27- DEFENSE NATIONAL STOCKPILE MERCURY INVENTORY CONTROL

Title: Defense National Stockpile Mercury Inventory Control **Doc. No.** 2015-MMTS-27

Approval Signatures and Date

Prepared/Reviewed by:		Date: 10/29/15
Approved by:	Burton Packard	Date: 10/29/15
Approved by:		Date:
Approved by:		Date: 10/29/15

	Initial Release		Annual Review/No Revision Required		Annual Review/Update (see history below)

NOTE: This document will be reviewed at least annually to ensure its suitability.

Revision History

Rev. No.	Change description	Author
4	Reformatted. Refer to "MMTS Initial Operations Observations, Communications and Improvements for Implementation Crosswalk- July 10, 2015".	Burton Packard and Renee Rodriguez
3	Change description Crosswalk Between NDEP CAPP Review Comments (dated 2014-12-09, 2015-01-30 and 2015-02-26) and Mercury Storage and Transfer Program Document Contents March 10, 2015	Burton Packard and Renee Rodriguez
2	Pgs 27-2 and 27-5, revised text to explain scale accuracy. Revised Table 27.1 and Attachment 27.2 spreadsheets for Building 110-98 based on updated information acquired the week beginning October 20, 2015. Corrected Example 1 in Attachment 27.1 to make it consistent with the data for Building 110-66 in Revision 1.	
1	Revised Table 27.1 and Attachment 27.2 spreadsheets for Buildings 110-66 and 110-98 based on updated information acquired the week beginning September 21, 2015.	

***NOTE**: Hard copies of this document may not be the current version. Refer to the "IAmTheKey" to verify the current version.*

Reference Documents

Document number	Document title
QP.EMS.HG.0007	Management of Change (Tier 1)

	Spreadsheet containing 14 building pallet layouts and mercury inventory prior to mercury transfer operations – original
	Working spreadsheet to manage inventory transfers
ORNL-TM-2009-003-V1 and V2	Flask Characterization for the DNSC Stockpile, Volumes 1 and 2
Procedure 2015-MMTS-3	Metric Ton Container Transport and Storage
Procedure 2015-MMTS-4	Pallet Transport and Handling
Procedure 2015-MMTS-13	Data Acquisition and Inventory Management (includes specified report generation requirements for the MMTS Process Control and Data Acquisition System)

27.1. PURPOSE AND BACKGROUND

The purpose of this procedure is to provide means to control mercury mass balance on the HWAD site. The current mass balance is based on 76 lb mercury per flask. The metric ton container sits on a scale that is accurate to ± 3 lb; therefore, the accuracy of the mass balance of the entire inventory is improved by implementation of this project. This procedure describes implementation of an inventory control system for the Mercury Transfer Program based on spreadsheets. This spreadsheet-based system (or equivalent) will be used for start-up and testing and will be maintained during the approximately 15-year duration of the Mercury Transfer Program. The spreadsheet system details the mass of mercury within the 14 mercury storage buildings and the MMTS at the end of each workday. The spreadsheet system is used to track and record inftrasite changes, i.e., movement of mercury inventory among buildings. Building 110-66 is the operations building used to accumulate loaded metric ton containers for transfer to the other long-term storage buildings. Along with Building 110-66, six long-term storage buildings are required for the entire inventory. The MMTS data acquisition and database management system will also be used for validating the mercury mass balance and supporting record and report generation.

27.2. SCOPE

This procedure describes the responsibilities of the Facility Manager (or designee when the Facility Manager is not present) to maintain an up to date (daily), accurate record of the mercury mass balance and the methods to be used to accomplish that end. Detailed layouts showing the current mercury inventory in the 14 mercury storage buildings, future layouts in metric ton containers in six identical buildings and in-process layouts for use in Building 110-66 as the operations center are provided in this procedure. A CD accompanies this procedure and it contains the baseline inventory spreadsheet (Spreadsheet 1).

27.3. BASIS AND SOFTWARE

The operation is based on transferring 29 flasks (~2.5 L mercury per flask) into each metric ton container; close to 2,205 lb mercury is expected to be transferred into each MT container.

The processing basis is defined to be 30 MT containers based on the pallet to drum to flask to MT container ratios. Each pallet holds five (5) drums and each drum contains six (6) flasks for a total of 30 flasks on a pallet. Each MT container holds the mercury from 29 flasks. Hence, the mercury contained on 29 pallets will fill 30 MT containers with no residual flasks.

Three (3) spreadsheets (or a combination of spreadsheets and worksheets) will be maintained to document and demonstrate control of the mercury mass balance. These are Spreadsheet 1 – Original Warehouse Inventory, Spreadsheet 2 – Modified Warehouse Inventory and Spreadsheet 3 – Current MMTS and Building 110-66 Inventory.

A separate working spreadsheet is required for use to include 110-66 and MMTS (Spreadsheet 3). This spreadsheet accounts for daily moves of pallets into MMTS and those retained in MMTS as full flasks either in drums or hoods, as well as end of day balance in the MT container and/or even retaining a loaded metric ton container overnight. The procedures are designed to keep these transfers and associated accountability simple with all drums emptied and end of day based on completion of a filled metric ton container moved out. Operations can be kept flexible by allowance of limited closed containers left in the MMTS overnight and this spreadsheet will account for each pound of mercury (flask or partially filled metric ton container) present.

After each processing basis of 30 metric ton (MT) containers (29 pallets), the Facility Manager (or designee when the Facility Manager is not present) uses Spreadsheet 2 to prepare a report and submits it to the SOC Mercury Storage Program CAPP manager for use in updating the Mercury Storage Program CAPP records. It is noted herein that no filled metric ton containers will be moved outside Building 110-66 until the entire mercury contents in Building 110-66 have been transferred into metric ton containers and placed for long-term storage.

Four metric ton container serial numbers can fit into a catch pan space in Spreadsheet 2. The operator will input the alpha numeric logic/tags to locate metric ton containers within the building and shall tie the serial numbers to each box.

27.4. MASS BALANCE DETAILS

The mass balance for flasks is based on 76 lb/flask. The mercury is stored as a commodity with government mandates never to sell it or transfer it off the site. The 76 lb/flask is the inventory control basis used to define the book value of the elemental mercury inventory stored (see Section 27.8, Attachment 27.1, Example 1).

The configuration of the mercury stockpile prior to starting mercury transfer operations is shown in Table 27.1. Note that Table 27.1 provides information about flask types that occur in each

building. Flask types are described in the reference document entitled *Flask Characterization for the DNSC Stockpile, Volumes 1 and 2 (ORNL-TM-2009-003-V1 and V2).*

Table 0.1 Initial configuration of the mercury stockpile at HWAD

HWAD Mercury Storage	PALLETS	DRUMS	FLASKS	NET WT (pounds)	NET WT (metric tons)
BUILDING #110-52 / ALL TYPE 5	316	1,580	9,462	719,112	326.2
BUILDING #110-66 / ALL TYPE 5	203	1,015	6,090	462,840	214.1
BUILDING #110-77 / ALL TYPE 5	316	1,580	9,480	720,480	326.8
BUILDING #110-78 / MIXED TYPES 5,6,7,8,14	316	1,580	9,480	720,480	326.8
BUILDING #110-87 / TYPE MIXED	316	1,580	9,475	720,100	326.6
BUILDING #110-88 / TYPE MIXED	316	1,580	9,480	720,480	326.8
BUILDING #110-89 / ALL TYPE MIXED	316	1,580	9,348	710,448	322.3
BUILDING #110-92 / TYPES UNK,1,2,6,16	316	1,580	9,480	720,480	326.8
BUILDING #110-93 / TYPES 6 & 15	316	1,580	9,474	720,024	326.6
BUILDING #110-94 / TYPES MIXED & 13	316	1,573	9,430	716,680	325.1
BUILDING #110-95 / ALL TYPE 13	316	1,580	9,480	720,480	326.8
BUILDING #110-96 / TYPES 13 & 5	303	1,515	9,090	690,840	313.4
BUILDING #110-97 / All TYPE 3	316	1,580	9,478	720,328	326.7
BUILDING #110-98 / TYPES 3,4,5,6,7,8,14,31,UNK,ORNL	316	1,576	9,452	718,352	325.8
TOTALS	**4,298**	**21,479**	**128,699**	**9,781,124**	**4,436.6**

Figures showing the spreadsheet-style layouts of each building are given in Section 27.8, Attachment 27.2. The spreadsheets (worksheets) for each building are attached as files on a CD that accompanies this procedure. The building-specific spreadsheet (worksheet) (Spreadsheet 2) will be used (expanded) to include cells with entries for metric ton containers. The pallet number will be replaced with container serial number, and each catch pan is used to store 4 containers. The change to the storage configuration records and the mass per building will be updated monthly.

The mass balance will be improved as the mercury transfer program progresses because the flask basis is an estimate based on industry standards and practice, and the mass of mercury in a metric ton container (29 flasks/MT container) is a measured value specified to be ± 3 lb. The equivalent 214 MT containers will be stored in Building 110-66.

To make room for additional metric ton container storage in the second building to be processed a five-truck transport of 70 pallets will be made (see Section 27.8, Attachment 27.1, Example 2). Each shipment is assumed to be 14 pallets. A sufficient number of catch pans will be returned to the building of origin from Building 110-66 to allow for placement of a filled MT container on a catch pan at that same location. Note that 30 MT containers (generated from 29 pallets) will fit on 8 drip pans; the remaining 21 drip pans (from the 29 pallets) may be reused elsewhere or recycled. The building inventory reported to SOC for the Mercury Storage Program CAPP will be based on a report generated every 30 MT container shipment period. The filled MT containers are stored temporarily in Building 110-66 and transferred to Building 110-XX for long-term storage.

27.5. RESPONSIBILITIES

The following personnel are required to read this procedure and be trained accordingly to maintain the accounting and generate records for the mercury inventory:

- Facility Manager and designee who record mass balance information in spreadsheets (or a combination of spreadsheets and worksheets)
- MMTS workers who perform tasks that result in reportable quantities for the mercury mass balance.

27.6. OPERATIONS

The mercury transfer operation is based on transferring 29 flasks (~2.5 L mercury per flask) into each metric ton container; close to 2,205 lb mercury is expected in each MT container.

As a space opens up because the pallet occupying the space has been removed, the serial numbers of four (4) metric ton containers will fit into a catch pan space (Spreadsheet 2). The Facility Manager (or his designee when the Facility Manager is not present) will input the alpha numeric logic/tags to locate metric ton containers within the building and shall tie the serial numbers to each box.

A separate working spreadsheet (Spreadsheet 3) is required for use to integrate 110-66 and MMTS operations. This spreadsheet accounts for daily moves of pallets into MMTS and mercury retained in MMTS as full flasks either in drums or hoods, as well as end of day balance in the MT container and/or even retaining a loaded metric ton container overnight. The procedures are designed to keep these transfers and associated accountability simple with all drums emptied and end of day based on completion of a filled metric ton container moved out. Operations can be kept flexible by allowance of limited closed containers left in the MMTS overnight and this spreadsheet (Spreadsheet 3) will account for each pound of mercury (flask or partially filled metric ton container) present.

The Building 110-66 configuration for startup includes space allocation for 207 mercury pallets, 42 pallets of empty flask waste drums, palletized industrial waste (stored in North-end diked

area), empty drums and drip pans, metal strapping and wood waste containers (located in South-end diked area), new empty metric container staging, and filled metric ton container staging (see Section 27.8, Attachment 27.3, Building 110-66).

The inventory of mercury in metric ton containers is based on measured amounts and it is useful procedurally for the Facility Manager to spot check the difference in weight between 2,205 lb. and the measured weight for each container. The Facility Manager (or his designee when the Facility Manager is not present) will include in Spreadsheet 3 a calculation of the difference in weight of each metric ton container and the total weight difference every 29 pallets, the frequency for reporting to SOC the overall mass balance in each building. The mercury storage building inventory will be based on a report generated every 30 MT shipment period (report based on Spreadsheet 2).

The basis for using the 30-MT shipment period as the incremental reporting period follows. If the processing rate is 1.5 containers per day and 29 pallets generates 30 metric ton containers, then 20 days of operation is the operational basis for generating a revised mass balance report for SOC. 20 days divided by 4 days per week = 5 calendar weeks. Maintaining operations with some material remaining for processing, and adding 70 pallets to Building 110-66 from time to time, is required. Lay-outs are included in this procedure to verify space availability exists (see Attachments 27.3). These lay-outs include provisions for container retrieval utilizing the specific model forklift procured for this service (see Section 27.8, Attachment 27.6). In some locations a limited number of containers must be moved to access a specific container. The space is available for this operation, which could be performed quickly.

Each metric ton move requires Spreadsheet 2 and 3 to be updated. Each truck move of pallets and metric ton containers also requires updates to Spreadsheet 2 and 3. There will need to be two people on staff expert in the use of these spreadsheets.

It will take 13-14 months to generate 214 MT containers in Building 110-66, i.e., to process the existing pallets in that building. Therefore, there is a significant time after the start of mercury processing prior to staging metric ton containers for moving from Building 110-66 to Building 110-XX.

Starting to load other buildings is based on storing 237 MT containers; 214 produced from pallets of mercury in Building 110-66 and 23 others added to allow for an even distribution in the other six (6) long-term storage buildings. Storing 237 MT containers will take an additional period beyond the 13-14 months required to generate the original 214 MT containers. The total period could be extended if more space were to be used in Building 110-66 for permanent storage, but flexibility is provided to keep that building largely open by using a total of seven (7) buildings for storage of the 4,437 MT inventory over the course of the MMTS operations. There is a need to process some containers from a second building to make space for storing the metric ton containers in that second building. That phase is a long way off and procedures are made flexible now to allow it to happen without being unduly constrained.

The suggested sequence of building usage and quantity stored is shown in Table 27.2. This grouping of mercury storage buildings was chosen to keep the long-term mercury storage buildings near each other. Aside from starting in Building 110-66, the precise sequence for filling the long-term storage buildings is at the discretion of the Facility Manager. A suggested building processing sequence is given in Attachment 27.4.

NOTE: The eight pallets ORNL used to do drum and flask integrity research are currently in Building 110-98. At some point, these eight pallets can be staged in Building 110-66. In order to preserve the ability to assess changes in flask integrity, the mercury from these eight pallets should be transferred at the very end of operations.

The suggested lay-out of MT containers on drip pans for each of the seven (7) long-term storage buildings is shown in Section 27.8, Attachment 27.3. Note that Building 110-66 retains about one-third the number of MT containers stored in each of the other six (6) long-term storage buildings (237 versus 700).

Table 0.2 Sequence of buildings used for long-term storage and inventories

Order	Lay-out* and sequence of fill	Number of MT containers	Number of catch pans loaded with MT containers
1	110-66	237	60
2	110-52	700	175
3	110-77	700	175
4	110-78	700	175
5	110-87	700	175
6	110-88	700	175
7	110-89	700	175

27.7. RECORDS

- Spreadsheet 2
- Spreadsheet 3

Section 27.8, Attachment 27.5 provides a current description of the planned records generation capability of the MMTS Process Control and Data Acquisition System. This capacity and functionality will improve with operations experience.

27.8. ATTACHMENTS

Mass balance example calculations (Attachment 27.1)

Current lay-outs/mass balance spreadsheets for mercury storage in flasks in drums – Spreadsheet 1 (Attachment 27.2)

Building 110-66 layout including filled metric ton containers and Layout of remaining six identical mercury storage buildings (Attachment 27.3)

Suggested processing sequence for reflasking mercury (Attachment 27.4)

Reports generation by for the MMTS Process Control and Data Acquisition System (Attachment 27.5)

Toyota forklift model 8FGU20 (Attachment 27.6)

ATTACHMENT 27.1 Mass Balance Example Calculations

- Example 1 – Processing the contents of Building 110-66

Two hundred-three (203) pallets of drums are currently stored in Building 110-66 and will be processed initially. This operation will take over one (1) year. The 203 pallets expressed in pounds of mercury are

$$203\ pallets * 5\frac{drums}{pallet} * 6\frac{flasks}{drum} * 76\frac{lb\ mercury}{flask} = 462{,}840\ lb\ mercury$$

This mass of mercury expressed in metric ton containers is

$$462{,}840\ lb\ mercury * \frac{1\ MT\ container}{2{,}205\ lb\ mercury} \sim 209\ MT\ containers$$

- Example 2 – Processing 70 pallets from 110-XX

Seventy (70) pallets are brought to Building 110-66 from Building 110-XX on a basis of 14 pallets per truck. The 70 pallets expressed in pounds of mercury are

$$70\ pallets * 5\frac{drums}{pallet} * 6\frac{flasks}{drum} * 76\frac{lb\ mercury}{flask} = 159{,}600\ lb\ mercury$$

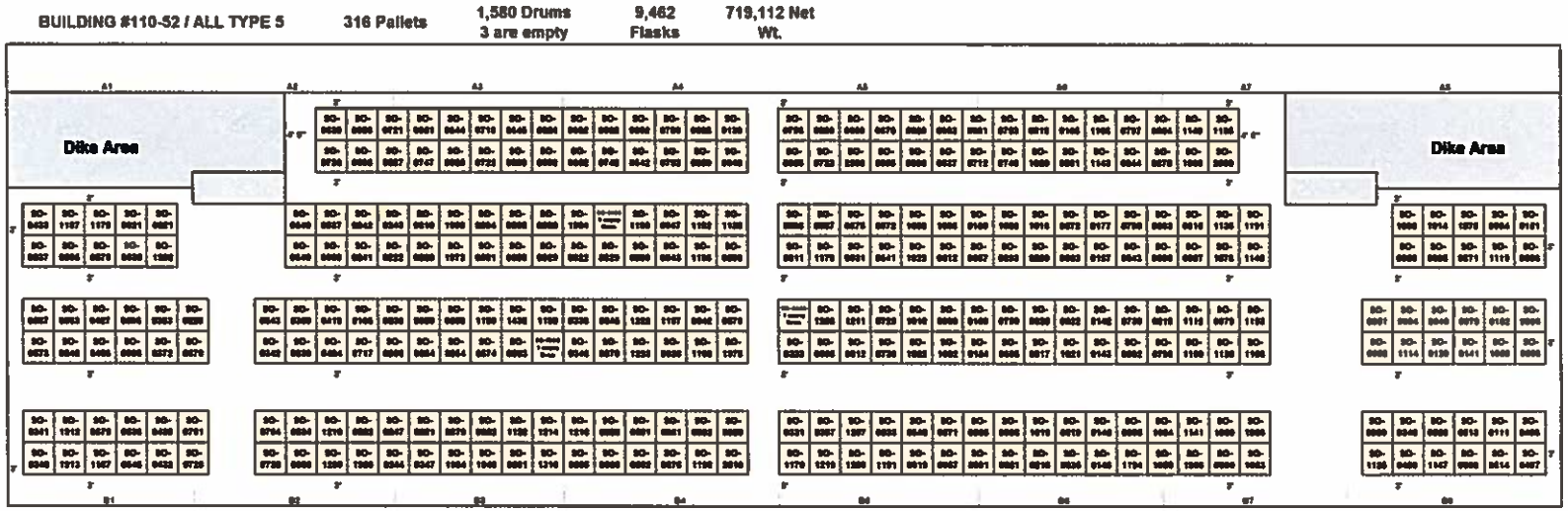
This mass of mercury expressed in metric ton containers is

$$159{,}600\ lb\ mercury * \frac{1\ MT\ container}{2205\ lb\ mercury} \sim 73\ MT\ containers$$

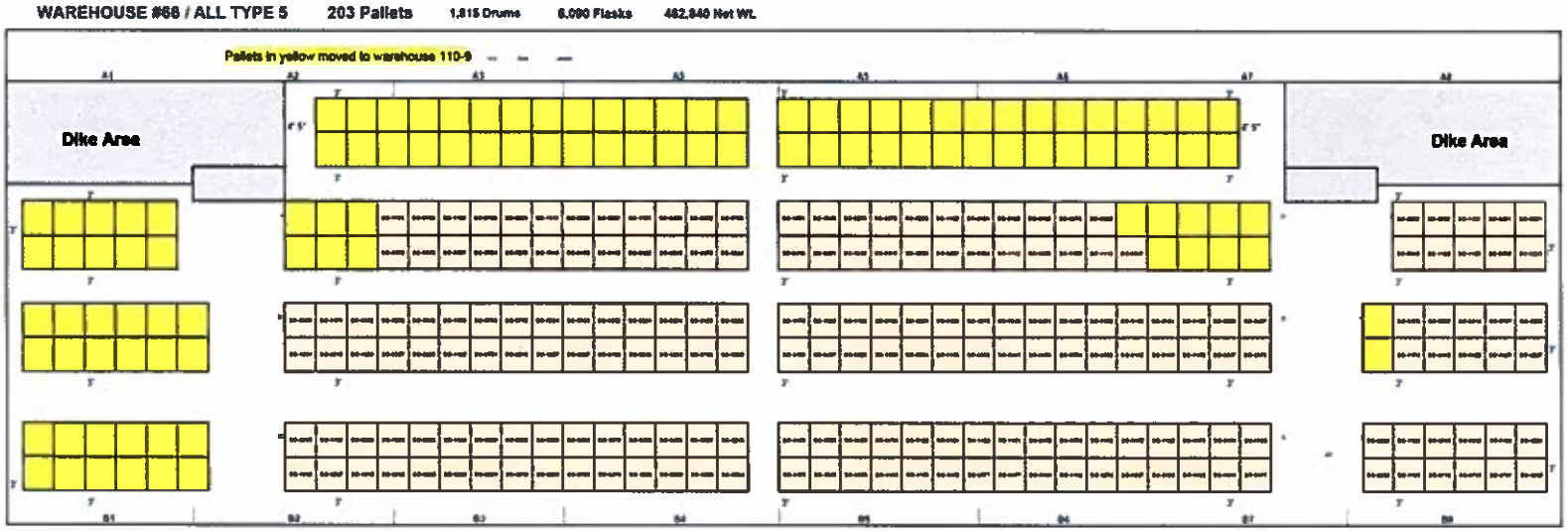
ATTACHMENT 27.2 Current lay-out/mass balance spreadsheet images for mercury storage in flasks in drums

The CD contains complete lay-out/mass balance spreadsheets for all 14 mercury storage buildings.

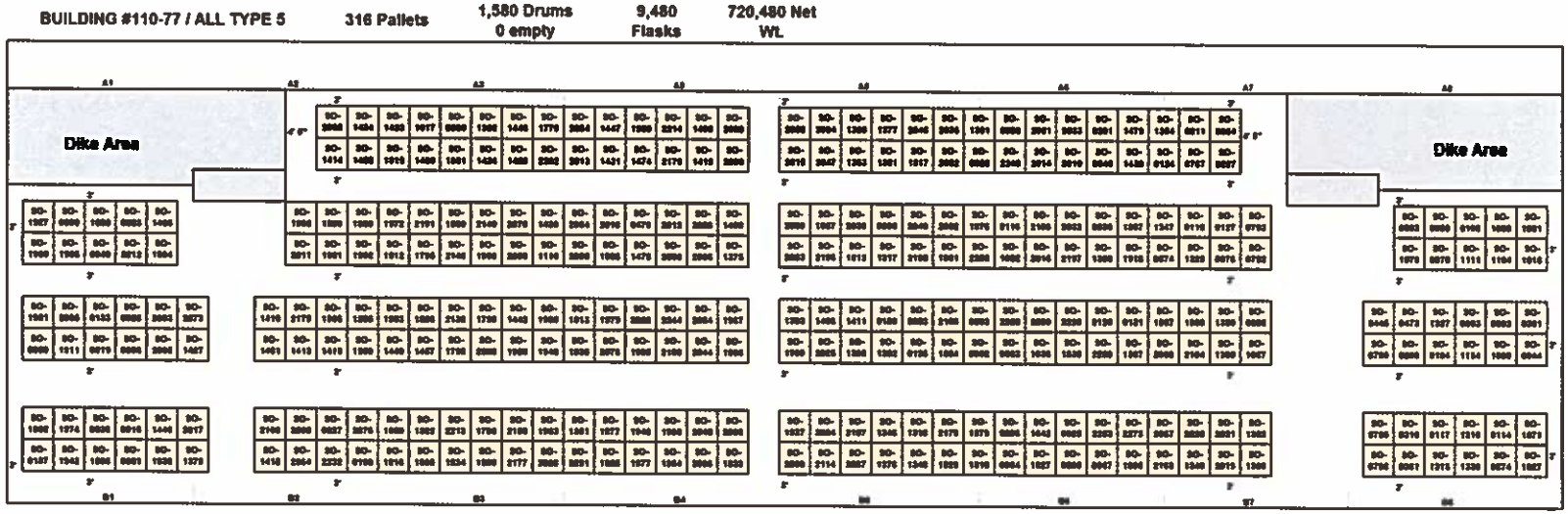
BUILDING #110-52



WAREHOUSE #110-66

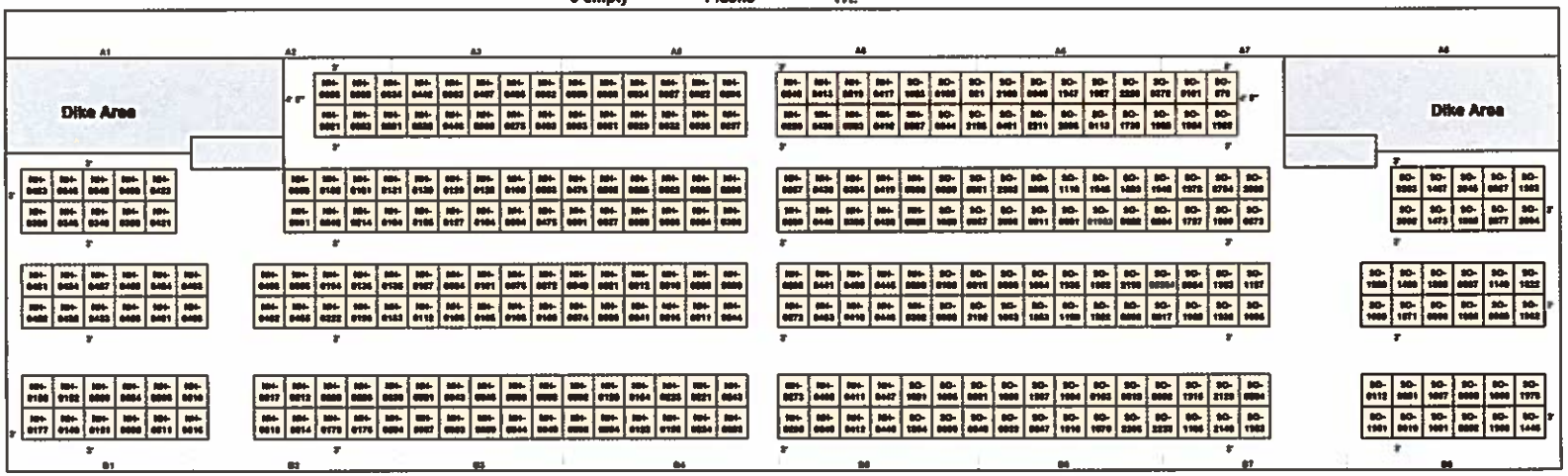


BUILDING #110-77

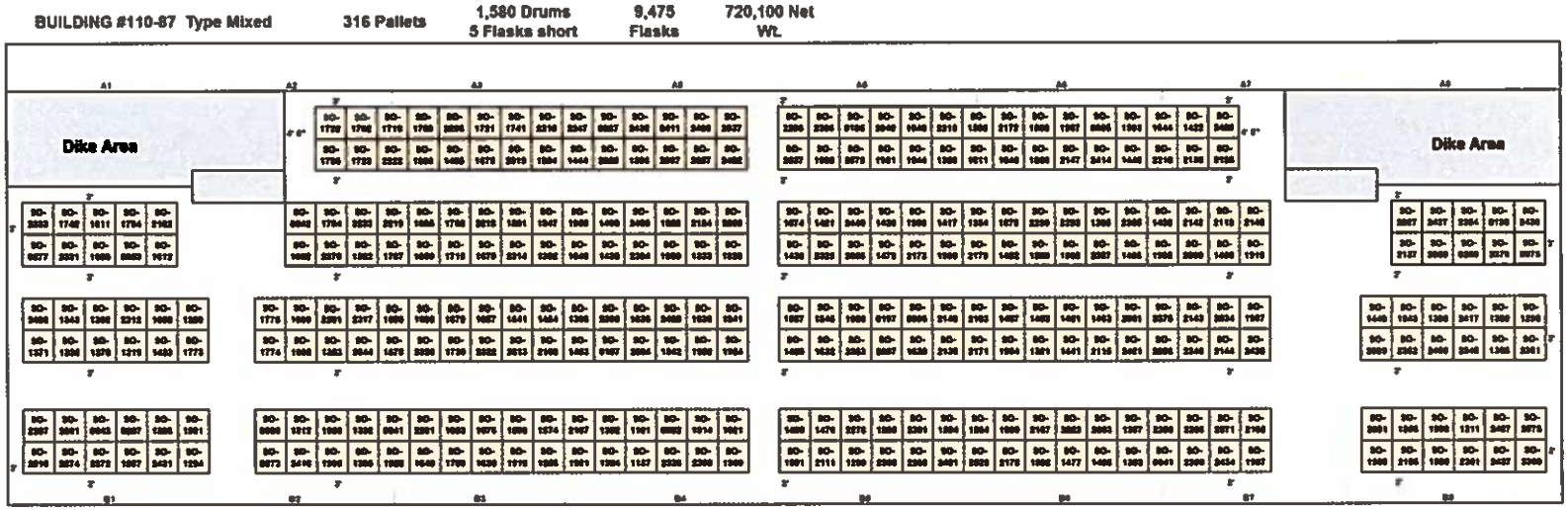


BUILDING #110-78

BUILDING #110-78 / MIXED TYPES 5,6,7,8,14 316 Pallets 1,580 Drums 0 empty 9,480 Flasks 720,480 Net Wt.



BUILDING #110-87



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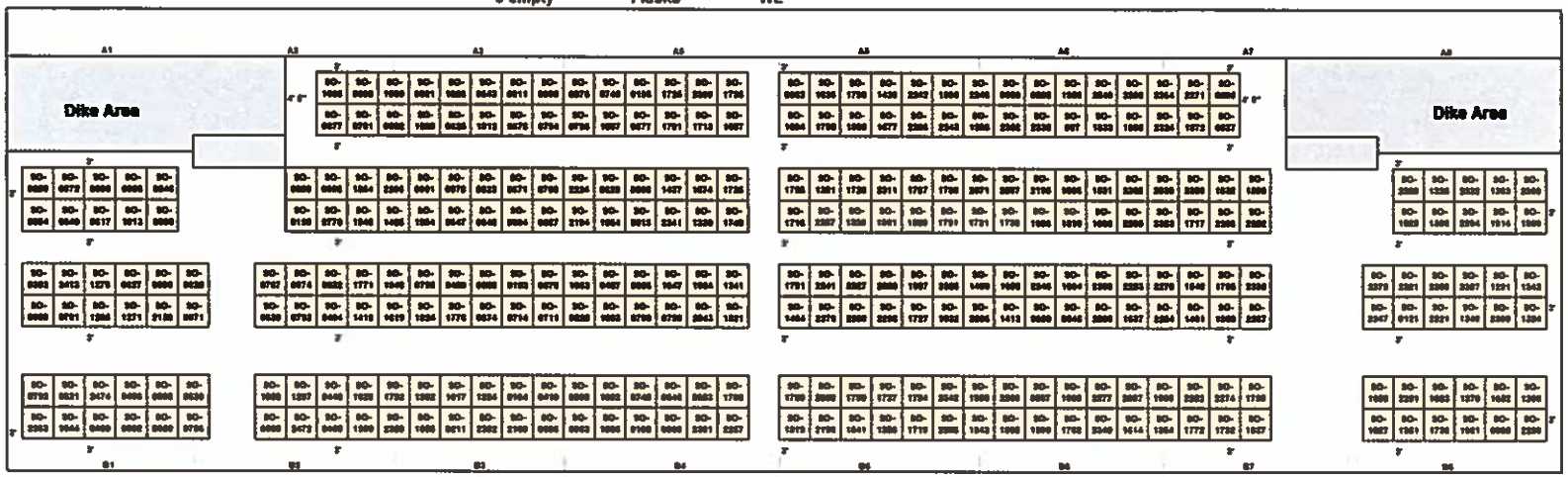
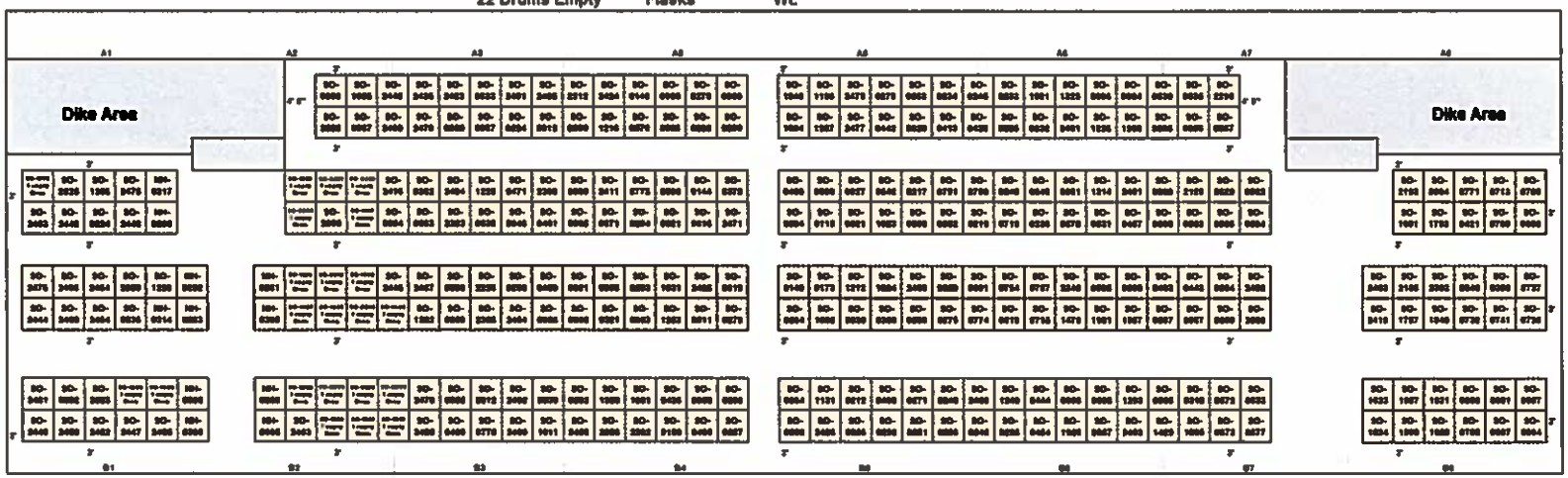
BUILDING #110-88

BUILDING #110-88 TYPE MIXED | 316 Pallets | 1,580 Drums 0 empty | 9,480 Flasks | 720,480 Net Wt.

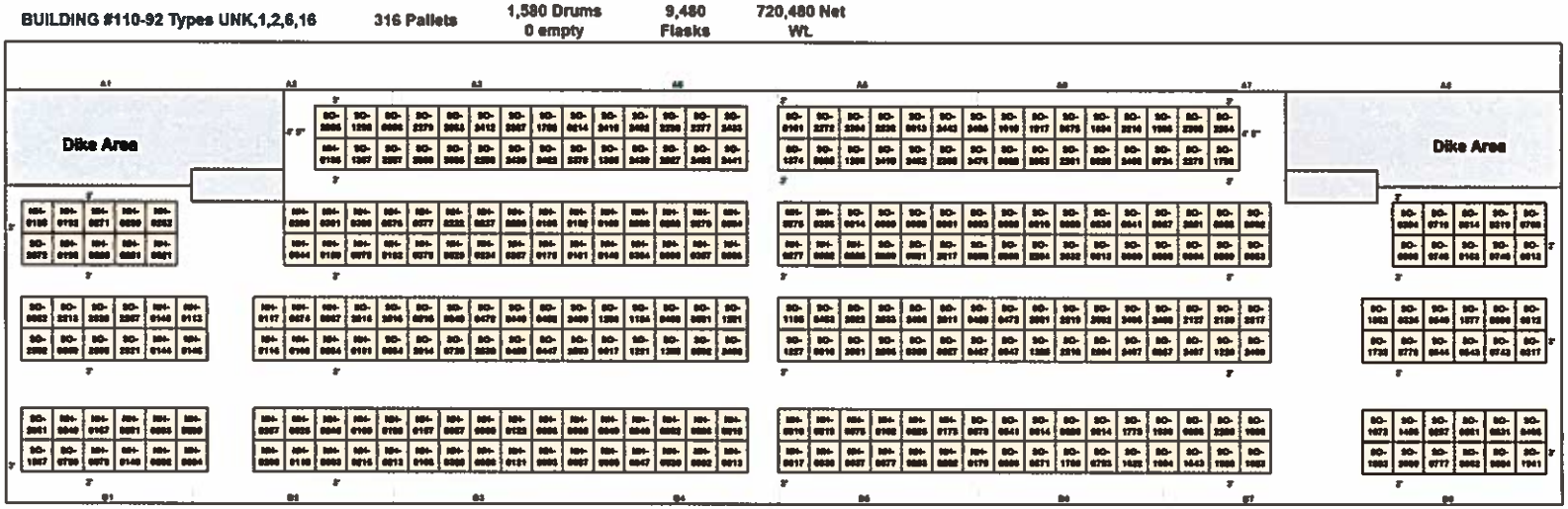


BUILDING #110-89

BUILDING #110-89 ALL TYPE MIXED | 316 Pallets | 1,580 Drums, 22 Drums Empty | 9,348 Flasks | 710,448 Net Wt.

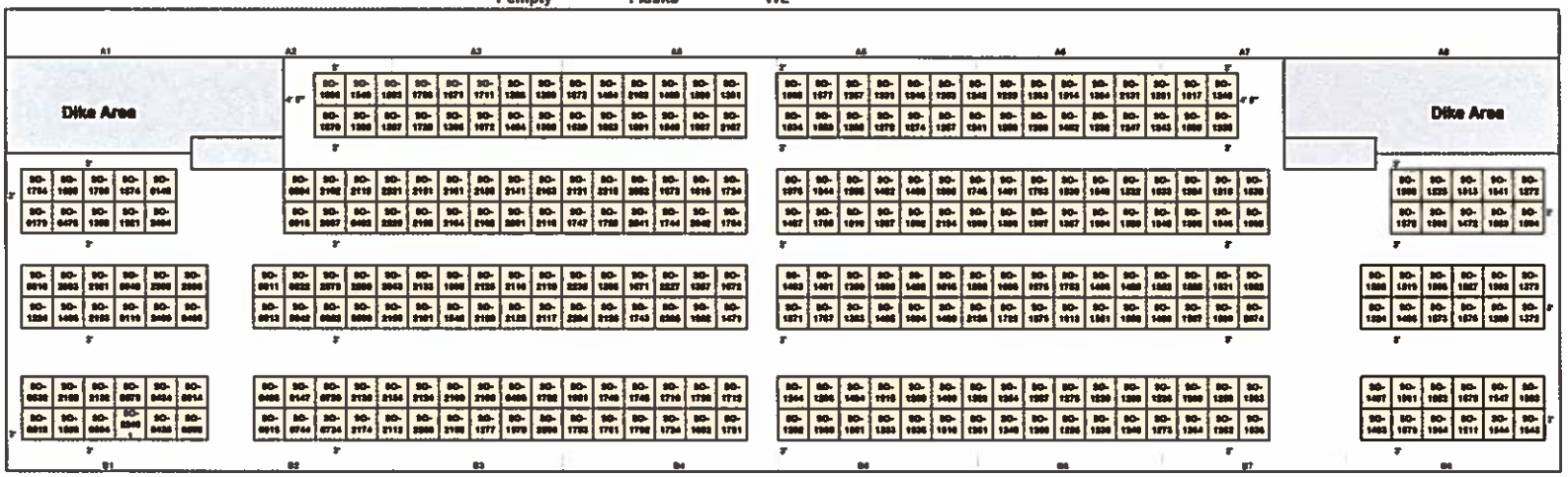


BUILDING #110-92



BUILDING #110-93

BUILDING #110-93 TYPES 6 & 15 | 316 Pallets | 1,580 Drums 1 empty | 9,474 Flasks | 720,024 lbs Net Wt.



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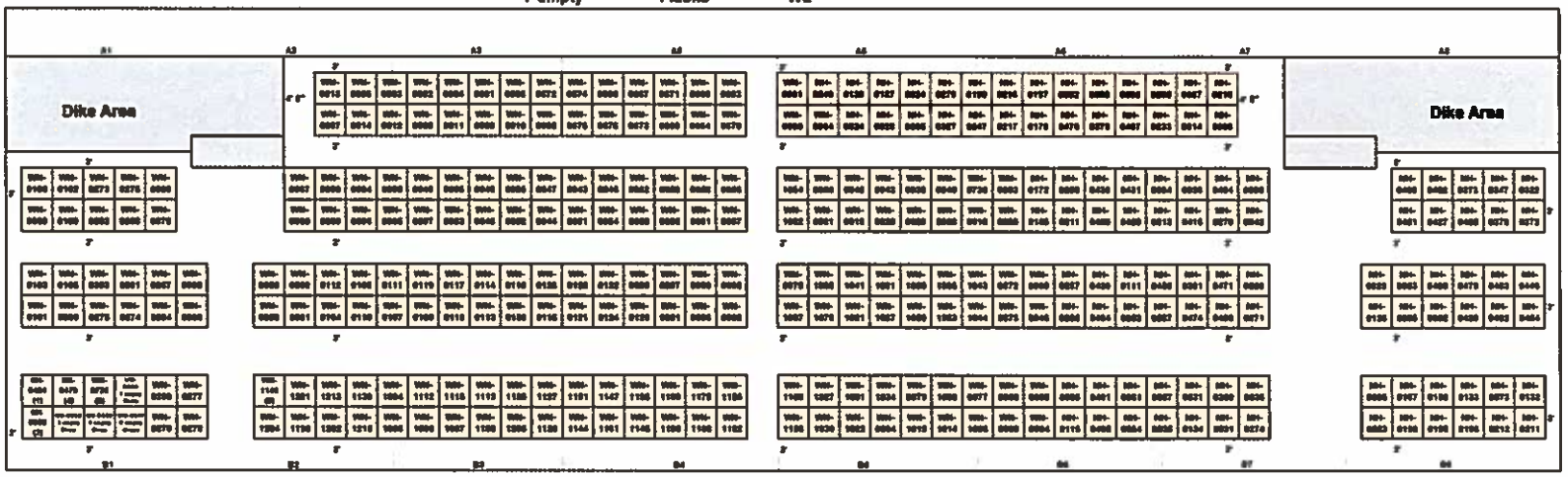
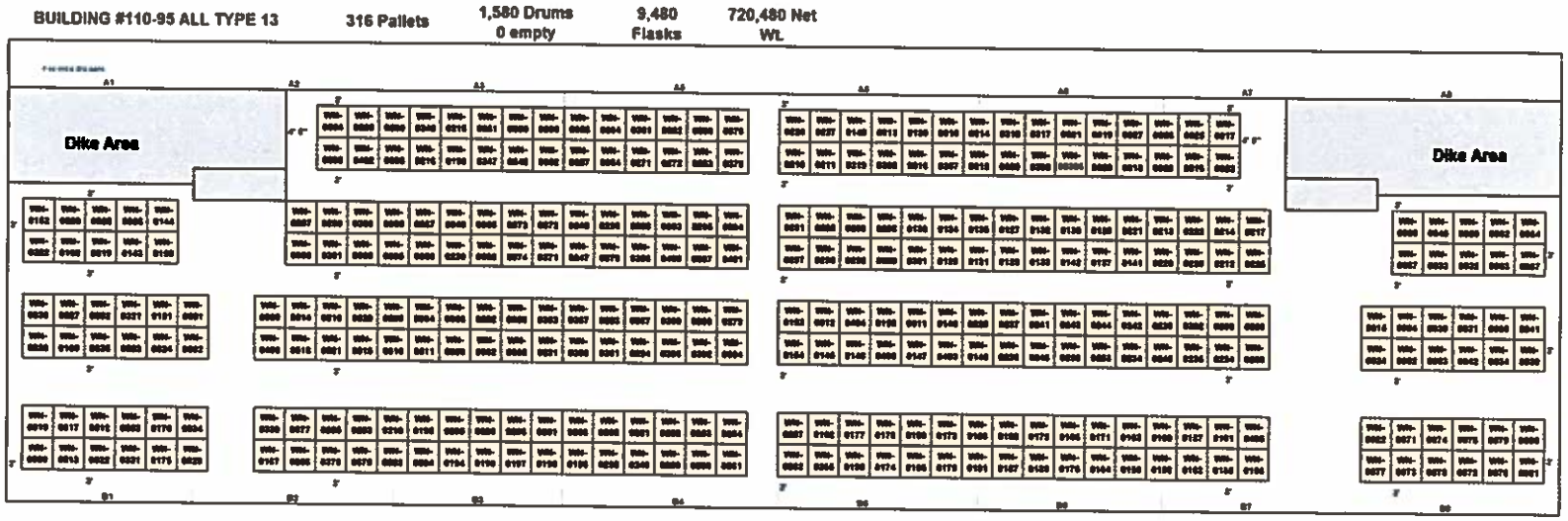
BUILDING #110-94

BUILDING #110-94 TYPES MIXED & 13 | 316 Pallets | 1,573 Drums 7 empty | 9,430 Flasks | 716,680 Net Wt.



(1) Pallet M1-004 drum M1-02883 contains 3 flask only.
(2) Pallet M1-008 drums 139-146 contain type 6 flask. Drum 137 contains type Unknown flask. Drum 134 contains type Mixed flask.
(4) Drum M1-06393 contains flask type Unknown. Remainder of pallet M1-079 contains flask type MIXED.
(5) Drum#3027 only 1 flask also 3 empty drums on pit.

BUILDING #110-95



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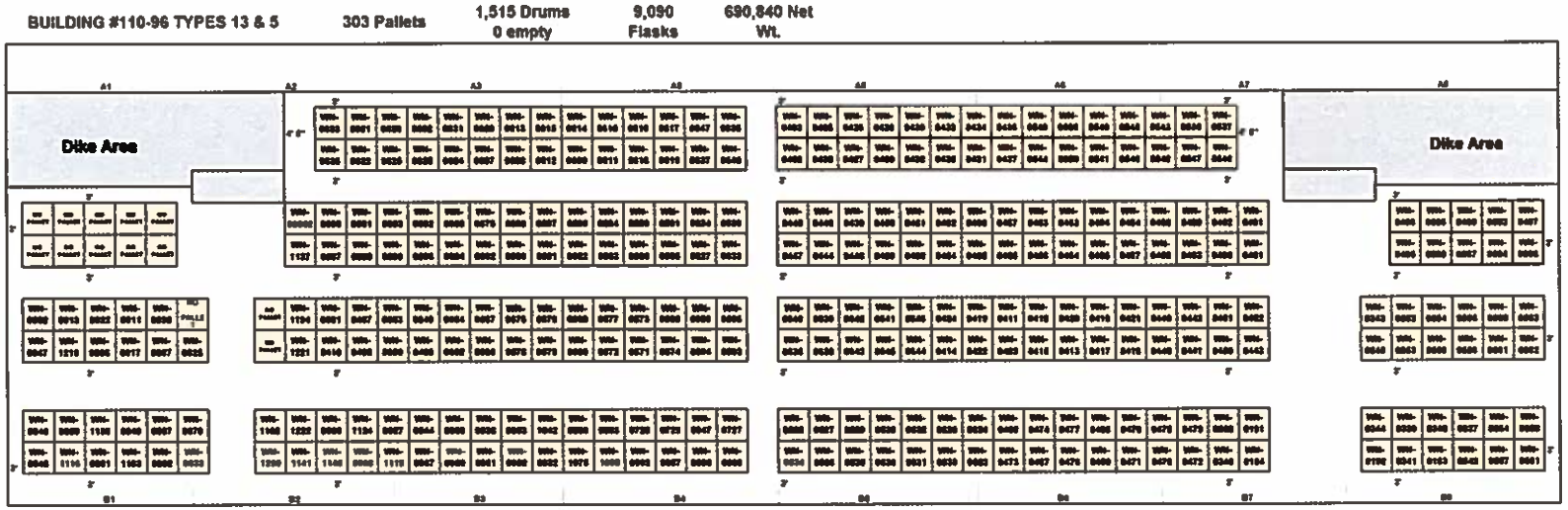
BUILDING #110-96



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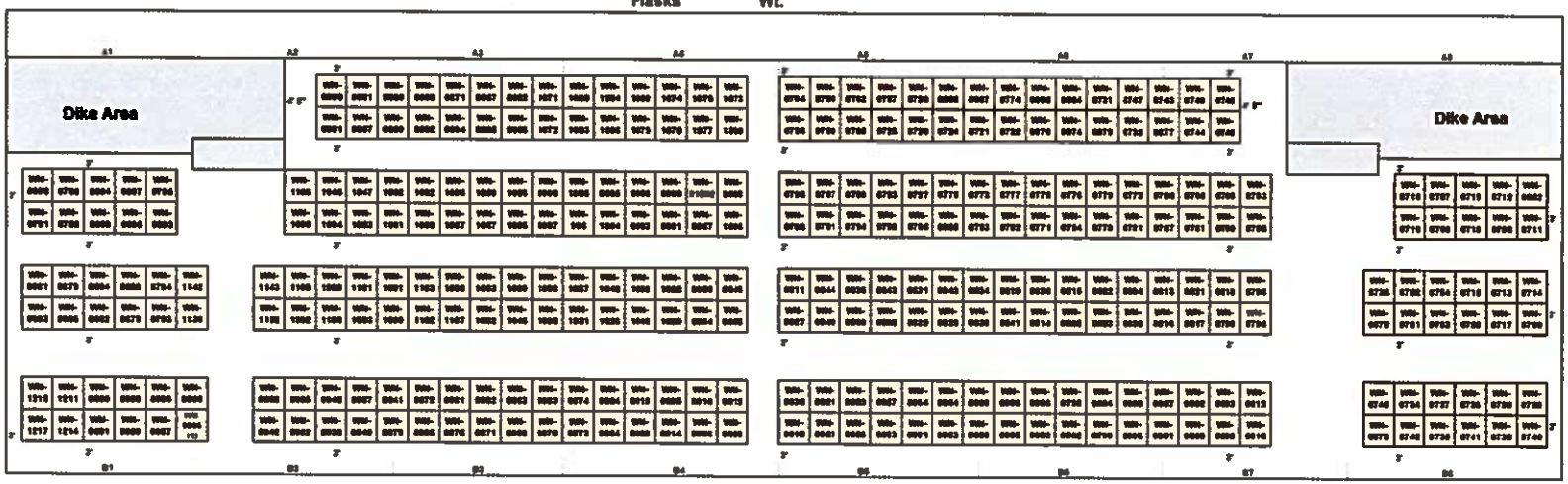
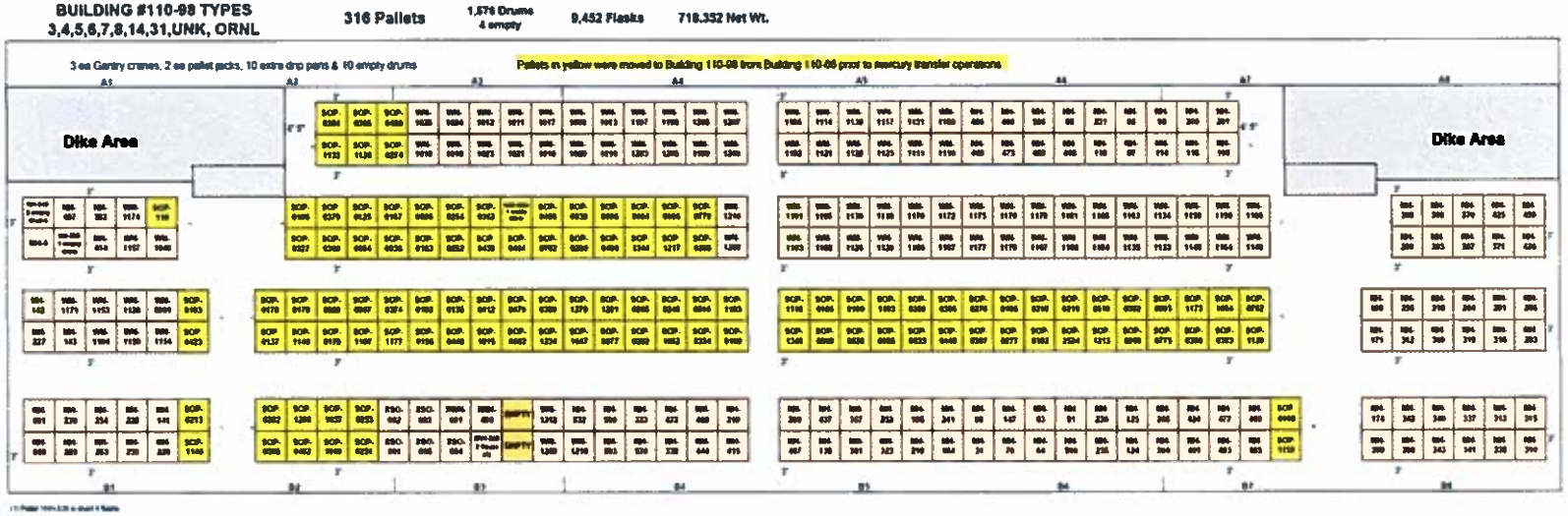
BUILDING #110-97

BUILDING #110-97 All TYPE 3 | 316 Pallets | 1,580 Drums | 9,478 Flasks | 720,328 Net Wt.

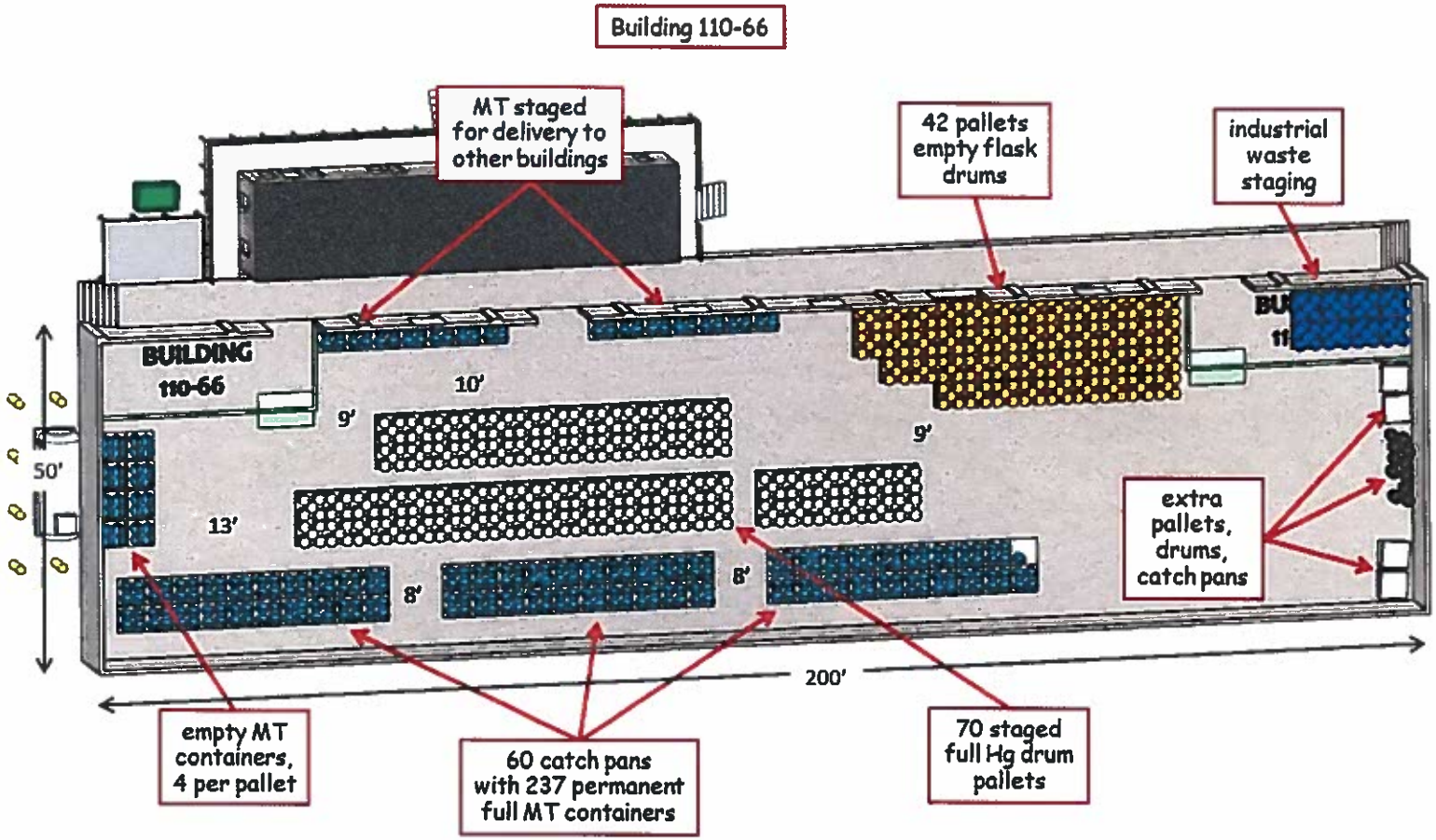


(1) Pallet WN-0696 Drum 3476 has 2 flasks

WAREHOUSE #110-98



ATTACHMENT 27.3 Building 110-66 layout including filled metric ton containers



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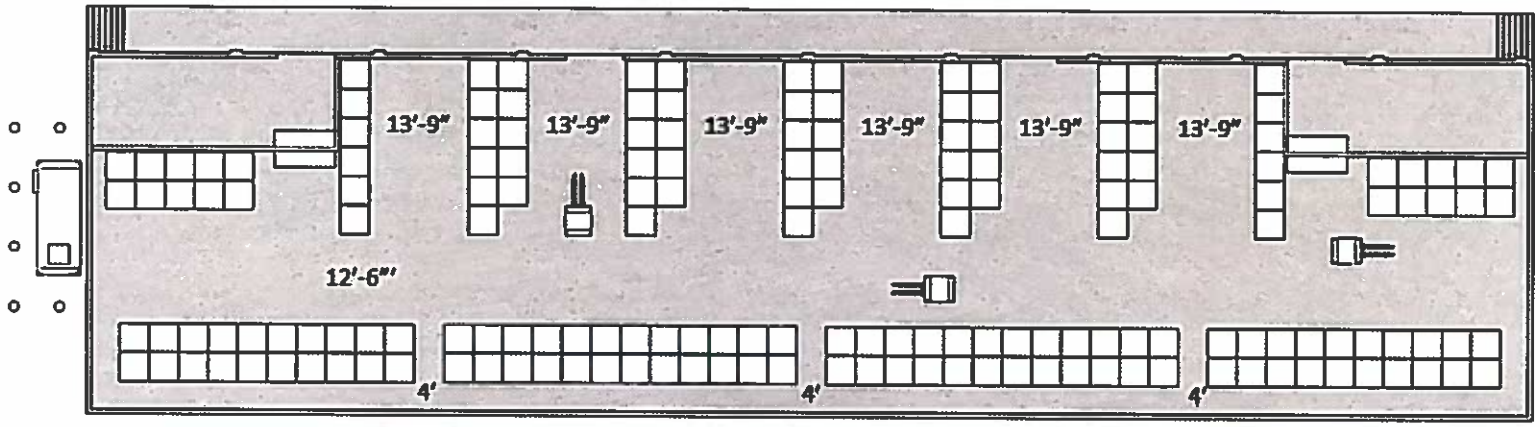
Layout of remaining six identical mercury storage buildings

6 Buildings
110-52
110-77
110-78
110-87
110-88
110-89

175 reused catch pans
4 MT containers per catch pan
700 MT containers per building
4200 MT containers



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ATTACHMENT 27.4 Suggested processing sequence for reflasking mercury.

MODEL FOR WAREHOUSE PROCESSING SEQUENCE

Sequence	Building	Rationale
1	110-66	Makes room for processing and eliminates greatest risks first – all T-5 flasks[1]
2	110-52	All T-5 flasks – eliminates greatest risks first
3	110-77	
4	110-78	Substantial number of pallets made up solely of T-5 flasks – eliminates
5	110-96	greatest risks first
6	110-97	All T-3 flasks[2] – eliminates high risks
7	110-98	Eliminates remaining pallets made up solely of T-3 and T-5 flasks – set aside the two ORNL pallets until the end of the repackaging campaign
8	110-87	Records show no pallets made up solely of T-3 or T-5 flasks. In the absence
9	110-88	of an overarching rationale for reflasking the contents of these in a specific
10	110-89	order, numerical sequence is suggested.
11	110-92	
12	110-94	
13	110-93	All T-6 and T-15 flasks[3] – suitable for long-term storage
14	110-95	All T-13[4] – suitable for very long-term storage

[1]Based on studies conducted by ORNL, T-5 flasks (> 44% of the stockpile) constitute the greatest qualitative risk of failure.

[2]T-3 flasks (> 16% of stockpile) follow closely behind T-5 flasks in qualitative risk of failure.

[3]T-6 flasks (> 4% of stockpile) and T-15 flasks (>4% of stockpile) are high quality seamless flasks – low qualitative risk of failure

[4]T-13 flasks (> 15% of stockpile) are very high quality seamless flasks – very low qualitative risk of failure

U.S. DEPARTMENT OF ENERGY

Mercury Stockpile Stewardship Program - Phase 3
Implementation of Long-Term Inspection
Sponsor: DLA Strategic Materials
Oak Ridge National Laboratory - UT-Battelle, LLC
DOE Proposal Number 1872-T394-07

7-14-2014

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

ATTACHMENT 27.5 Reports generation by the MMTS Process Control and Data Acquisition System

REPORTING REQUIREMENTS

The PCDAS (Process Control and Data Acquisition System) shall be capable of generating production reports. This system shall be optimized during the first few months of operation, with additional standard reports implemented. The inventory control reports are managed using spreadsheets; the following summary and detailed reports are for back-up and trending. The standard report contents using the PCDAS system will be finalized in conjunction with operating experience.

Weekly/monthly summary reports

- Reporting period—define the interval.
- Amount of mercury transferred from 3-L containers to 1-MT containers during the reporting period.
- Number of 1-MT containers filled during the reporting period.
- Warehouse(s) receiving 1-MT containers and the number of 1-MT containers received during the reporting period.
- Warehouse(s) contributing 3-L containers, drums and pallets, and the number of each removed during the reporting period—make a note of any departures from six flasks per drum and five drums per pallet.
- Maximum and minimum environmental parameters measured during the reporting period with the date and time of each measurement (time stamps).
- Maximum and minimum mercury concentrations measured during the reporting period with time stamps

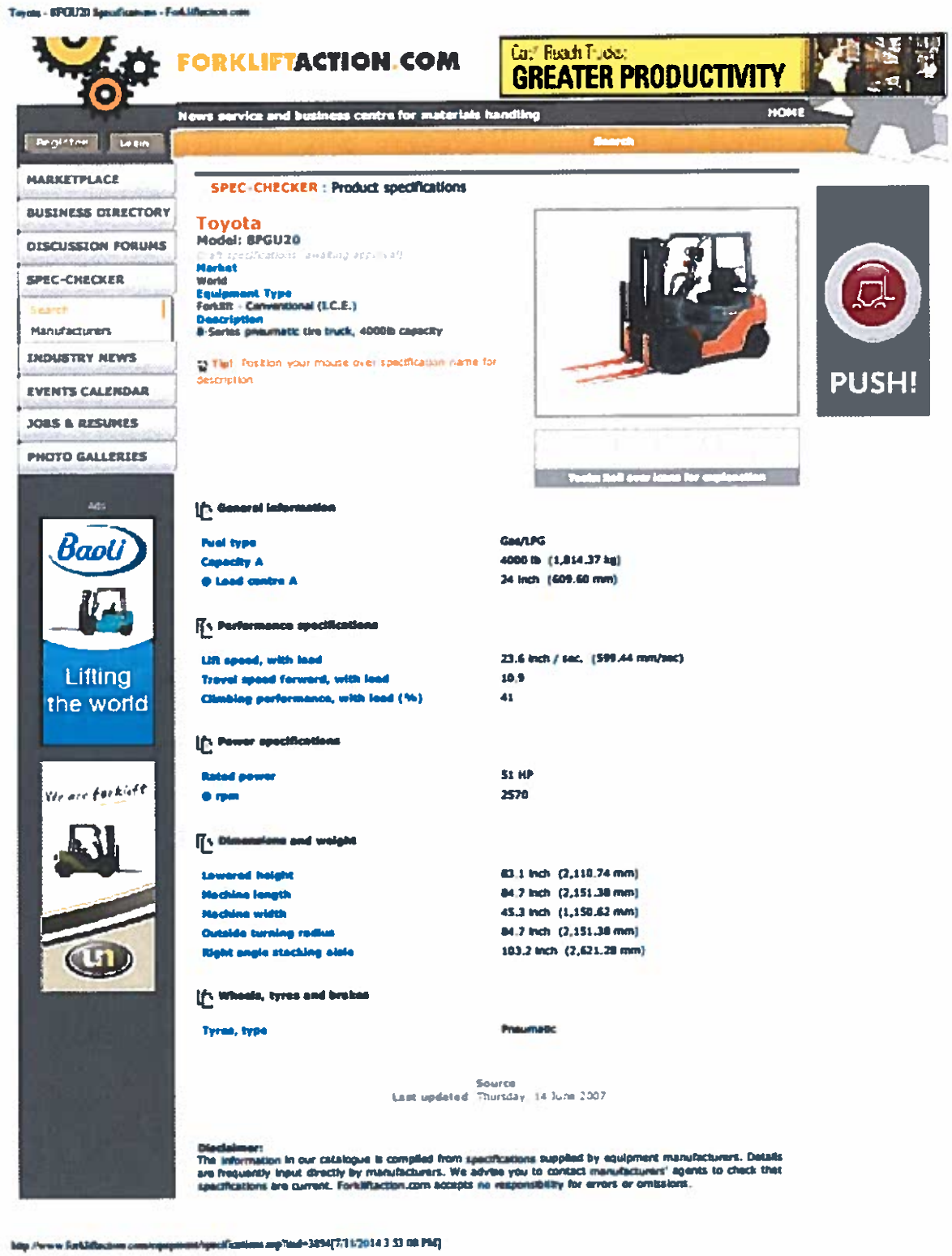
Weekly/monthly detailed reports

- Reporting period—define the interval.
- Amount of total and daily mercury transferred from 3-L containers to 1-MT containers during the reporting period.
- Total and daily number of 1-MT containers filled during the reporting period.
- Mercury content of each of the 14 warehouses at the beginning and end of the reporting period, designate any buffer stocks in Building 110-66 as such.
- Warehouse(s) contributing 3-L containers, drums and pallets, and the number of each removed during the reporting period—make a note of any departures from six flasks per drum and five drums per pallet—list drum and pallet numbers with time stamps—present incremental (time period) and total datasets.
- Warehouse, drip tray locations within the warehouses (locations should be equivalent between warehouses, e.g., a drip tray at position 110-52-1 should be at the same relative

location as a drip tray at position 110-93-1) and number of 1-MT containers on each drip tray, including time stamps—present incremental (time period) and total datasets.

- Daily max and min environmental parameters with time stamps
- Daily max and min mercury concentrations with time stamps

ATTACHMENT 27.6 Toyota forklift model 8FGU20



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SPEC-CHECKER : Product specifications

Toyota
Model: 8FGU20

Market
World
Equipment Type
Forklift - Conventional (I.C.E.)
Description
8-Series pneumatic tire truck, 4000lb capacity

Tip! Position your mouse over specification name for description

PUSH!

General information

Fuel type	Gas/LPG
Capacity A	4000 lb (1,814.37 kg)
@ Load centre A	24 inch (609.60 mm)

Performance specifications

Lift speed, with load	23.6 inch / sec. (599.44 mm/sec)
Travel speed forward, with load	10.9
Climbing performance, with load (%)	41

Power specifications

Rated power	51 HP
@ rpm	2570

Dimensions and weight

Lowered height	83.1 inch (2,110.74 mm)
Machine length	84.7 inch (2,151.38 mm)
Machine width	45.3 inch (1,150.62 mm)
Outside turning radius	84.7 inch (2,151.38 mm)
Right angle stacking aisle	103.2 inch (2,621.28 mm)

Wheels, tyres and brakes

Tyres, type	Pneumatic

Source
Last updated Thursday 14 June 2007

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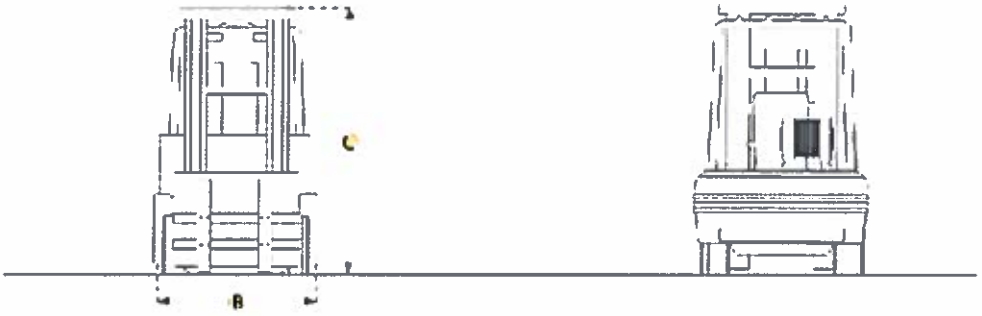

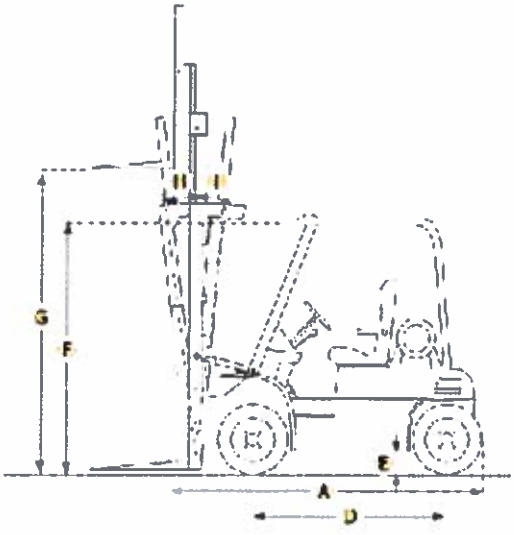

Selected Dimensions

Dimensions		
A. LENGTH TO FORK FACE	8.3 ft in	2575.6 mm
B. OVERALL WIDTH	3.8 ft in	1150.6 mm
C. OVERALL HEIGHT - MAST LOWERED	ft in	mm
F. HEIGHT TO TOP OF OVERHEAD GUARD	6.9 ft in	2110 mm

Specification

Engine		
MODEL	4Y-ECS	
POWER	51 hp	38 kw
TORQUE	105.1 lb ft	156 Nm
POWER MEASURED @	2570 rpm	
TORQUE MEASURED @	2100 rpm	
FUEL TYPE	Gas	
Operational		
TIRE TYPE	Pneumatic	
NUMBER OF FRONT WHEELS	2	
NUMBER OF REAR WHEELS	2	
MAX SPEED	10.9 mph	17.5 km/h
MAST		
LOAD CAPACITY	4000 lb	1814.4 kg
LOAD CENTER	23.6 in	600 mm
LIFT SPEED	118 ft/min	m/min
Dimensions		
LENGTH TO FORK FACE	8.3 ft in	2575.6 mm
OVERALL WIDTH	3.8 ft in	1150.6 mm
OVERALL HEIGHT - MAST LOWERED	ft in	mm
TURNING RADIUS	7.1 ft in	2159 mm
HEIGHT TO TOP OF OVERHEAD GUARD	6.9 ft in	2110 mm
RIGHT ANGLE STACK	8.6 ft in	2621.3 mm