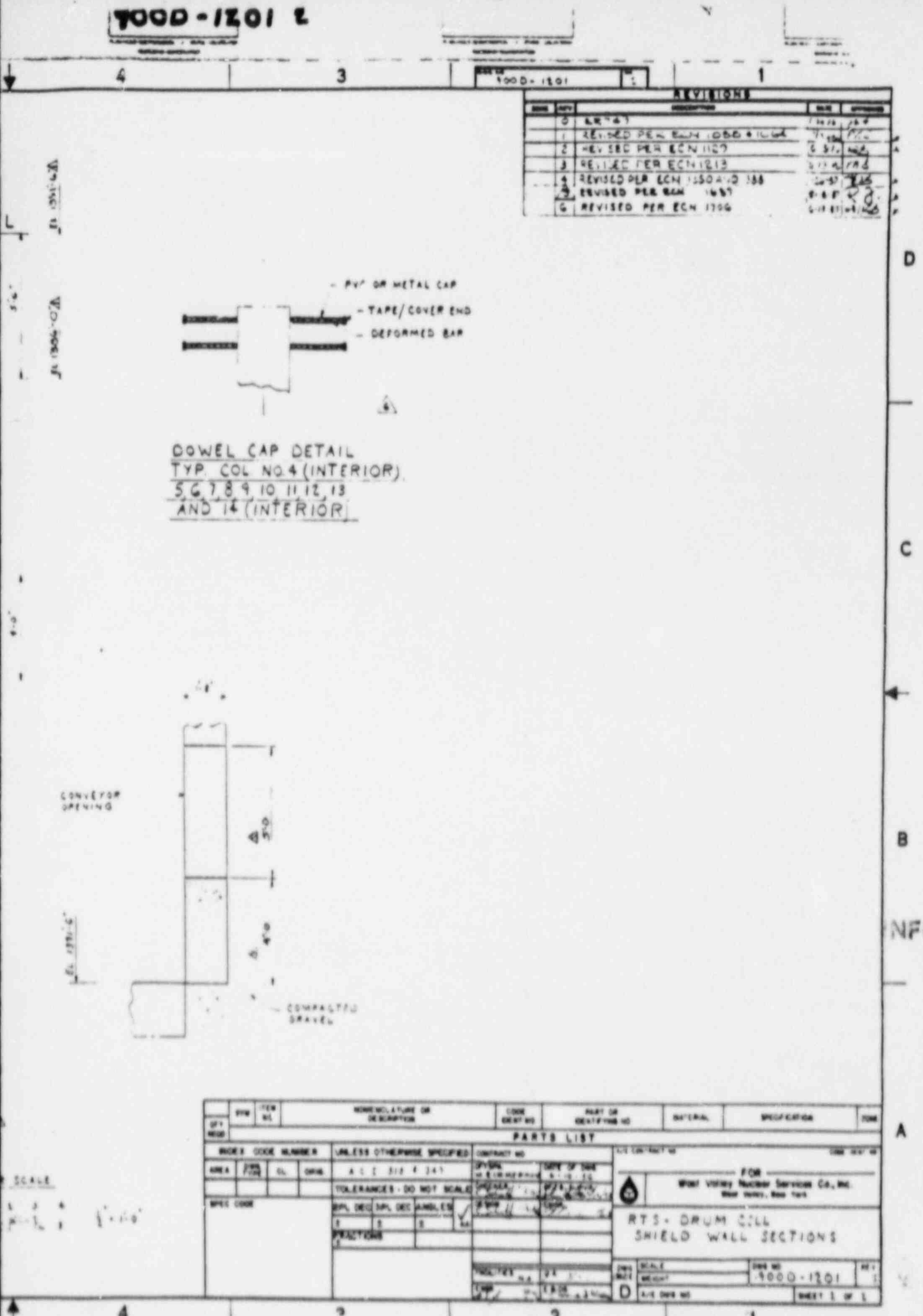


Figure k.5.2-3

FOR INFORMATION ONLY

8802030514 -11

k.6.0 PROCESS SYSTEMS

Not applicable to this SAR.

k.7.0 WASTE CONFINEMENT AND MANAGEMENT

k.7.1 WASTE MANAGEMENT CRITERIA

The overall waste management plan for the site is described in WVDP-019, "Long-term Radioactive Waste Management Plan."

The guiding principles followed in the preparation of this plan are:

- o Minimize all waste generation,
- o Provide flexibility in designed facilities to accommodate future uncertainties (e.g., solid waste volumes, storage, process equipment, etc.),
- o Segregate uncontaminated from contaminated waste as early as possible to minimize additional storage, disposal, and transportation requirements,
- o Minimize occupational exposures,
- o Minimize costs,
- o Protect the worker, public health, and the environment, and
- o Conform to applicable DOE Orders and guidance from other regulations provided by DOT, EPA, NRC, and New York State.

k.7.2. RADIOLOGICAL WASTES

All Class B and C waste (as defined by 10 CFR 61) will be stored in the RTS Drum Cell. No hazardous, mixed or transuranic waste in any form is planned to be placed in the drum cell. Certified, stabilized nonradiological waste in the form of cement-filled drums will be placed on top of the waste mass to provide additional shielding.

k.7.3 NONRADIOLOGICAL WASTE

Preliminary construction and disposal operations will produce a small amount of nonradiological waste which will be collected and disposed of off-site.

k.7.4 OFF-GAS TREATMENT AND VENTILATION

Not applicable to this SAR

k.7.5 LIQUID WASTE TREATMENT AND RETENTION

Rainwater which may accumulate in the perimeter drain or sumps surrounding the drum cell will be sampled and depending upon the test results, the collected water will either be pumped to a discharge point or processed prior to discharge.

k.7.6 LIQUID WASTE SOLIDIFICATION

Any collected water which contains radioactivity at a concentration above release limits will be processed prior to discharge. Radioactive materials resulting from any processing may be solidified by the Cement Solidification System.

k.7.7 SOLID WASTES

k.7.7.1 DESIGN OBJECTIVES

Solid waste which will be placed in the RTS Drum Cell must meet the waste form criteria of 10 CFR 61.56 and DOE Order 5480.2.

k.7.7.2 EQUIPMENT AND SYSTEM DESCRIPTION

Equipment used to handle, package, transport and dispose of Class B/C radioactive waste does not differ from equipment which is routinely used for similar purposes in other industrial radioactive waste applications.

k.7.7.3 OPERATING PROCEDURES

The operating procedure for low-level waste handling and storage operations at the RTS Drum Cell will be prepared, reviewed and approved in accordance with established WVNS policy prior to the initiation of operations.

k.7.7.4 CHARACTERISTICS OF SOLID WASTE

The required characteristics of Class B and C radioactive wastes are defined in 10 CFR Part 61.56. The major requirements which are directly applicable to the WVDP include:

1) Free standing liquid in high integrity containers shall not exceed one percent by volume. Free standing liquid in drums containing cement-solidified waste shall not exceed 0.5 percent by volume.

2) Waste must have structural stability under the expected disposal conditions.

3) Waste must not be capable of detonation, explosive decomposition or reaction at normal temperatures and pressures or of explosive reaction with water.

4) Waste must not be pyrophoric.

5) Waste must not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste.

6) Waste must not be packaged for disposal in cardboard or fiberboard boxes.

Class B waste and Class C waste are classified according to 10 CFR 61.55 (refer to Tables k.7.7-1 and k.7.7-2):

1) If the concentration of a nuclide listed in Table k.7.7-1 exceeds 0.1 times the value listed in Table k.7.7-1 but does not exceed the value listed in Table k.7.7-1, the waste is Class C, provided the concentration of nuclides listed in Table k.7.7-2 does not exceed the value shown in Column 3 of Table k.7.7-2.

2) If the concentration exceeds the value in Column 1 of Table k.7.7-2 but does not exceed the value in Column 2, the waste is Class B.

3) For determining the classification of waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each nuclide's concentration by the appropriate limit taken from the same column of the same table. The sum of the fractions for that column must be less than 1.0 if the waste is to fall within the class whose upper concentration limits are listed in that column.

   Example: A waste contains Sr-90 in a concentration of 50 Ci/m^3 and Cs-137 in a concentration of 22 Ci/m^3. Since the concentrations both exceed the values in Column 1, Table k.7.7-2, they must be compared to Column 2 values. For Sr-90 the fractional concentration is 50/150 = 0.33; for Cs-137 the fraction is 22/44 = 0.5; the sum of the fractions = 0.83. Since the sum is less than 1.0, the waste is Class B.

The expected volumes of Class B and Class C waste requiring disposal through the end of the vitrification process are listed in Table k.4.1-1. Most of these data were previously reported in DOE/EA-0295, Environmental Assessment for Disposal of Project Low-Level Waste. From Table k.4.1-1, the total estimated volume of Class B/C waste requiring storage in the drum cell is approximately 4,900 m^3.

k.7.7.5 **WASTE CONTAINERS**

Low-level waste containers which are used to package Class B/C waste at the WVDP are controlled by WVNS specifications and procedures. The following is a list of the types of containers which may be used to dispose of Class B/C waste:

1) DOT Specification 17C and 17H steel drums

2) Rectangular B-25 steel containers

3) DOT Specification 7A boxes

4) DOT Specification 7A 71-gallon steel square drums

5) High Integrity Containers (certified to maintain their integrity for 300 years)

k.7.7.6 **STORAGE FACILITIES**

Any temporary storage facilities required prior to transport and emplacement of all Class B/C waste in the drum cell must meet the restrictions and requirements of WVDP-010, Radiological Controls Manual.

REFERENCES FOR SECTION k.7.0

Code of Federal Regulations, Title 10, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

U. S. Department of Energy, DOE-ID Order 5480.2, "Hazardous and Radioactive Mixed Waste Management."

U. S. Department of Energy, DOE/EA-0295, "Environmental Assessment for Disposal of Project Low-Level Waste", West Valley Demonstration Project, April, 1986.

WVDP-010, Radiological Controls Manual.

TABLE k.7.7-1

10 CFR 61 WASTE CLASSIFICATION TABLE FOR LONG-LIVED NUCLIDES

Radionuclide	Concentration Limits (Ci/m^3)
C-14	8
C-14 in activated metal	80
Ni-59 in activated metal	220
Nb-94 in activated metal	0.2
Tc-99	3
I-129	0.08
Alpha emitting transuranic nuclides with half-life greater than five years	[1]100
Pu-241	[1]3,500
Cm-242	[1]20,000

[1]Units are nanocuries per gram.

TABLE K.7.7-2

10 CFR 61 WASTE CLASSIFICATION TABLE FOR SHORT-LIVED NUCLIDES

RADIONUCLIDE	Concentration Limits (Ci/m³)		
	Class A	Class B	Class C
Total of all nuclides with less than 5 year half life	700	(1)	(1)
H-3	40	(1)	(1)
Co-60	700	(1)	(1)
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7,000
Sr-90	0.04	150	7,000
Cs-137	1	44	4,600

[1] There are no limits established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other nuclides in Table K.7.7-2 determine the waste to be Class C independent of these nuclides.

k.8.0 RADIATION PROTECTION

k.8.1 ASSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE ALARA

See Section A.8.1 of Volume I of the Project SAR.

k.8.2 RADIATION SOURCES

Radionuclide inventories for Class B/C waste resulting from existing operations and presolidification decontamination have been estimated in Volume II, Section B.8.2. Class B/C radionuclide inventories for vitrification secondary waste are reported in Volume III, Section C.8.2 and Volume IV, Section H.8.2. RTS secondary waste streams are also reported in Volume IV, Section H.8.2. All accident analyses and dose assessments are based upon the most recent waste stream inventory data contained in the Environmental Assessment (DOE/EA-0295).

k.8.3 RADIATION PROTECTION DESIGN FEATURES

In order to facilitate the placement and up to 20 years storage of waste in the drum cell, twenty inch concrete shield walls are required to protect operations personnel, site personnel and the general public. Table k.4.1-1 lists the estimated average surface exposure rate per container for each type of Class B/C waste. The shield walls were designed under the assumption that each waste container had one curie of Cs-137 in a cemented waste form. In addition, the control room, due to its proximity to the drum cell must also be adequately shielded to protect operations personnel from scattered radiation (skyshine). All shielding calculations were based on the assumption that worker access and general area access would be in accordance with the Radiological Controls Manual (WVDP-010).

k.8.4 ON-SITE DOSE ASSESSMENT

Occupational doses for the handling, transport and emplacement of Project low-level waste have been estimated previously (DOE/EA-0295). These projections were based on two waste handling activities (one for waste loading and one for waste unloading and placement in the RTS Drum Cell). The total estimated occupational dose associated with handling and storage of all Class B/C waste was approximately 46 person-rem.

Although the EA does not discuss the construction and utilization of a shielded drum cell and temporary weather structure, the on-site exposure estimates were based on the assumption that emplacement of B/C waste would require remote handling. The operations currently planned at the drum cell are essentially the same as those envisioned when the EA was written. Therefore, the occupational dose estimate cited above is considered current.

The projected on-site dose to a trespassing (nonintruder) member of the general public is assumed to be zero based upon WVNS procedural and institutional controls to be placed on the operation of the RTS Drum Cell.

The projected on-site dose to a trespassing member of the general public was evaluated for transient site residency of up to one year following the termination of the nominal 100-year period of active institutional surveillance (DOE/EA-0295). This individual is assumed to be unaware of the presence of radioactive waste beneath the surface. He lives on the site temporarily and consumes food produced from on-site gardening. It is also assumed that the on-site resident does not actually dig into the waste.

The highest yearly dose projected to be received by this individual from B/C waste only is 2.5 mrem and occurs 600 years after disposal. Class B/C waste contributes 76 percent of the total dose to the maximally exposed individual at 600 years when compared with all classes (A, B and C). Transient occupancy under similar conditions prior to 600 years would result in a lower dose.

k.8.5 HEALTH PHYSICS PROGRAM

The health physics program for the WVDP is described in Volume I, Section A.8.5 of the Project SAR. The health physics requirements associated with the handling and disposal operations for Class B/C waste are defined by WVDP-010, Radiological Controls Manual, and other procedures written to support handling and disposal operations at the drum cell.

k.8.6 OFF-SITE DOSE ASSESSMENT

The projected off-site dose to a member of the general public is assumed to be near zero during the normal operational phase (preclosure), storage phase, and over the 100 years of active institutional control following closure (assuming the drum cell were to be converted into a permanent disposal tumulus). The collective dose during the storage phase (up to 20 years) was estimated at 1.9 E-04 person-rem/yr (WVDP, 1987a).

The computer programs PRESTO-EPA, AIRDOS-EPA and LADTAP II were used to assess off-site collective doses and maximally exposed off-site individual doses (DOE/EA-0295) (during and following the institutional control period). The majority (essentially 100 percent for the water pathway, 65 percent for the air pathway) of the dose is contributed by the Class B/C waste when compared with the total from all classes (A, B, and C). The predicted off-site doses from Class B/C waste only and the year (post disposal site closure) in which they occur are shown in Table k.8.6-1.

It should be noted that given a constant 1990 estimated population within an 80 km radius, the cumulative collective dose from natural background during the 1,000 years following closure is estimated to be 170 million person-rem.

REFERENCES FOR SECTION k.8.0

Oak Ridge National Laboratory (ORNL), 1979, "AIRDOS-EPA: A Computerized Methodology for Estimating Environmental Concentrations and Dose to Man from Airborne Releases of Radionuclides," ORNL-5532, June, 1979.

Oak Ridge National Laboratory (ORNL), 1980, "User's Manual for LADTAP II - A Computer Program for Calculating Radiation Exposure to Man from Routing Release of Nuclear Reactor Liquid Effluents," NUREG/CR-1276, May, 1980.

U. S. Department of Energy, DOE/EA-0295, "Environmental Assessment for Disposal of Project Low-Level Waste, West Valley Demonstration Project, West Valley, New York".

U. S. Environmental Protection Agency, 1985, "PRESTO-EPA-POP: A Low-Level Radioactive Waste Environmental Transport and Risk Assessment Code - Methodology Manual," EPA 520/1-85-001.

WVDP-010, Radiological Controls Manual.

WVDP, 1987a, "Environmental Evaluation for Extended Storage of Class B/C Radioactive Waste," Revision 0, WVDP-064.

WVDP, 1987b, "Radiological Parameters for Assessment of West Valley Demonstration Project Activities", Revision 1, WVDP-065.

TABLE K.8.6-1

PREDICTED DOSES TO THE OFF-SITE POPULATION

RESULTING FROM PROJECT ON-SITE WASTE STORAGE AND DISPOSAL[1]

Type of Dose	Pathway	Predicted Occurrence of Maximum Dose (years following closure)	Dose (Units)
Collective	Air	Storage[2]	1.9 E-04 (person-rem/yr)
Maximum Individual[3]	Water	400	1.3 E-02 (mrem/yr)
Maximum Individual[4]	Air	700	1.1 E-03 (mrem/yr)
Collective	Water	400	7.3 E-02 (person-rem/yr)
Collective	Air	700	2.0 E-03 (person-rem/yr)
Cumulative Collective During 1,000 Years	All	N/A	5.3 E+01 (person-rem)

(1) Assumes population remains at 1990 estimates within 80 km radius of site.

(2) 0 - 20 years prior to closure (WVDP, 1987a).

(3) Individual is assumed to consume 21 kg of fish taken from Cattaraugus Creek downstream of the Project (WVDP, 1987b).

(4) Individual is a permanent resident located 1.4 km northwest of the plant (WVDP, 1987b).

k.9.0 ACCIDENT SAFETY ANALYSIS

k.9.1 ABNORMAL OPERATIONS

Abnormal operations during disposal of Class B/C waste in the drum cell are events which occur due to equipment malfunctions or human error. Abnormal events which are of potential consequence are those which could result in inadvertent release of radioactive material or increased occupational exposure. The following examples are representative of credible abnormal events involving Class B/C waste.

k.9.1.1 IMPROPER WASTE PACKAGING

Class B/C waste will be placed into a number of different types of packages including steel drums, steel boxes and high integrity containers (HICs). Improper waste packaging can be due to a defective package or operator error. The consequences of this event are minimal in that, the planned checks and inspections would identify the container, and it would either be sealed properly or repacked. Either option would result in minimal dose to operations personnel (<0.1 person-rem to collect and repackage the waste). Events in which improper packaging leads to a loss of radioactive material are covered in Section k.9.2, Accidents.

The consequences of faulty packaging will be minimal in that, upon discovery, the container would either be properly sealed or overpacked with another container, or the waste would be repacked into a new container depending upon ALARA considerations.

k.9.1.2 TRANSPORT VEHICLE TIRE FAILURE

This abnormal event would have no significant radiological consequences but would most likely delay waste handling operations and placement of Class B/C waste into the drum cell. All waste would be remotely handled should the transport vehicle have to be unloaded to effect repair. Occupational dose due to the increased handling would be minimal because of the use of remote handling equipment.

k.9.1.3 FAILURE OF DRUM CELL CRANE

Consequences resulting from crane malfunction at the storage site include:

1) delay of storage operations until crane is repaired or replaced, and

2) occupational exposure to crane maintenance repair crew (31 mR/hr maximum outside Drum Cell; a backup retrieval system will be used, if necessary, to free the crane and move it behind the shield wall). Item two assumes that no cold drums are in place to shield stored waste.

k.9.2 ACCIDENTS

Five credible accidents during the handling and storage of Class B/C radioactive waste in the drum cell have been analyzed. The first event is a design basis tornado (DBT) passing over the drum cell. The second accident is a handling mishap involving the transport vehicle and a HIC. The third accident involves collision of a HIC being moved with a crane with another HIC. The fourth accident involves a crane failure inside the drum cell, resulting in the rupture of a 71-gallon drum filled with unsolidified cement. The last accident is the radiation exposure of an intruder entering the drum cell after ignoring or failing to recognize radiation warning signs and barriers.

k.9.2.1 DESIGN BASIS TORNADO

For a worst case tornado accident scenario, it was assumed that Operations Personnel are in the process of unloading the waste conveyor with the overhead crane at the time the tornado passes over the work site. It was further assumed that the crane has picked up a package, thus creating the possibility of the DBT generating a missile by explosive injection. For the purpose of this analysis, the average density of all Class B/C waste was assumed to be 1.5 g/cm^3. This is conservatively low based on average densities expected for cemented drums (1.7 g/cm^3) and equipment and hardware (~2 g/cm^3). Therefore, a steel box was assumed to weigh 3300 pounds, a 55-gallon drum 700 pounds and a 71-gallon drum 1000 pounds. High integrity containers, which typically weigh more than 10,000 pounds when empty within a shield, were not considered in this analysis.

The temporary weather structure (Butler building) housing the drum cell area was assumed to disintegrate (roof tears off and walls collapse) under DBT conditions. The analysis examined whether or not a waste container in the drum cell or hanging from the crane could become airborne. For the aerodynamic injection case, the waste package was conservatively assumed to act as a cambered airfoil with a zero degree angle of attack with respect to any horizontal winds. The analytical methods used for this analysis were those of Stevenson (n.d.) under DBT conditions as reported by Fujita (1981) and McDonald (1981). Table K.9.2-1 summarizes the results of this analysis. The negative results clearly demonstrate that for both types of injection, no container would become airborne for a significant period of time under DBT conditions. The waste was also assumed not to move since the 20-inch concrete walls forming the drum cell shielding (other than a direct passover) would provide an effective wind break for any sustained horizontal winds associated with the DBT. The positive values obtained for the steel drum in the aerodynamic injection case were based on the assumption that the drum is flat and is shaped like a cambered airfoil. Even under these conservative assumptions, the container would remain airborne for only 0.25 seconds and reach a height of 20 cm, which is insufficient to move it from the drum cell.

The analyses of container motion under DBT conditions show that no significant movement will occur. Therefore, no release of radioactivity from the preclosure drum cell is expected from the tornado.

k.9.2.2 TRANSPORTATION ACCIDENT

The transportation accident for Class B/C waste considered a high integrity container (HIC) loaded with 3 m^3 of FRS resin and filter precoat which falls off the transport vehicle. The HIC was assumed to crack open, damaging the internal liner and spilling 0.3 m^3 of FRS resin onto the ground. This accident was considered improbable since HICs are designed to maintain their integrity when dropped from 9 m onto a flat unyielding surface. The fall from the transport vehicle would be approximately 2 metres to a yielding surface.

The FRS resin was assumed to have 16 curies per cubic meter of Cs-137 plus other nuclides present in concentrations established by actual measurement of loaded resin. Table k.9.2-2 presents a summary of the results of the analysis including dose to the maximally exposed off-site individual. The resin was assumed to be saturated with water (1 percent by volume) which evaporates to the atmosphere, thus providing the potential for off-site dose. The resulting dose to the maximally exposed off-site individual was estimated to be 1.5 E-02 mrem.

Taking no credit for air dilution, the maximum dose a worker could receive due to the release of radioactive material from the transportation accident was estimated to be 9 mrem. This assumes that the activity released to the atmosphere, per Table k.9.2-2, was inhaled by the worker for a period of two hours.

The occupational dose resulting from initial clean up of the HIC and any lost contents was estimated to be 3.2 person-rem. This dose projection results from the assumption that clean up efforts will require eight men working 16 hours in average fields of 25 mR/hr. Clean up of the residual activity may take up to two weeks, but would be carried out in considerably lower radiation fields.

k.9.2.3 CONTAINER COLLISION ACCIDENT

In this accident it was assumed that a HIC being handled by a crane outside the drum cell collided with another HIC containing FRS resin and precoat already in place. The stationary HIC was assumed to be partially crushed, the liner damaged and ten percent of the liner volume (0.3 m^3) spilled to the ground. The HIC being handled was assumed to remain intact.

Both the dose to the maximally exposed off-site individual and the occupational inhalation and external doses resulting from clean up operations are expected to be the same as those estimated following the transportation accident.

k.9.2.4 DRUM RUPTURE ACCIDENT

A 71-gallon drum being handled by the crane inside the drum cell is assumed to drop and rupture. The cement in the drum is assumed to be in a plastic (incomplete set) phase, spilling over the drum cell floor. A maximum waste loading of 1 Ci Cs-137 was assumed with all other radionuclides scaled to their relative concentrations in decontaminated supernatant. This activity was assumed to be released from the cement at a resuspension rate of 1 E-10/sec for a period of eight hours. At this time the cement was assumed to have solidified, resulting in no further airborne releases. No ventilation was assumed for the air inside the TWS, resulting in an increase in the airborne concentration of radionuclides over the release period.

A crew of eight workers was assumed to enter the TWS without respiratory protection for eight hours following the spill, staying behind the shield wall to effect remote clean-up operations. The inhalation dose to these workers was estimated to be 0.12 person-rem. The results of this calculation are summarized in Table k.9.2-3.

The dose to the maximally exposed off-site individual at the site boundary was estimated by assuming that all the airborne activity released from the cement escapes or is vented to the atmosphere, resulting in an estimated dose of 1.1 E-02 mrem. The results of this calculation are summarized in Table k.9.2-4.

The external radiation dose to the clean-up crew was estimated to be 1.6 person-rem, based on a crew of eight workers working ten eight-hour shifts in average fields of 2.5 mR/hr.

k.9.2.5 INTRUDER EXPOSURE

Due to the somewhat remote location of the drum cell with respect to other plant facilities, an intruder was assumed to defeat the normal security at the site perimeter and at the drum cell and to enter the waste storage (emplacement) area. The intruder was also assumed to ignore or not understand the significance of radiation placards placed at the entrance and at various locations within the temporary weather structure. The drum cell was assumed to have approximately 5,000 cement drums in place at the time of intruder entrance. Before discovery by security or operations shift personnel, the intruder was assumed to spend approximately eight hours in the waste cell in average fields of approximately 100 mR/hr and therefore would receive a dose of 800 mrem.

REFERENCES FOR SECTION k.9.0

Stevenson, John D. (n.d.) Engineering and Management Guide to Tornado, Missile, Jet Thrust and Pipe Whip Effects on Equipment and Structures. Prepared for Nuclear Structural Systems Associates.

Fujita, T. Theodore, 1981. Tornado and High Wind Hazards at Western New York Nuclear Service Center, West Valley, New York.

McDonald, James R., 1981. Assessment of Tornado and Straight Wind Hazard Probabilities at the Western New York Nuclear Service Center, West Valley, New York.

WVDP, 1987, "Radiological Parameters for Assessment of West Valley Demonstration Project Activities", Revision 1, WVDP-065.

TABLE k.9.2-1

SUMMARY OF TORNADO GENERATED MISSILE DYNAMICS (1)

Container Type	Container Volume	Missile Exposed Area (m^2)	Explosive Injection Case(2)			Aerodynamic Injection Case(3)		
			V_i ($^m/s$)	Z_i(m)	T_a(s)	V_i ($^m/s$)	Z_i(m)	T_a(s)
Steel box	3	2.42	-5.9E-01(4)	-1.2E-02	-1.2E-01	-9.4E-01	-4.9E-02	-1.9E-01
Steel drum (square)	0.27	0.49(5)	-6.1E-01	-1.2E-02	-1.2E-01	1.2	2.0E-1	2.5E-01
Steel drum (round)	0.21	1.8E-02	-9.7E-02	-6.7E-04	-2.0E-02	-1.8	-1.1E-02	-3.8E-01

1 Analysis from methodology of Stevenson (n.d.) assumes waste containers act like a cambered airfoil (ATCM, 1966).

2 Case assumes that a significant volume of air is below the object, for example, a box or a drum suspended from the drum cell overhead crane.

3 Container configuration assumed to produce lift in the horizontal wind field where:

V_i - injection velocity, metres/second

Z_i - elevation of missile, metres

t_a - time missile is airborne, seconds

4 Negative Values for V_i, Z_i and t_a indicate no container movement would occur under DBT conditions

5 Largest surface area of square drum is assumed to be the missile exposed area.

TABLE k.9.2-2

OFF-SITE INDIVIDUAL DOSE FROM SIGNIFICANT RADIONUCLIDES RELEASED AS A RESULT OF A TRANSPORTATION ACCIDENT INVOLVING A SPILL OF FRS RESIN[1]

Nuclide	Curies in Spill	Curies in Evaporate [2]	Partition Coefficient[3]	Curies Released to Atmosphere	Dose to the Maximally Exposed Off-Site Individual (mrem)
Sr-90	0.9	9 E-03	1,000	9 E-06	5.0 E-03
Cs-137	4.8	4.8 E-02	1,000	4.8 E-05	3.6 E-04
Pu-238	4.2 E-04	4.2 E-06	1,000	4.2 E-09	5.5 E-04
Pu-239	1.1 E-04	1.1 E-06	1,000	1.1 E-09	1.6 E-04
Pu-240	8.7 E-05	8.7 E-07	1,000	8.7 E-10	1.2 E-04
Pu-241	5.7 E-03	5.7 E-05	1,000	5.7 E-08	1.7 E-04
Am-241	4.8 E-03	4.8 E-05	1,000	4.8 E-08	7.2 E-03
Am-243	1.6 E-04	1.6 E-06	1,000	1.6 E-09	2.4 E-04
Cm-244	1.4 E-03	1.4 E-05	1,000	1.4 E-08	1.5 E-03
				TOTAL	1.5 E-02

1 Includes only those radionuclides which contribute more than 0.1 percent to the total dose.

2 FRS resin is assumed to contain 1 percent free liquid in the form of water.

3 The partition coefficient is the ratio of the activity concentration in the liquid to that in the air above the liquid.

TABLE K.9.2-3

INHALATION DOSE COMMITMENT TO AN INDIVIDUAL WORKER EFFECTING CLEANUP OF A SPILL OF CEMENT FROM A 71-GALLON DRUM DROPPED BY THE DRUM CELL CRANE

Nuclide[1]	Curies in Cement	μCi Deposited in Lungs[2]	Inhalation DCFs mrem/μCi[3]	Inhalation Dose (mrem)
Sr-90	4.0 E-01	3.8 E-04	2.2 E+03	8.4 E-01
Cs-137	1.0 E+00	9.6 E-04	3.1 E+01	3.0 E-02
Pu-238	1.7 E-02	1.7 E-05	5.2 E+05	8.8 E+00
Pu-239	3.5 E-03	3.4 E-06	5.8 E+05	2.0 E+00
Pu-240	2.6 E-03	2.5 E-06	5.8 E+05	1.4 E+00
Pu-241	2.0 E-01	1.9 E-04	1.2 E+04	2.3 E+00
			Total	1.5 E+01

(1) Includes only those radionuclides which contribute more than 0.1 percent to the total dose.

(2) Fraction of activity in spill deposited in lungs = 9.64 E-10 during eight-hour exposure.

(3) From WVDP-65.

TABLE K.9.2-4

OFF-SITE MAXIMUM INDIVIDUAL DOSE FROM RADIONUCLIDES RELEASED BY SPILL OF CEMENT FROM A 71-GALLON DRUM DROPPED BY THE DRUM CELL CRANE

Nuclide(1)	Curies in Cement	Curies Released to Atmosphere(2)	DCFs mrem/Ci (3)	Dose to the Maximally Exposed Off-Site Individual (mrem)
Sr-90	4.0 E-01	1.1 E-06	5.2 E+02	6.0 E-04
Cs-137	1.0 E+00	2.9 E-06	7.3 E+00	2.1 E-05
Pu-238	1.7 E-02	5.0 E-08	1.2 E+05	6.0 E-03
Pu-239	3.5 E-03	1.0 E-08	1.4 E+05	1.4 E-03
Pu-240	2.6 E-03	7.4 E-09	1.4 E+05	1.0 E-03
Pu-241	2.0 E-01	5.8 E-07	2.8 E+03	1.6 E-03
			Total	1.1 E-02

(1) Includes only those radionuclides which contribute more than 0.1 percent to the total dose.

(2) Fraction of activity in spill that is released to the atmosphere = 2.9 E-06.

(3) From WVDP-65, assuming the maximum χ/Q value for a ground level release is applicable (corresponding to an exposure which occurs over a period of no more than two hours).

k.10.0 CONDUCT OF CLASS B/C WASTE HANDLING AND STORAGE OPERATIONS

k.10.1 ORGANIZATION STRUCTURE

See Section A.10.1 of Volume I

k.10.2 PREOPERATIONAL TESTING AND OPERATION

Preoperational testing of components and the waste handling and storage operations associated with Class B/C waste are addressed in existing WVNS procedures. Equipment and components such as are currently in use at the WVDP necessary to perform these operations do not differ from standard equipment used in routine industrial applications. All procedures concerning waste storage operations are prepared, reviewed and approved per the requirements of the WVNS Policy and Procedures and Quality Assurance Manuals.

k.10.2.1 ADMINISTRATIVE PROCEDURES FOR CONDUCTING THE TEST PROGRAM

All administrative procedures and instructions for conducting test programs and evaluating, documenting and approving the test results are prepared, received and approved per the requirements of the WVNS Policy and Procedures and Quality Assurance Manuals.

k.10.3 TRAINING PROGRAMS - DISPOSAL OPERATION

k.10.3.1 INTRODUCTION

This training program provides a structured learning package which outlines specific objectives to be met by the operator for progression through the ranks of the Disposal Operations Group. The training standard outlines the minimum level of knowledge and job performance requirements which an operator must meet to become a qualified WVNS Disposal Operator.

k.10.3.2 DISPOSAL OPERATOR TRAINING PROGRAM OUTLINE

The Disposal Operations Operator Qualification Standard is divided into the following ten parts:

Part	I	Prerequisites
Part	II	Radiological Considerations
Part	III	Radiological Incidents/Site Emergency
Part	IV	Personnel Protective Clothing
Part	V	Contamination and Containment
Part	VI	Waste Management
Part	VII	Disposal Operations
Part	VIII	Rigging and Handling Equipment
Part	IX	Procedures and Procedural Compliance
Part	X	Miscellaneous Equipment Operation

The trainee is required to demonstrate knowledge and minimum levels of skill in performing tasks under each of the above sections.

The Disposal Operations Manager or his designee must provide all signature verifications unless otherwise specified. Each signature will verify that the "Examiner" is satisfied that the student has displayed adequate knowledge of the subject material. All sign-offs will be completed before final testing and evaluation. All trainee operational checkouts (hands-on performance) must be completed unless this qualification standard has been modified by an Advance Change Notice (ACN) issued by the Training Department.

k.10.4 NORMAL OPERATIONS

All drum cell loading operations will be performed remotely using a computerized crane operated from a dedicated drum cell control room. Cemented drums are delivered in batches of eight to the drum cell load-in area via a shielded truck. Power for the truck loadout mechanism is connected by the driver/operator who then proceeds to the Control Room. The load-in area shield door is opened, the drums are off-loaded from the truck conveyors to the load-in conveyors and to the drum tipping mechanism, which tips an individual drum onto its side to allow the crane to pick up and place the drum in the drum cell.

k.10.4.1 FACILITY PROCEDURES

The following procedures will be used to operate and maintain RTS Drum Cell for up to a 20-year storage period.

SOP 72-02 Operation of the RTS Drum Cell Crane
SOP 72-03 Operation of the RTS Drum Cell Conveyor
SOP 72-04 Operation of Drum Cell CCTV

k.10.4.2 FACILITY RECORDS

Drums entering the RTS Drum Cell will be identified using a bar code scanner and the information sent to the crane computer control system. This identification number is linked to the drum storage location and then made part of the drum cell permanent facility record. These records will be retained as computer printouts, as stored computer magnetic medium (back-up disks) and as part of the drum cell computer system.

REFERENCES FOR SECTION k.10.0

WVNS Policy and Procedures Manual, September, 1986.

WVNS Quality Management Manual, June, 1986.

k.11.0 OPERATIONAL SAFETY REQUIREMENTS

k.11.5 OPERATIONAL SAFETY REQUIREMENTS (OSRs)

k.11.5.1 LOW-LEVEL WASTE CHARACTERISTICS

Applicability: This OSR applies to all Class B/C low-level radioactive waste which will be placed in the RTS Drum Cell.

Objective: To assure that all Class B/C low-level waste to be placed in the RTS Drum Cell meets all appropriate Federal regulations for the waste form and waste characteristics which in turn assures the safety of the general public.

Requirements:

1) All low-level waste placed in the RTS Drum Cell shall meet the requirements for Class B or Class C waste as defined in 10 CFR 61, and DOE Order 5480.2.

2) Low-level waste containers which are used to package Class B/C waste at the WVDP are controlled by WVNS specifications and procedures. The following is a list of the types of containers which may be used to dispose of Class B/C waste:

    1) DOT Specification 17C and 17H steel drums

    2) Rectangular B-25 steel containers

    3) DOT Specification 7A boxes

    4) DOT Specification 7A 71-gallon square steel drums

    5) High Integrity Containers (certified to maintain their integrity for 300 years)

Basis: Acceptable performance of the disposal unit (tumulus) requires that the waste form and characteristics meet specific criteria. This OSR establishes these criteria by reference. Proper waste packaging will ensure waste form stability upon site closure and thereby insure the future safety of the general population against release of radioactivity. Proper waste packaging also protects workers and the general public during waste handling and storage operations.

k.11.5.2 DISPOSAL UNIT CHARACTERISTICS

Applicability: This OSR applies to all tumuli which are created for the purpose of Class B and Class C waste disposal.

Objective: To assure the tumuli will perform as predicted and therefore safeguard the general public.

Requirements:

1) The TWS and shield wall footers of the drum cell shall be proportioned for a contact pressure of six kips* per square foot (ksf). The calculated settlement under the six ksf contact pressure shall be less than one inch for footings which are less than ten feet in the least dimension.

2) The minimum slope of the top clay layer shall not be less than three percent.

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* 1 Kip = 1000 pounds

3) The clay layer of the base pad shall be at least 18 inches in thickness to underlay the gravel drain. The clay shall have a permeability of 1E-07 cm/sec or less.

4) The clay shall have at least 60 percent particles finer than a number 200 sieve and Atterberg limit test results which confirm that the material is classified as CL or CH in accordance with the unified soil classification system.

5) The base pad shall have side slopes of 2:1 (horizontal:vertical) to assure stability until the remainder of the base pad and the overlying tumulus are constructed.

6) Instrumentation shall be installed below the base pad to monitor settlement. Instruments shall be located so that settlements of the center, midpoint and edge of the base pad can be monitored as the waste and cover layers are placed. These instruments are intended to provide information to assist in the development of closure plans. In the event the instruments fail, a more conservative approach can be used in closure design. Therefore the instruments are not replaceable.

7) Moisture detection instrumentation shall be installed in the base pad. Moisture detection instrumentation shall include devices to detect changes in the moisture content of the clay liner and to detect the presence of free water on the surface of the clay layer. The free water detector shall also be capable of extracting a sample. Moisture detection instrumentation shall be installed in a grid pattern spaced to permit detection and location of moisture buildup which might be attributed to seepage through the tumulus cover system. The data from these instruments constitutes a small part of the data set which

will be interpreted and evaluated by the designers. The failure of these instruments will not affect the safety of this evaluation but it may affect the degree of conservatism used by the designers.

Basis - This approach is standard practice for the observational approach used for earth structures.

REFERENCES FOR SECTION k.11.0

Code of Federal Regulations, Title 10, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

U. S. Department of Energy Order DOE-ID 5480.2, "Hazardous and Radioactive Mixed Waste Management."

k.12.0 QUALITY ASSURANCE

Most of the Class B/C waste handling and storage operation is classified as quality level C. This has been done to assure independent verification and documentation of the design, construction, and operations of the Class B/C waste disposal system. The quality assurance program will use existing WVNS manuals and systems which implement NQA-1-1983. The quality assurance program will provide the following controls and checks:

- Organization will be defined in Section A.10.1 of Volume I. This includes a quality assurance organization which is independent from costs and schedule and has sufficient authority to stop work, if necessary. QC inspectors will be trained and qualified as required by NQA-1-1983 and report independent from the performing organization. Disposal Operations training will be as detailed in k.10.3.2.

- Design controls will be in accordance with WVNS approved procedures and will, as a minimum, have designs which are reviewed and approved by safety and quality assurance and then engineering released. Once approved and released, design will be controlled with documented changes and approved in accordance with standard WVNS engineering procedures.

- Construction and testing will be done in accordance with approved designs, specifications and procedures. All significant design features will be verified by either inspection or test or both, as appropriate. Included in this is normal construction testings that will be performed by a testing laboratory of the constructor and qualified as appropriate.

- Handling and emplacement of Class B/C waste meeting the waste form criteria for 10 CFR 61 will be performed as stated in k.10.0. Training and proper performance to written approved procedures will be the primary assurance that the waste forms meet 10 CFR 61, Part 61.56.

Characteriscics as detailed in k.7.7.4 will be verified by independent inspectors through direct inspection and surveillance. The verification will be performed to approved quality inspection plans, which will provide for random sampling based upon waste source and form.

- Sufficient records will be maintained by CSS Operations and RTS Drum Cell Operations such that there is an auditable record of the Class B/C waste verification of what waste forms have been emplaced in the RTS Drum Cell.

- The Class B/C waste disposal operation will be audited at least yearly. Audits will be lead by a qualified lead auditor, as required by NQA-1-1983.

REFERENCES FOR SECTION k.12.0

American National Standards Institute ANSI/ASME NQA-1-1983, Quality Assurance Program Requirements for Nuclear Power Plants.

Code of Federal Regulations, Title 10, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," Section 56, "Waste Characteristics."