

Reduced Air Emissions for Hard Chrome Plating at the NADEP NAS North Island, San Diego

Using an Alternative Emission Control Technology

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The NADEP's Hard Chrome Plating Facility

The NADEP facility located on the NAS North Island, San Diego, CA currently has five (5) hard chrome plating tanks in operation. The facility typically plates 3-5 million amp-hours per year and is identified as a Small Hard Chromium Electroplating Facility by the San Diego Air Pollution Control District.

The NADEP's Cr⁺⁶ Permit Conditions

“THE HEXAVALENT CHROMIUM EMISSIONS SHALL NOT EXCEED 0.233 POUNDS IN EVERY CONSECUTIVE 12-MONTH PERIOD. THE HEXAVALENT CHROMIUM SHALL BE DETERMINED USING THE THREE MOST RECENT APPLICABLE SOURCE TESTS APPROVED BY THE DISTRICT* FOR THE ABOVE EQUIPMENT.”

*** San Diego Air Pollution Control District**

The NADEP's Current Air Pollution Control Device

The NADEP currently incorporates a 40,000 CFM Mesh Pad Mist Eliminator Exhaust System driven by a 100 HP motor as its add-on control device. The measured Cr^{+6} emissions at the stack is 0.0015 mg/amp hour. At this emission level, the NADEP could plate approximately 70 million amp hours annually and remain in compliance with their permit. The exhaust fan motor is operated 24 hours per day 7 days per week at an average cost of 10.7 cents per kilowatt hour.

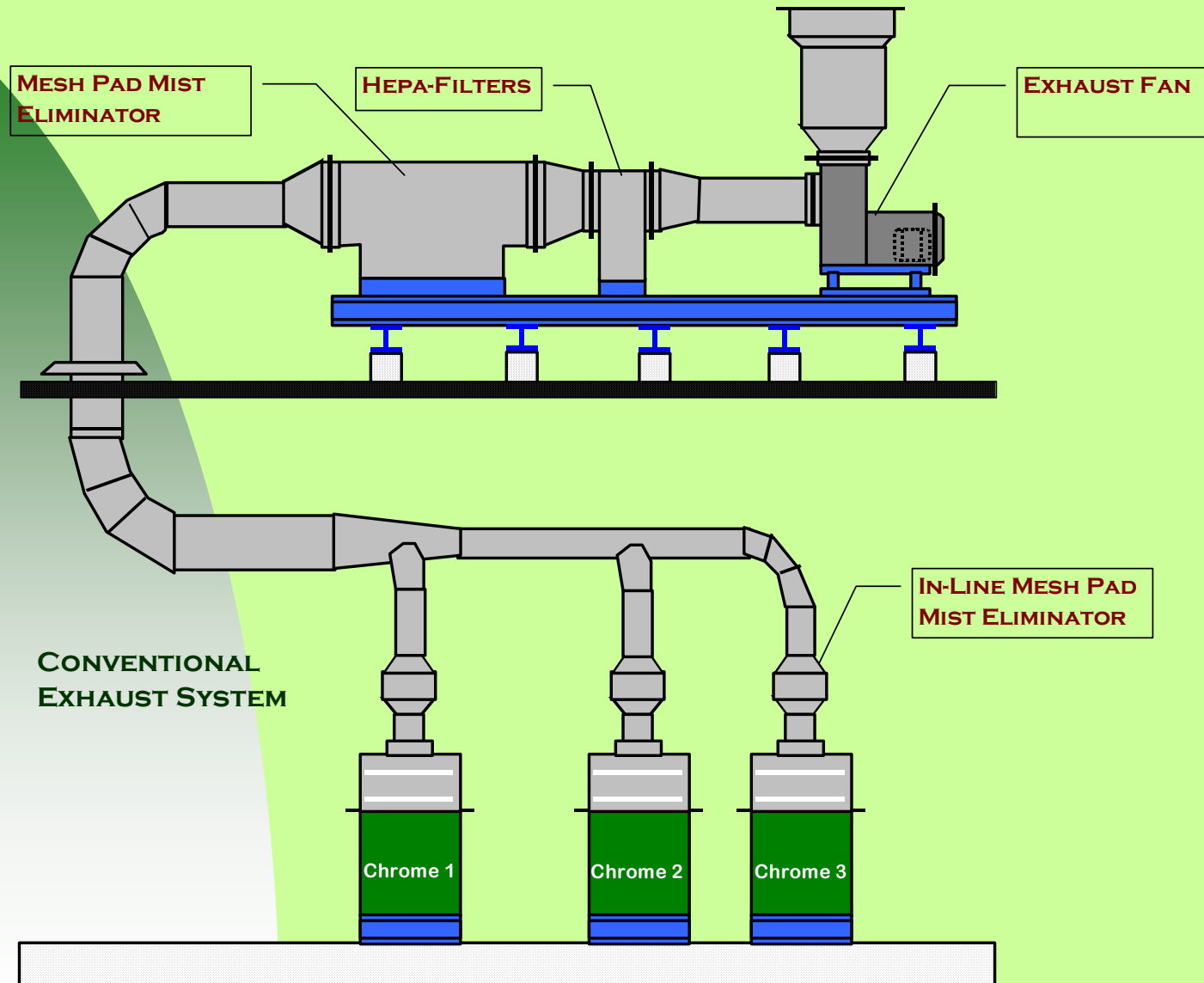
ENCAPSULATING TANK COVERS

This presentation addresses the implementation of encapsulating tank covers, hereafter referred to as the Chrome Plating Emission Elimination Device (EED), on the NADEP's hard chrome plating process tanks, as an alternate control device used to eliminate Cr^{+6} emissions to the outside environment, reduce operating costs, and provide enhanced operator safety and exposure in the chrome plating facility.

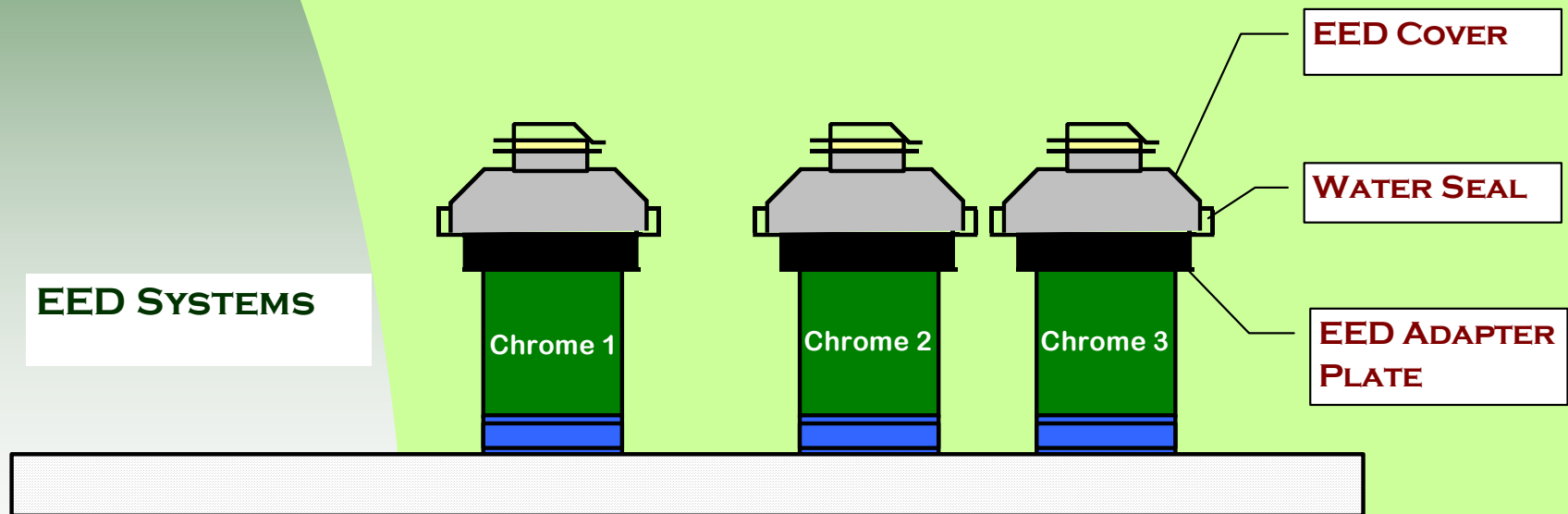
EED DEFINITION

As a stand-alone, self-contained system requiring no exhaust fans, scrubbers or mesh pad mist eliminators, fume suppressants, or exhaust ducts and vents to the outside environment, the EED System has by definition, zero emissions to the outside environment.

CONVENTIONAL EXHAUST SYSTEM



SAME TANKS WITH EED SYSTEM

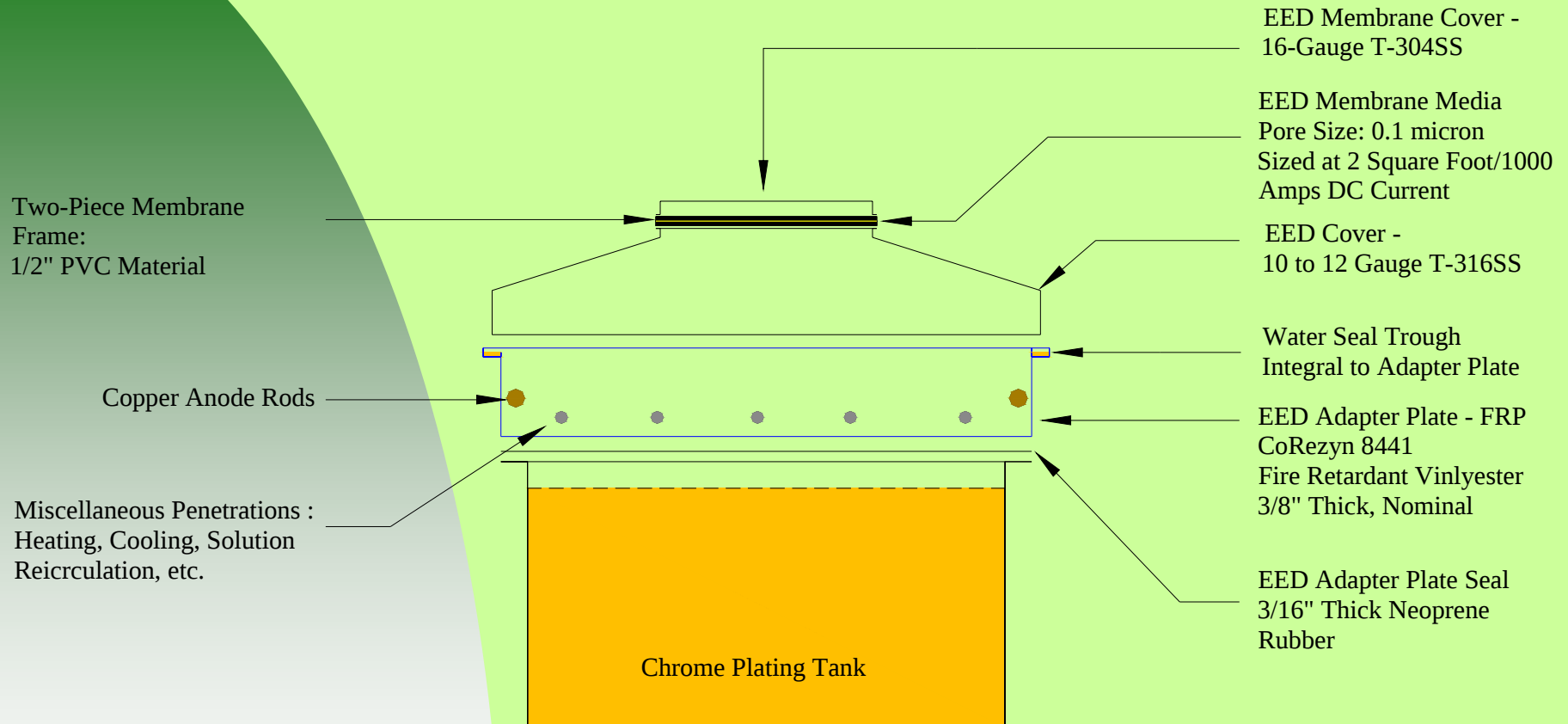


BUILDING AN EED SYSTEM

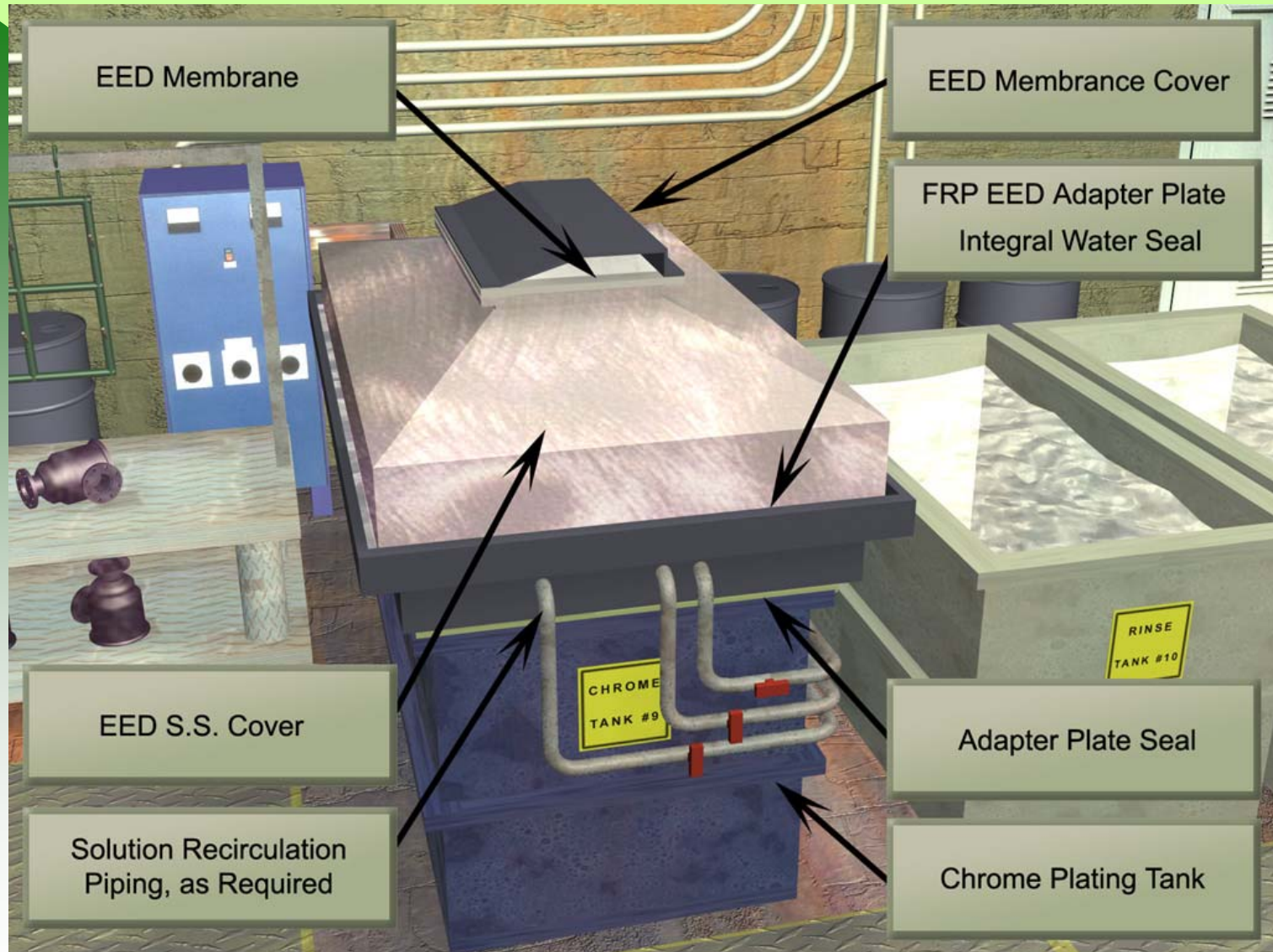
The EED system is comprised of the following components:

- Chrome Plating Tank
- Adapter Plate-Tank Lip Seal
- EED Adapter Plate w/Water Seal
- EED Membrane & Frame
- EED Membrane Cover
- EED Evacuation System

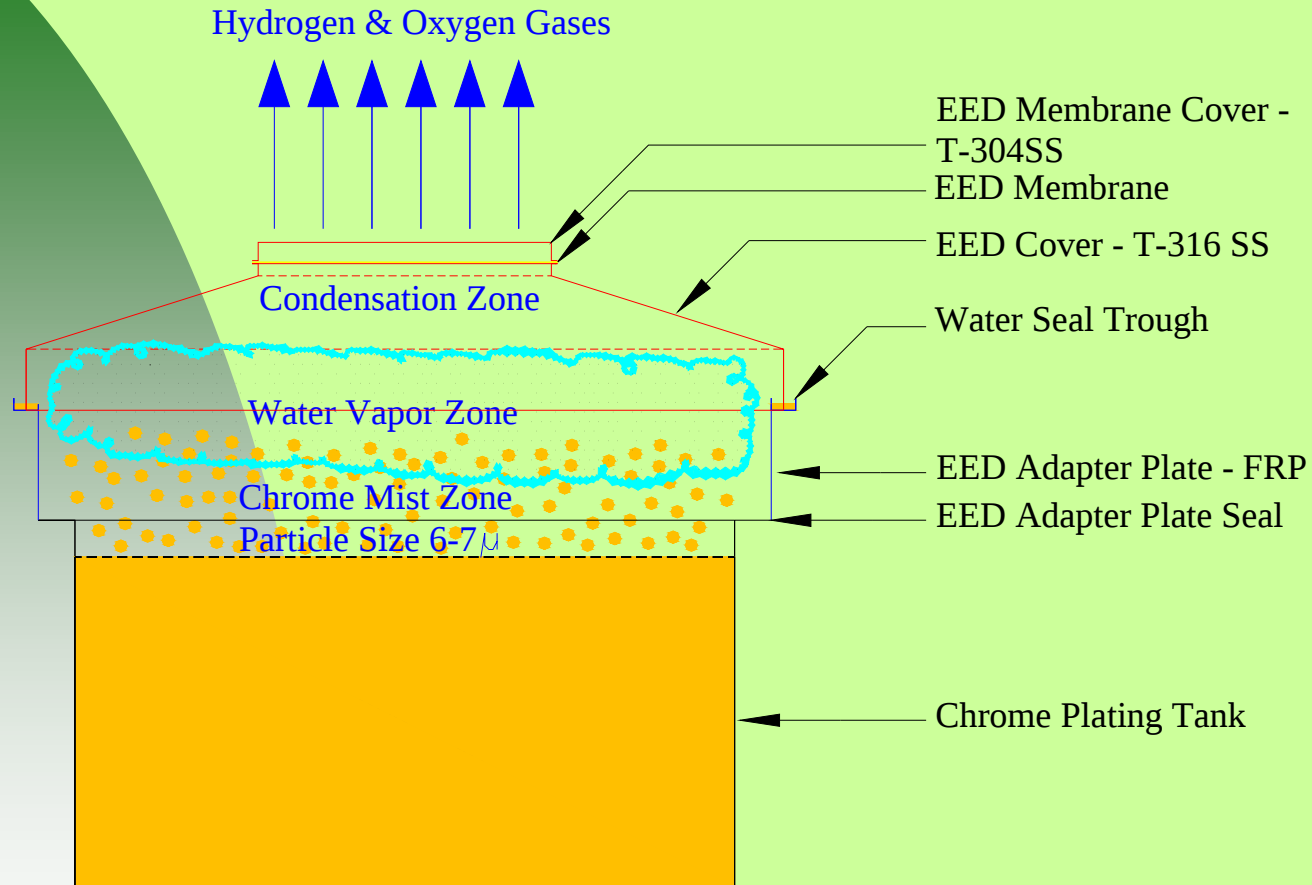
BUILDING AN EED SYSTEM



BUILDING AN EED SYSTEM



THEORY OF OPERATION

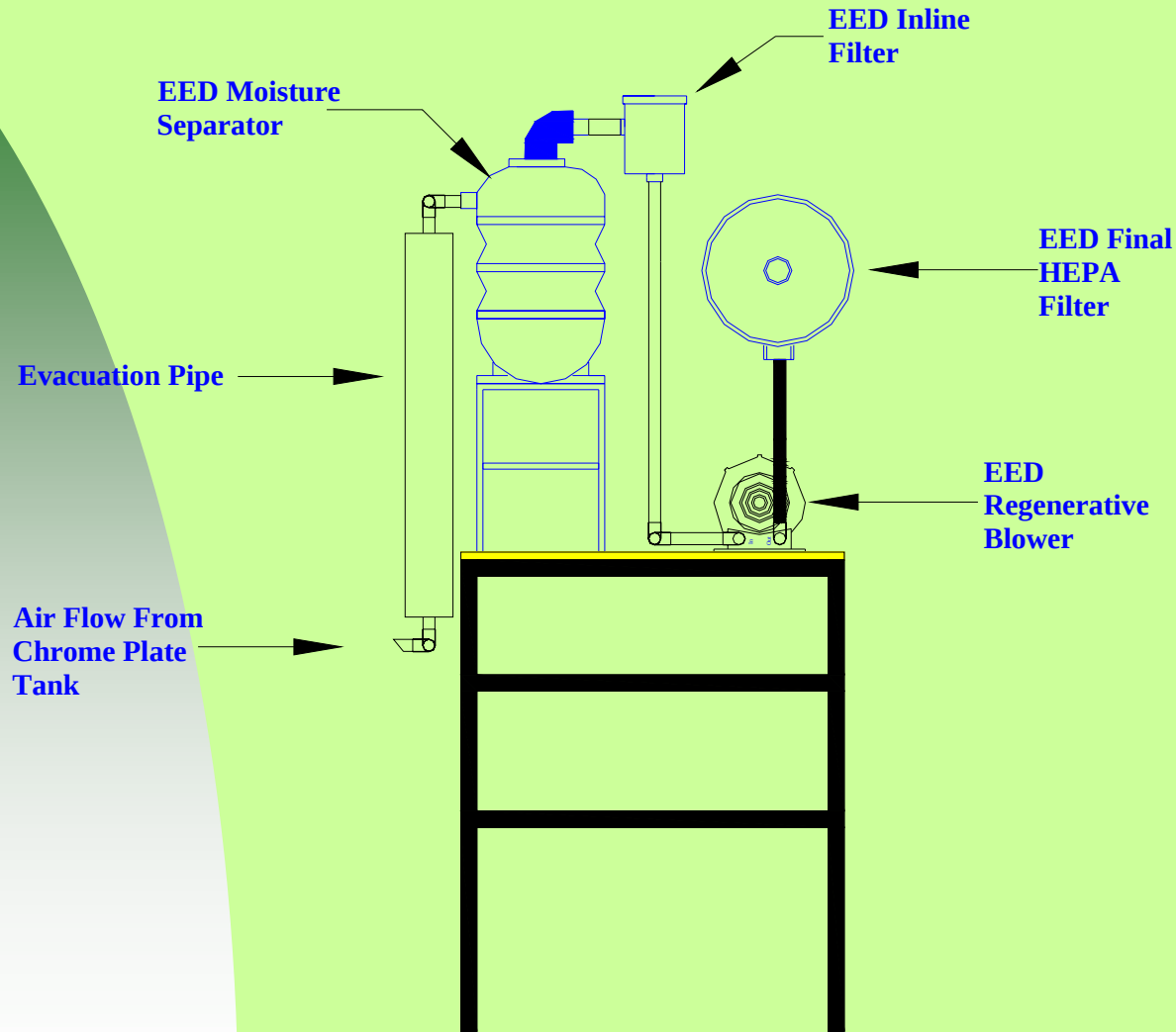


THEORY OF OPERATION

EED Operation:

As chrome plating takes place, several things occur simultaneously beneath the EED cover. Water vapor is created due to the 135°F operating temperature of the hard chrome bath. Chrome mist is generated due to electrolysis. Additionally, hydrogen and oxygen gasses are created at the cathode and anode due to the inefficiency of the hard chrome plating bath. As the water vapor rises beneath the cover, a cloud forms blanketing the plating solution. Chrome mist that comes in contact with the cloud is “washed” by the water vapor, creating heavy chrome droplets that fall, by gravity, back into the plating tank. As the water vapor continues to rise, it comes in contact with the cover, condenses, forms water droplets, which in turn fall back into the water seal trough and plating tank. The hydrogen and oxygen gasses rise to the highest point beneath the cover where the patented membrane allows free passage of these gases into the atmosphere.

THE EVACUATION SYSTEM



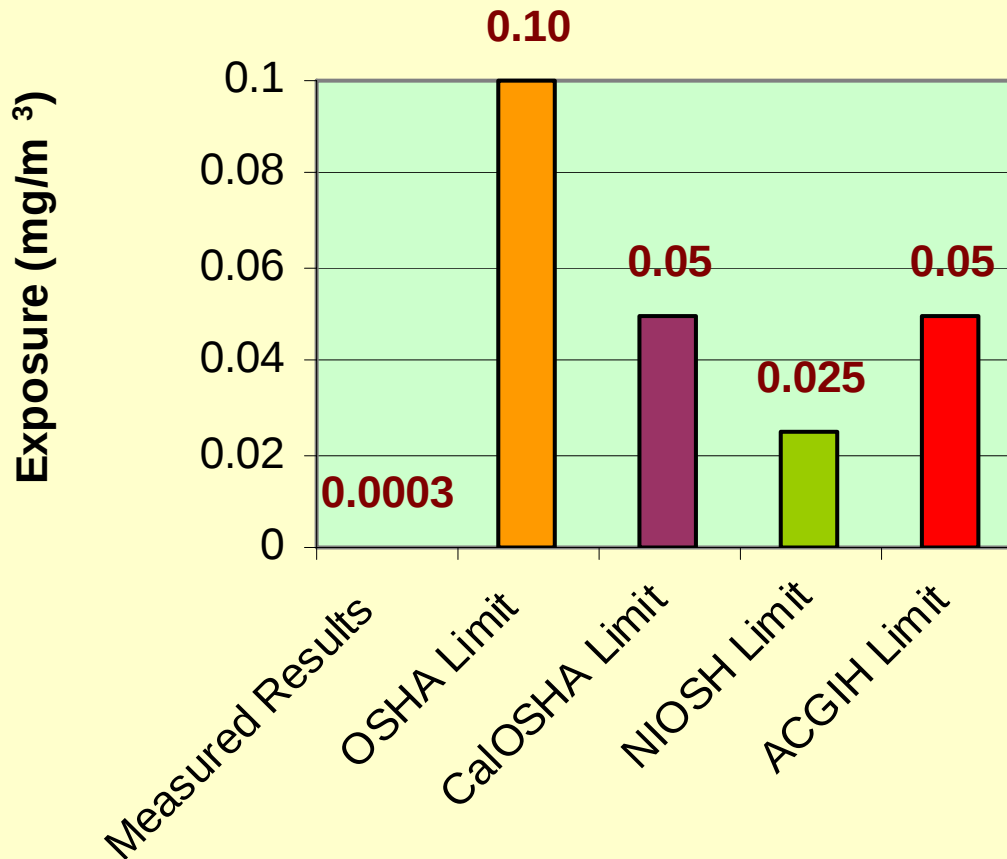
THE EVACUATION PROCESS

Evacuation System Operation:

On completion of the plating cycle, residual hydrogen and oxygen gasses and water vapor must be evacuated from the unit prior to opening the cover. Once the rectifier has been turned off, it takes approximately 3-5 minutes to complete this effort. The evacuation system consists of a regenerative blower, moisture separator, pre-filter and final HEPA filter. The operation is as follows: The blower is activated, the air flow passes through the moisture separator where residual moisture is collected, through the pre-filter, into the blower, and finally into the room atmosphere through a 0.3 micron HEPA filter.

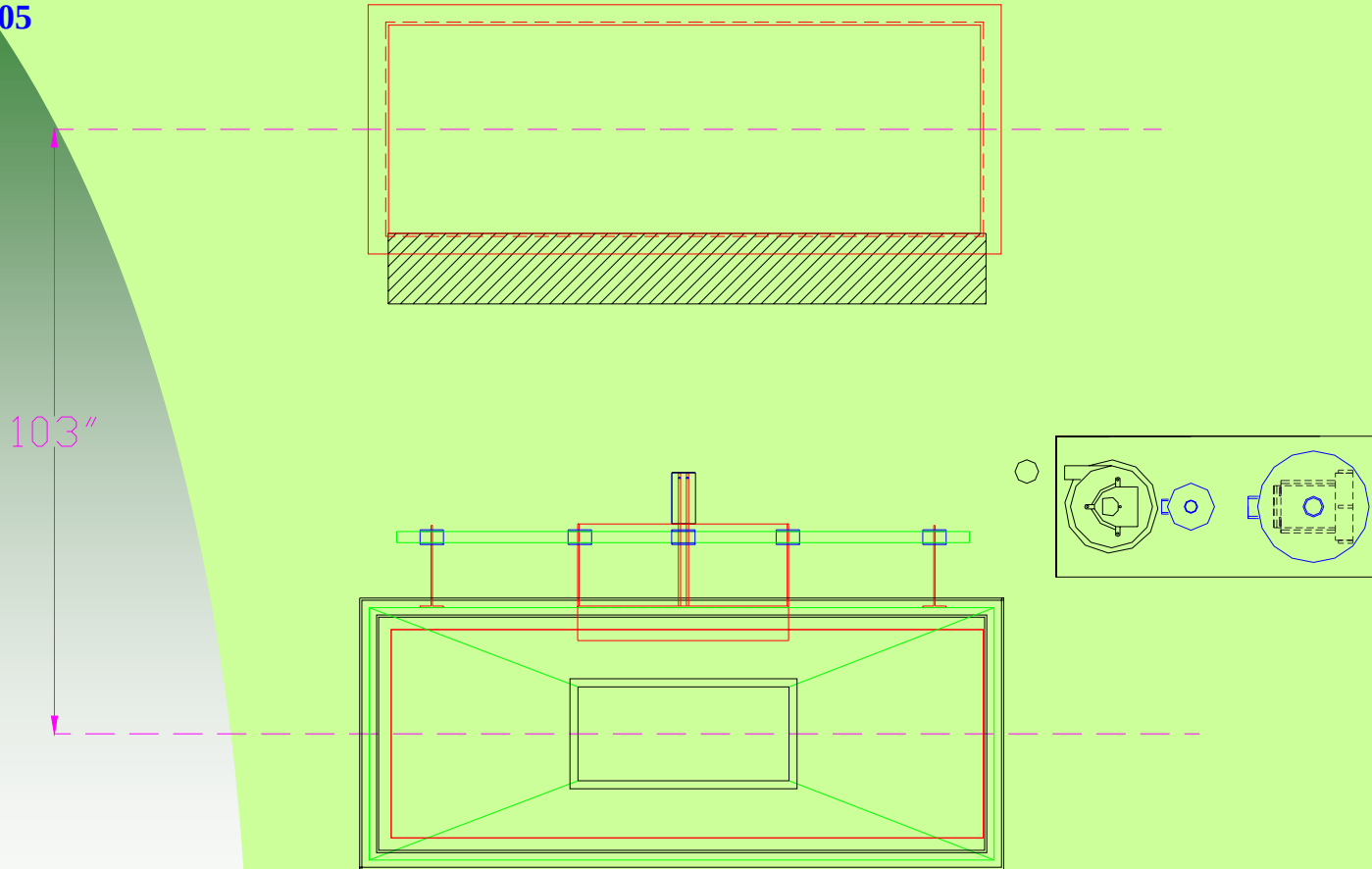
AIR QUALITY MONITORING

Indoor Air Quality - Monitoring Chromium⁺⁶
Emissions at Evacuation Filter

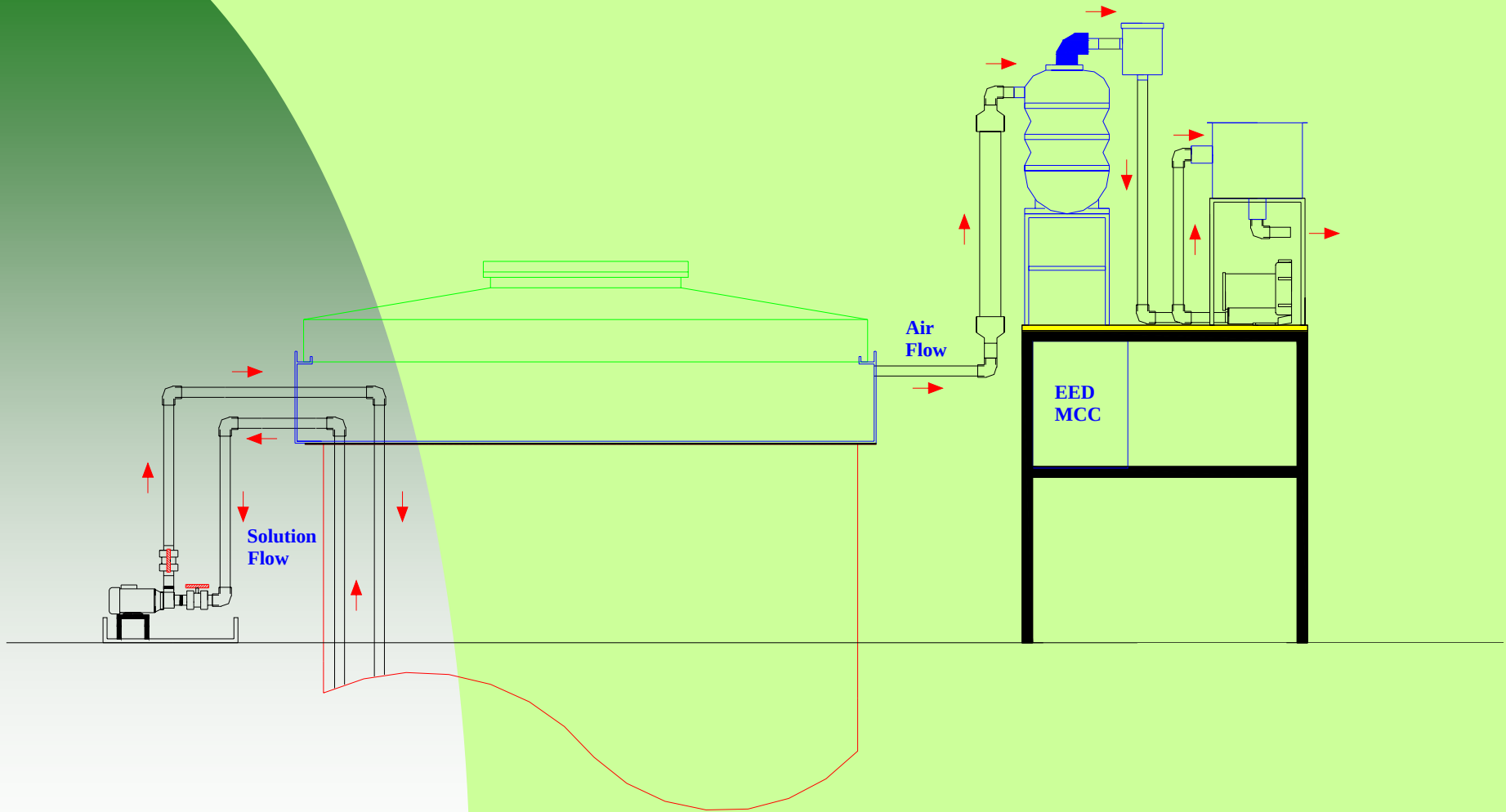


PROPOSED NADEP EED SYSTEM, TANK NO. 1

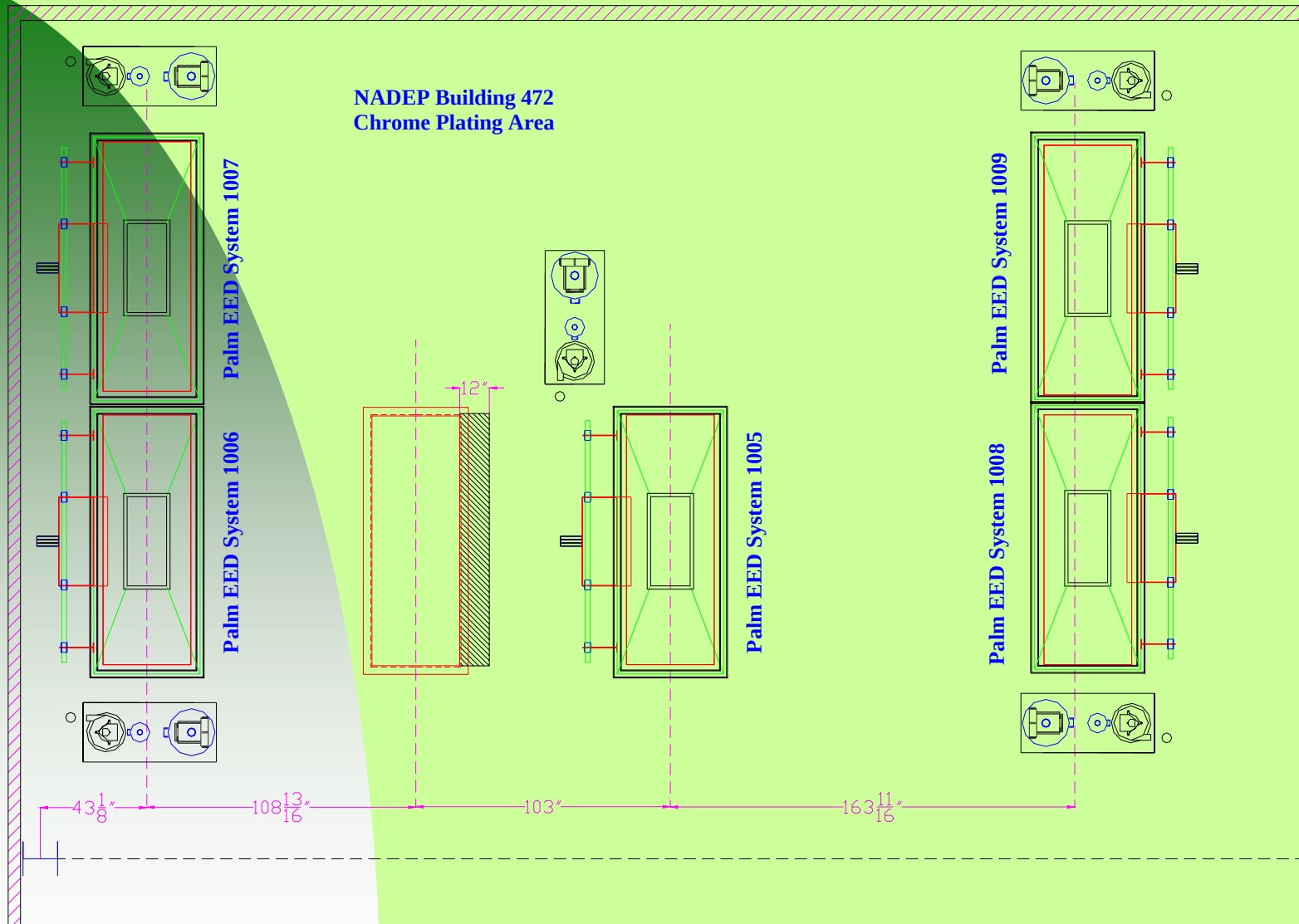
NADEP Building 472
Chrome Plating Area
EED System 1005



PROPOSED NADEP EED SYSTEM, TANK NO. 1



PROPOSED NADEP EED SYSTEMS



ADVANTAGES OF THE EED

SAVINGS

- Associated scrubber costs are eliminated.
- Potentially leaking ductwork eliminated.
- Heated make-up air requirements are eliminated.
- Fume suppressants are no longer needed.
- Energy requirements are reduced by 60-70%.
- Floor space requirements could be reduced.
- Long life estimated to be 15 years or longer.

ESTIMATED EED COST & PAYBACK ANALYSIS

FIVE-TANK SYSTEM
NADEP - SAN DIEGO, CA

TANK SIZE - LENGTH: 101" x WIDTH: 34"

CONVENTIONAL CHROME PLATING TANK			CHROME PLATING TANK W/EED SYSTEM		

COST SAVINGS

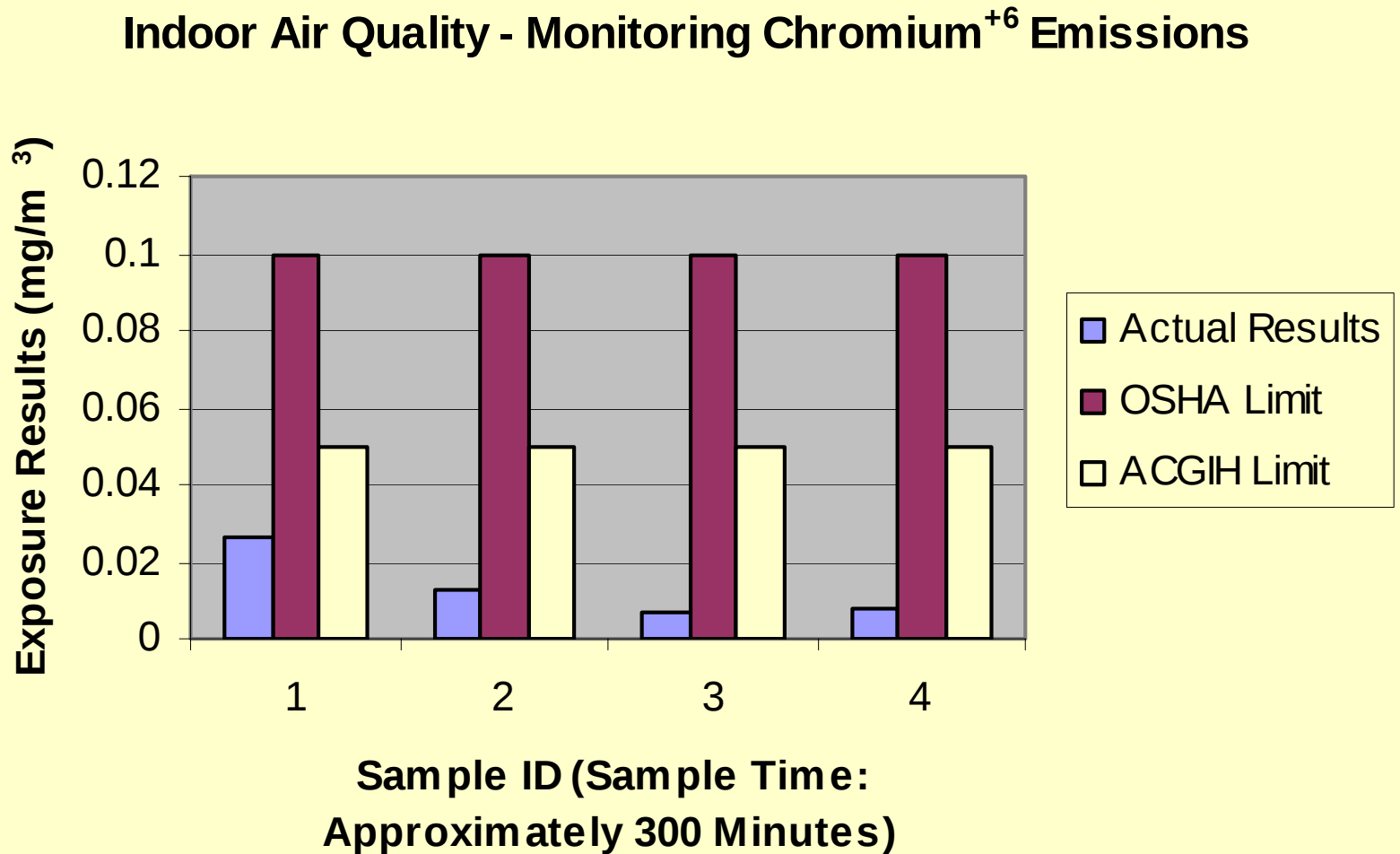
FIRST YEAR EQUIPMENT COST	\$ -	<u>EED PAYBACK ANALYSIS</u>	
FIRST YEAR OPERATING COST	\$ 150,808	EXHAUST SYSTEM INVESTMENT	\$ -
TOTAL FIRST YEAR COST	\$ 150,808	EED SYSTEM INVESTMENT	\$ 293,715
		EQUIPMENT SAVINGS	\$ (293,715)
		ONE-YEAR OPERATING COST SAVINGS	\$ 150,808
		TOTAL SAVINGS ONE YEAR	\$ (142,907)
		FIRST YEAR SAVINGS	\$ (142,907)
		SECOND YEAR SAVINGS	\$ 147,218
		PAY BACK - MONTHS	23.74
<u>10 YEAR ESTIMATED COST</u>		<u>10 YEAR ESTIMATED COST</u>	
TOTAL INSTALLATION COST	\$ -	TOTAL 1ST YEAR COST	\$ 294,715
10-YEAR OPERATING COST (PER ABOVE)	\$ 1,508,080	10-YEAR OPERATING COST (PER ABOVE)	\$ 32,310
TOTAL TEN YEAR COST	\$ 1,508,080	TOTAL TEN YEAR COST	\$ 327,025
PROJECTED TEN YEAR SAVINGS			\$ 1,181,055

ADVANTAGES OF THE EED

S A F E T Y

- Reduced danger of hydrogen explosion; rectifiers are off during start-up – preventing arcing.
- The patented design allows hydrogen to freely leave the EED. In the unlikely event of an explosion, the EED shields the operator from any splashing solution.
- Potential hood or duct fires eliminated.
- Noise from fan and pump motors is eliminated.
- The potential for worker exposure is minimized when the EED is installed because no Cr^{+6} molecules are emitted to the atmosphere while plating is taking place.

AIR QUALITY MONITORING



ADVANTAGES OF THE EED

- **Air:** The need for exhaust hoods, ductwork and fume scrubbers/fans is eliminated.

Air: With a properly installed and operated EED system, emissions are eliminated.

- **Air:** Because no exhaust stacks are required, chrome fumes cannot escape into the atmosphere as they could if the scrubber system fails. The EED is environmentally friendly.

- **Water:** Effluent control for treating scrubber solutions is no longer required.

R E G U L A T I O N S ADVANTAGES OF THE EED

- Since there are no exhaust stacks with the EED, no exhaust operational reports are required. Stack source testing is eliminated resulting in savings of \$10,000 annually, as required by local regulatory authorities.

ADVANTAGES OF THE EED

- Because the EED includes a cover that must be opened, operators become more aware of their work habits. Production throughput will actually improve due this renewed attention to procedures.

CONCLUSIONS

The EED System, when operated properly, is a proven alternative control device that will meet or exceed all requirements of the Chrome Plating NESHAP while eliminating the need for conventional ventilation systems and fume suppressants. Due to the simple design and operation of the EED, significant savings are achievable using this technology when compared to conventional exhaust systems. In the particular case of the NADEP, as shown above, ten-year savings are estimated to be greater than \$1.18 Million with an investment payback of approximately 24 months.