Gas Chlorine is Still Used for Disinfection – Designing for Safety

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OVERVIEW

- Disinfection Type Prevalence
- Key Safety Elements
- Review of an Upgrade Project
- Review of a New Installation Project
- Questions

Why do we care about Gas Chlorine when so many systems are moving away from it?

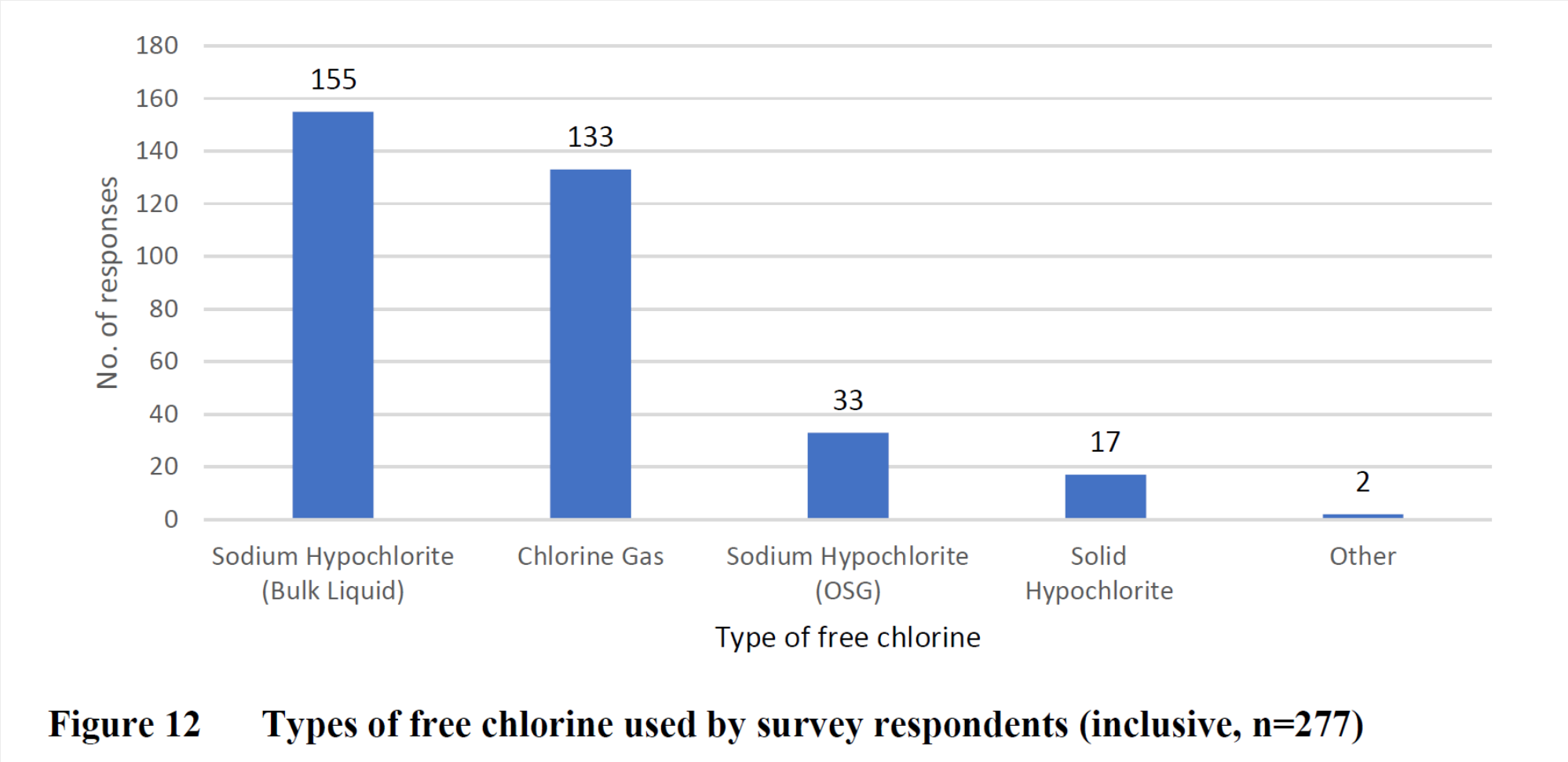


Figure 12 Types of free chlorine used by survey respondents (inclusive, n=277)

From AWWA's 2017 Water Utility Disinfection Study Report, Copyright AWWA 2018.

Proper Storage
Separate Room
Ventilation
Rapid Egress

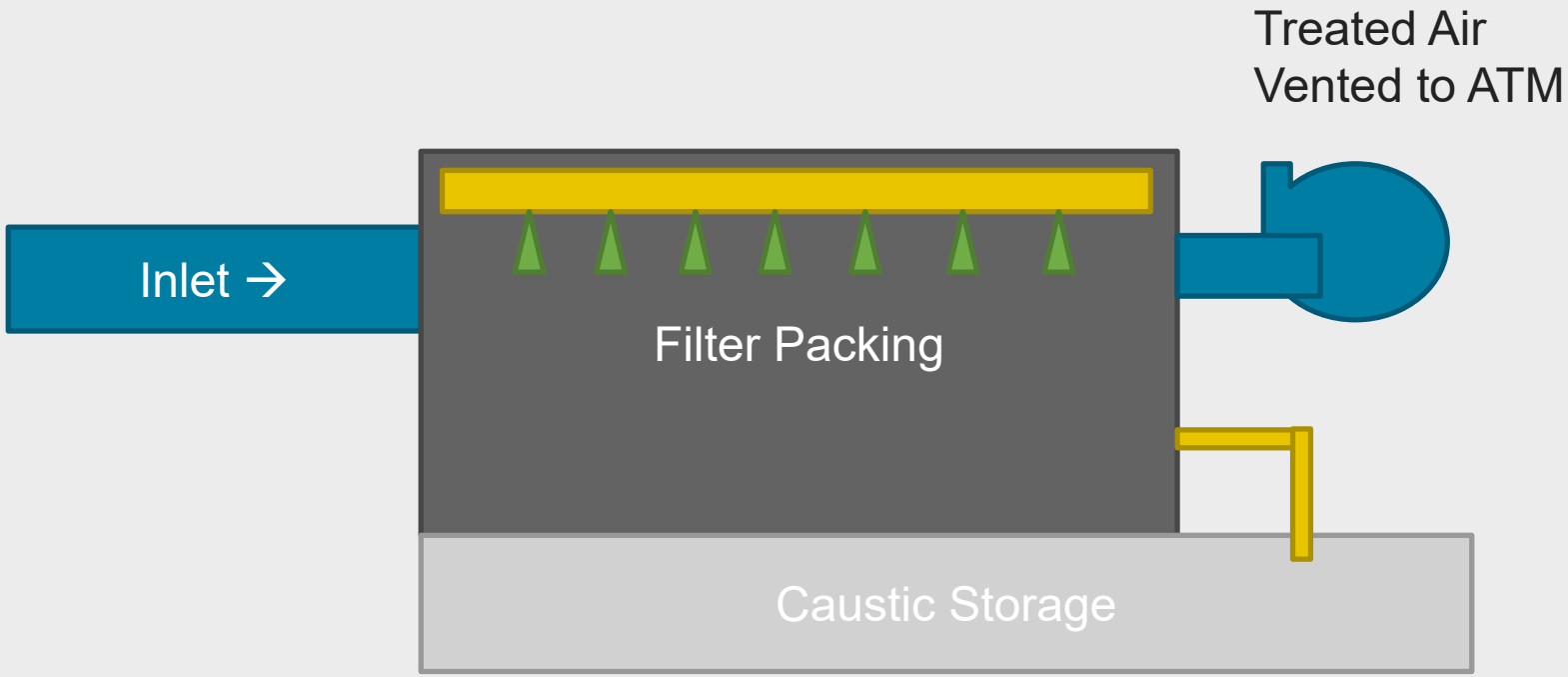
Leak Detection
Monitoring
Alarms

Gas Containment
Capture
Scrubbing

Key Elements in Designing for Safety

“Wet” Scrubbers

- Sodium Hydroxide (Caustic) to neutralize
- Liquid wastes to be managed
- $Cl_2 + 2\ NaOH \Rightarrow NaOCl + NaCl + H_2O$



“Dry” Scrubbers

- Packed with Sieve material of alumina and other reagents
- No Aqueous solutions or additional chemicals

SYSTEM REHABILITATION PROJECT

The Project

- **A great client!** Skagit PUD
- Judy Water Treatment Plant
- 1990's System
- NaOH Wet Scrubber Tower that had reached the end of its useful life.
- Desired to change disinfection types, but needed to ensure safety in operations until that time.

Existing Conditions

Figure 1-1. Existing Chlorine Scrubber and Layout Area for New Scrubber

Figure 1-2. Existing Chlorine Scrubber and Exhaust Fan

Existing Conditions (continued)

Figure 1-3. Chlorine Cylinder Storage Room

Figure 1-4. Existing Exhaust Duct and Damper

Existing Conditions (continued)

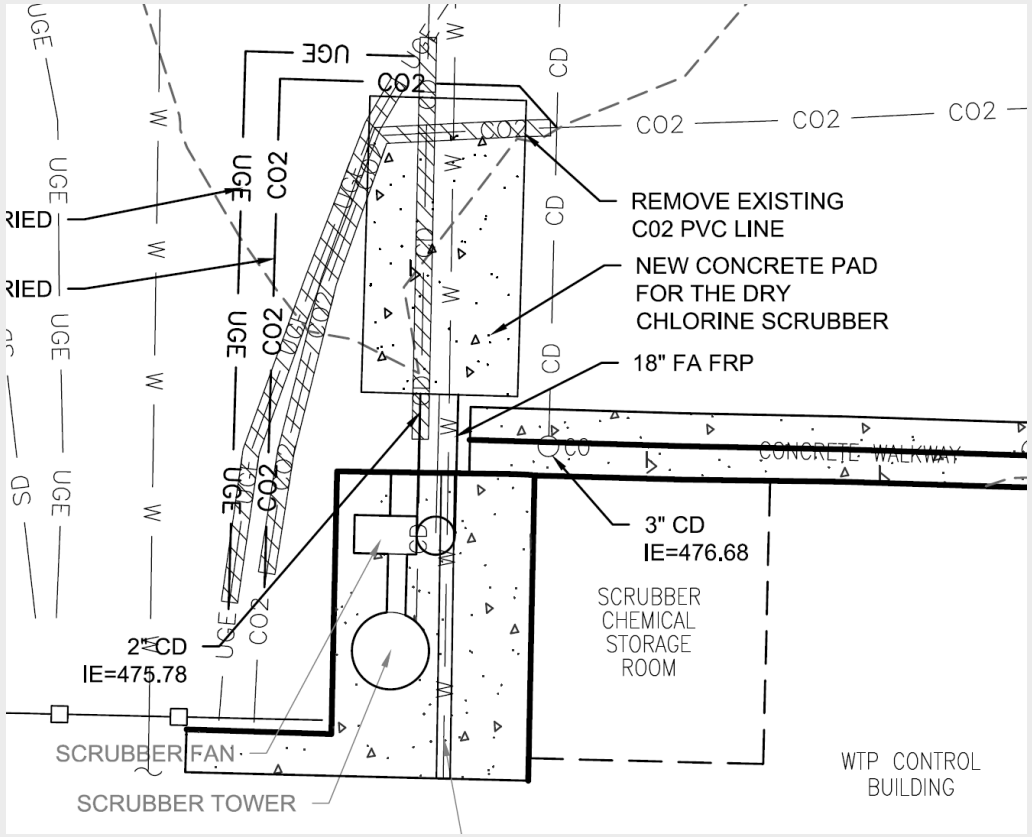
- Sized to handle rupture of 1-ton cylinder
- 5 each 10-hp Pumps and a 10-hp fan

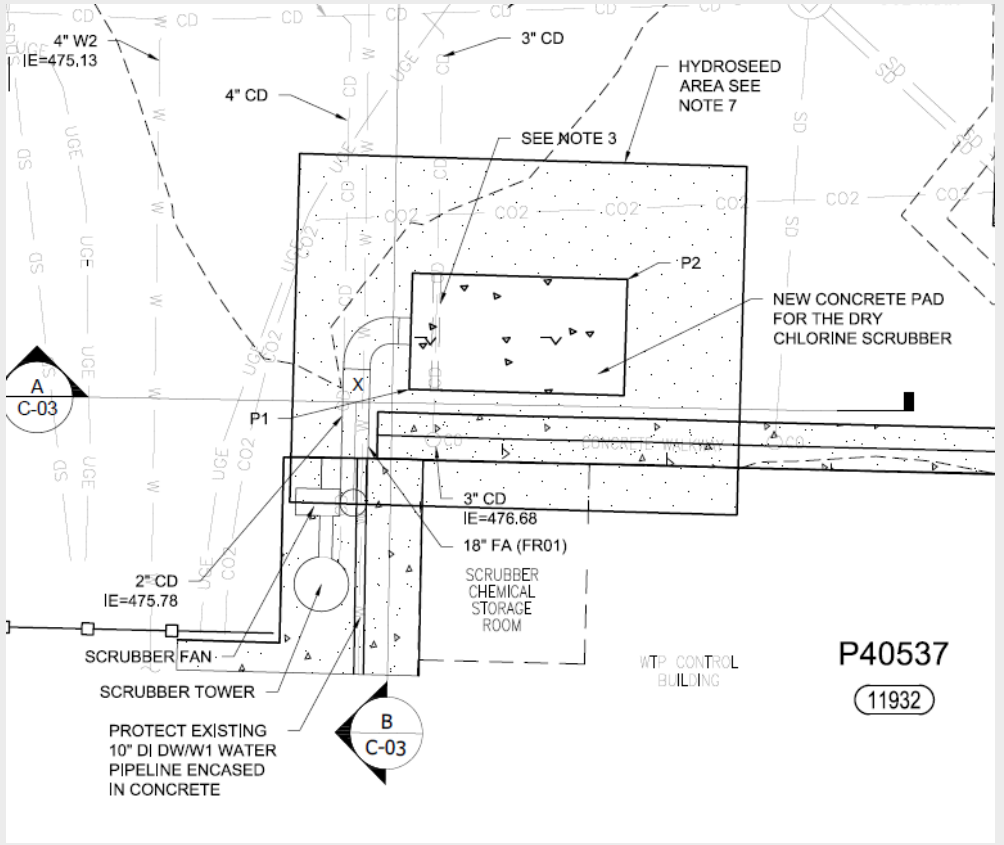
Evaluation of Dry Scrubber Alternatives

- Dry Scrubber
- Handle 1-Ton Cylinder Rupture

Item	Units	Purafil	PureAir
Chlorine Scrubber	--	Dry-media, Aluminum vessel with horizontal layout	Dry Media, FRP Vessel: horizontal or vertical layout possible
Volume of Media	Cf	432	440
Height	Ft	8’10” to top of vessel	9’5” to top of horizontal vessel
Length	Ft	11 feet plus 6 feet for blower	13’4” plus 5’3” for blower
Width	Ft	8	8
Media – Activated Carbon with Alumina coating	Lbs	19,440	22,000
Inlet Duct	In	18	18
Air Handler Air Flow	Cfm	5000	5000
Maximum Pressure Drop Accommodated	In water column	22	16
Motor size	hp	30 to 40	20 to 30

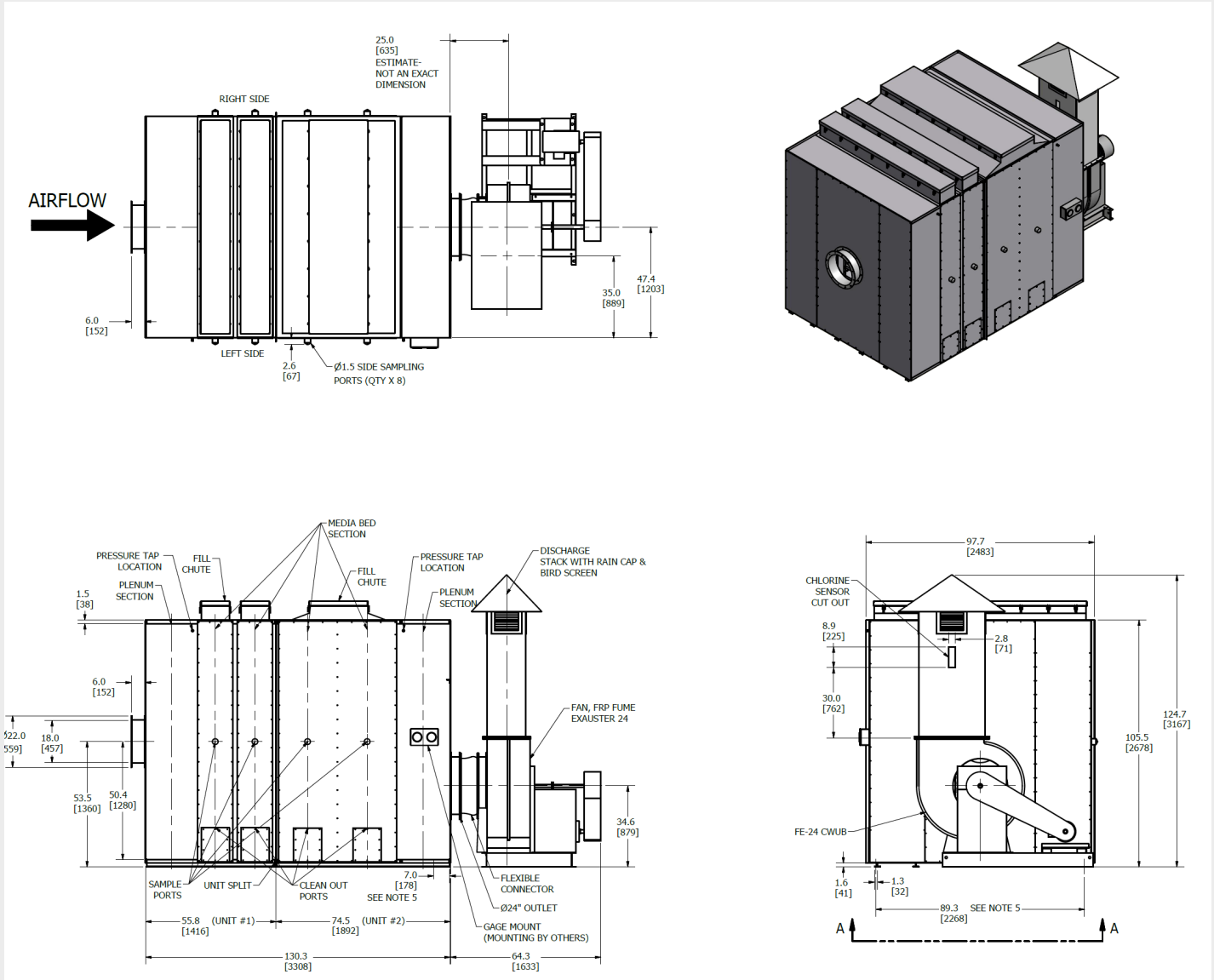
How to Set the new Unit On the Site





Winner!

The Selected Scrubber



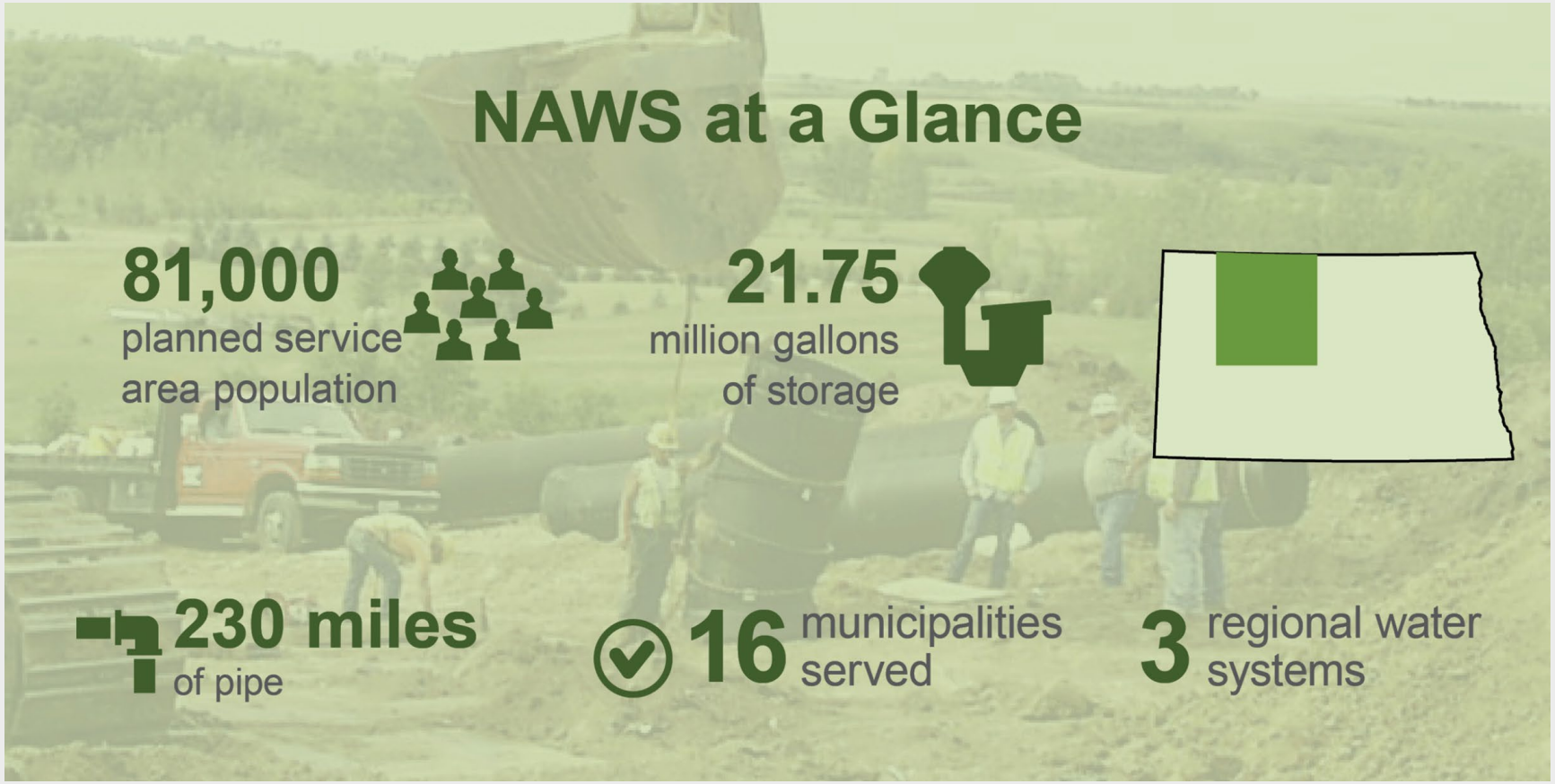
From Purafil Design Sheets, Copyright Purafil Filtration Group

Set in Place and Ready to Connect

GREENFIELD PLANT PROJECT

The Project

- **Northwest Area Water Supply Project** Bureau of Reclamation
- North Dakota Water Commission



Graphic Credit to Houston Engineering

The Project (continued)

- Boundary Waters Compliance Requirements
- Manitoba sued over potential biota transfer from the Missouri River into the Souris River Basin that drains into the Hudson Bay in Canada.
- Water will be pumped from the biota treatment plant to the continental divide, where gravity flow will carry it the rest of the way to Minot.
- Initial 12.25 MGD expandable to 24.5 MGD
- Final Treatment in Minot

Chemicals at Site

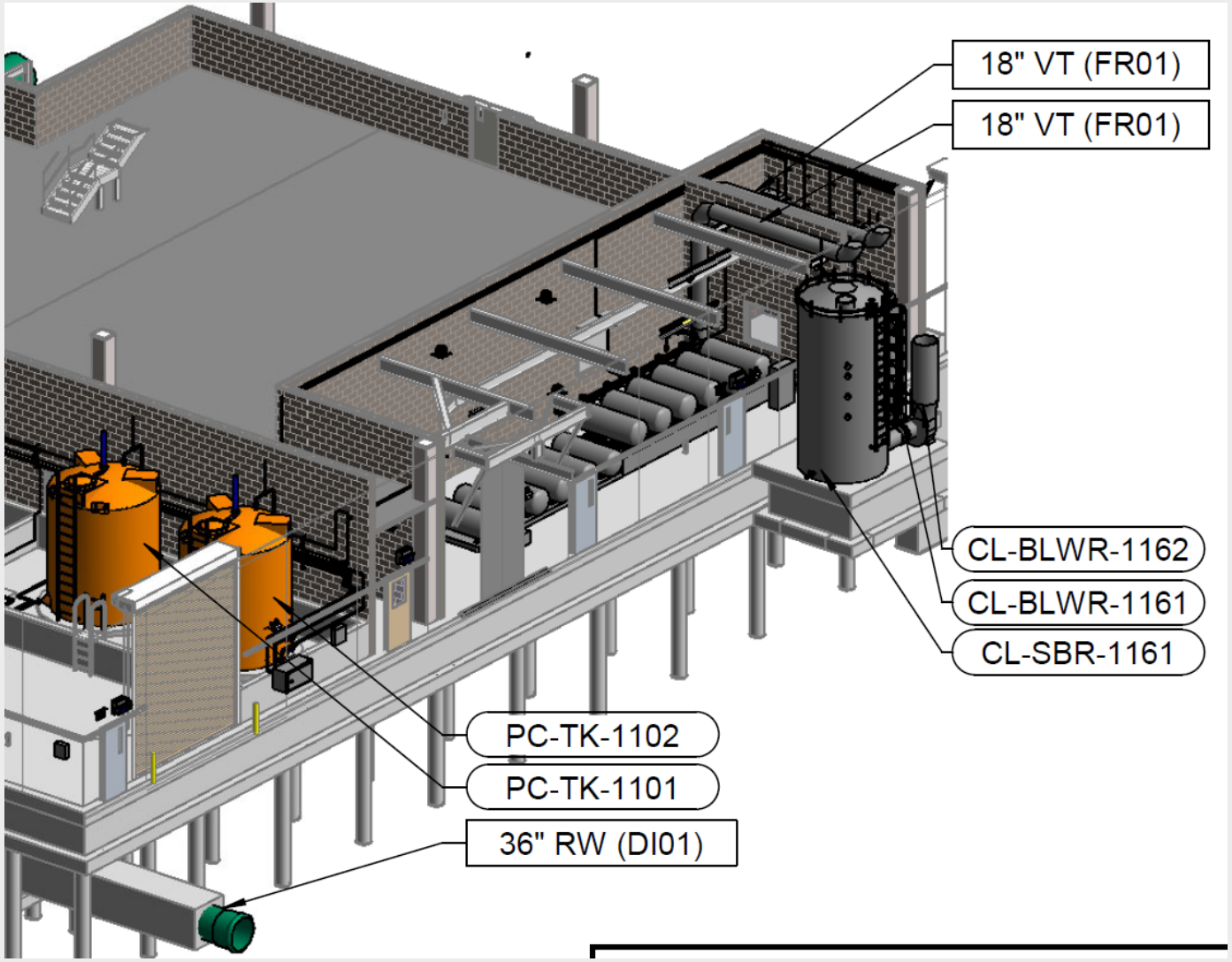
HAZARDOUS MATERIALS

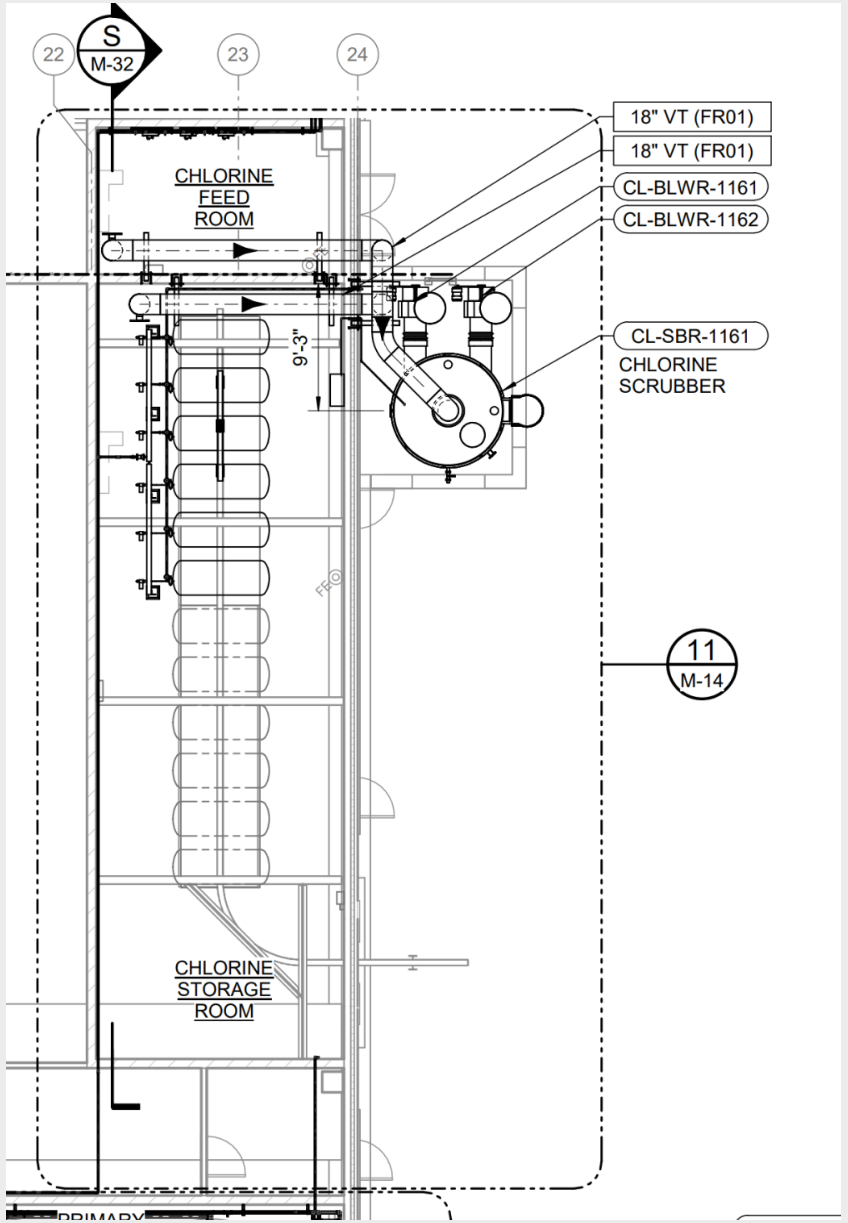
CHEMICAL	CAS NO.	QUANTITY	NFPA 704 RATING				HAZARD PROPERTIES		OCCUPANCY WHEN MAX. ALLOW. QUANITITY EXCEEDED	REMARKS
			HEALTH	FLAMMABILITY	REACTIVITY	SPECIAL	PHYSICAL	HEALTH		
ALUMINUM CHLOROHYDRATE (AH 607)	1327-41-9	13,200 GAL	3	0	1	-	NO	ACUTE HAZARD		CHEMICAL STORAGE ROOM
CATIONIC POLYMER (AH 6527)	7705-08-0	1,320 GAL	1	0	0	-	NO	ACUTE & CHRONIC HAZARD		CHEMICAL STORAGE ROOM
FILTER AID POLYMER (AH 9907)	-	55 GAL	1	1	0	-	NO	ACUTE HAZARD		CHEMICAL STORAGE ROOM
CHLORINE GAS	7782-50-5	12 TONS	4	0	0	OX	NO	CORROSIVE TOXIC	H-3	CHLORINE STORAGE ROOM, COMPRESSED LIQUIFIED OXIDIZING GAS
AMMONIUM SULFATE (AH 347)	7783-20-2	6,600 GAL	2	0	0	-	NO	ACUTE HAZARD		CHEMICAL STORAGE ROOM
CARBON DIOXIDE GAS (FUTURE)	124-38-9	30 TONS	2	0	0	SA	COMPRESSED GAS	SIMPLE ASPHYXIANT		EXTERIOR STORAGE

Use of Chlorine Gas at Within Treatment Plant

- Raw Water – 12 to 76 lbs/day
- Filter Influent – 12 to 76 lbs/day
- UV Effluent – 75 to 301 lbs/day

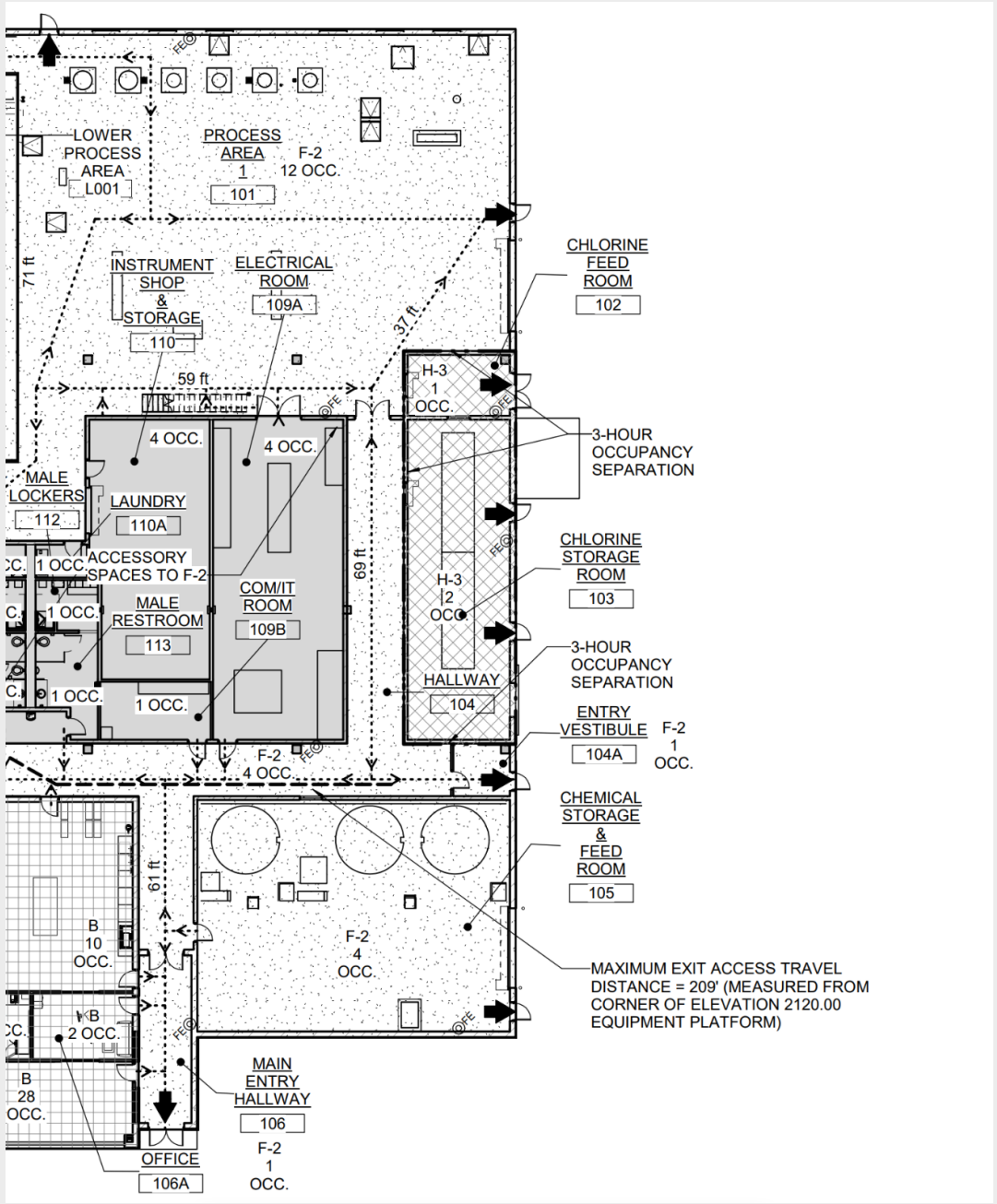
Separated Area for Chlorine Gas Storage





Safety Features of Building

- Good Egress from Chlorine area
- No interior Doors
- Not tied into to other intake or exhaust areas



Safety In Feeder Equipment

- Chlorine feeder is designed so that the chlorine gas will be continuously fed under less than atmospheric pressure from the time that it passes the vacuum regulator check unit mounted at the chlorine ton containers until it is absorbed at the injector.

- If the water supply to the injector should fail, or if the vacuum should fail to be maintained, for any reason whatsoever, the chlorine vacuum regulator check unit will close automatically.

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QUESTIONS