Implementation of New Nitrogen-Based Anoxic Systems Historic New England, USA

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My name is Adam Osgood, I am the Collections technician and IPM Coordinator at Historic New England. This presentation is an update on a project that is currently underway to upgrade expand and convert our current pest treatment facility. In Museumpests Working Group we have saying that we accept no apologies so I will unapologetically let you know that this project is so current and still incomplete that there is going to be gaps of information in this presentation but still I thought this would be a great opportunity to share what we've been up to.

Historic New England

We serve the public by preserving and presenting New England heritage.

Historic New England is a museum of cultural history that collects and preserves buildings, landscapes, and objects dating from the seventeenth century to the present and uses them to keep history alive and to help people develop a deeper understanding and enjoyment of New England life and appreciation for its preservation.

HISTORIC NEW ENGLAND

First, just briefly about my organization, Historic New Eng
oldest historic preservation organization in the United St

Our house museums are in a wide range of the New Eng
have 38 properties and 30 of them are furnished with m
collections with a vary wide range of materials.

A full 40% of our object collection is on view or in storag
houses which have varying levels and often minimal clim

Because of this we face significant pest challenges seasonally in Clothes moths…

…Carpet Beetles…

…And wood boring furniture beetles

Historic New England has a decades long history of IPM implementing many strategies and out program is robust.

The Old Bubble

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One of our strategies is to use a 1,000 cubic foot controlled atmosphere treatment chamber or "Bubble" which uses CO_2 to replace the atmosphere as a safe and effective means of insect pest remediation. Historic New England has been operating some version of this system for nearly 30 years for both internal use and as a service to other institutions regionally and nationally. In the fall of 2019 we began noticing that the efficiency of the system was decreasing probably due to a small leak. The PVC membrane was nearing its ten year shelf life and it was time to start planning for a replacement.

By February of 2021 at last year's MPWG meeting I got into conversation with our colleagues Pat Kelley of Insects Limited and Bill Smith of Heritage Packaging among others. Pretty quickly after discussing what kind of improvements could be brought to our system it became clear that the technology is available to create a new system of the same size (1,000 cubic feet) using a static process with a reusable chamber and switching to Nitrogen rather than CO_2.

Carbon Dioxide is an Ozone Depleting Gas

Nitrogen makes up 78% of the air we breath

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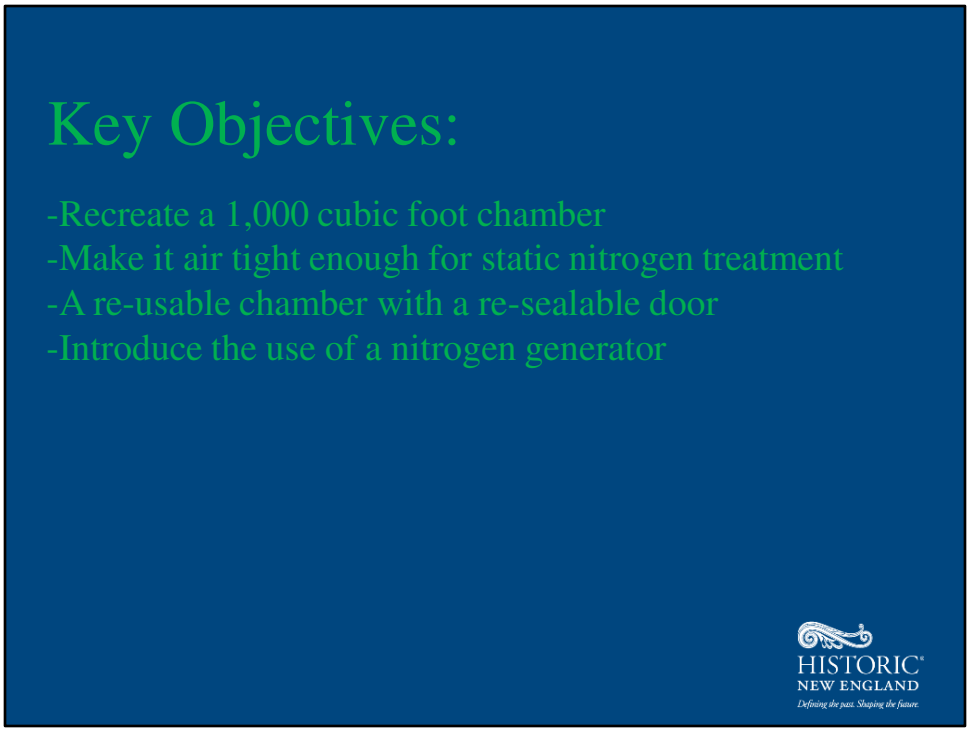
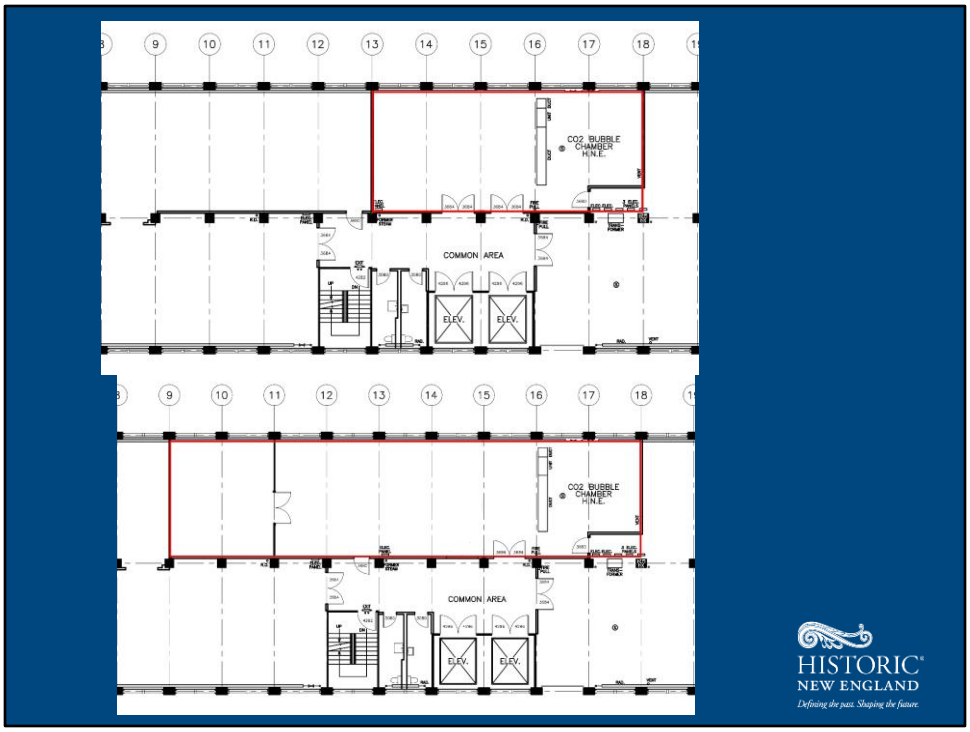
After weighing many options this switch was most attractive in financial sustainability with the introduction of a Nitrogen generator, safety in eliminating the personnel hazards of CO_2 and a positive environmental impact in our use of a non-greenhouse gas. Most importantly we were quite fortunate to have a regular client who wishes to remain anonymous agree to underwrite the entire project. We then contracted Pat as a consultant and Bill to fabricate the new chamber.

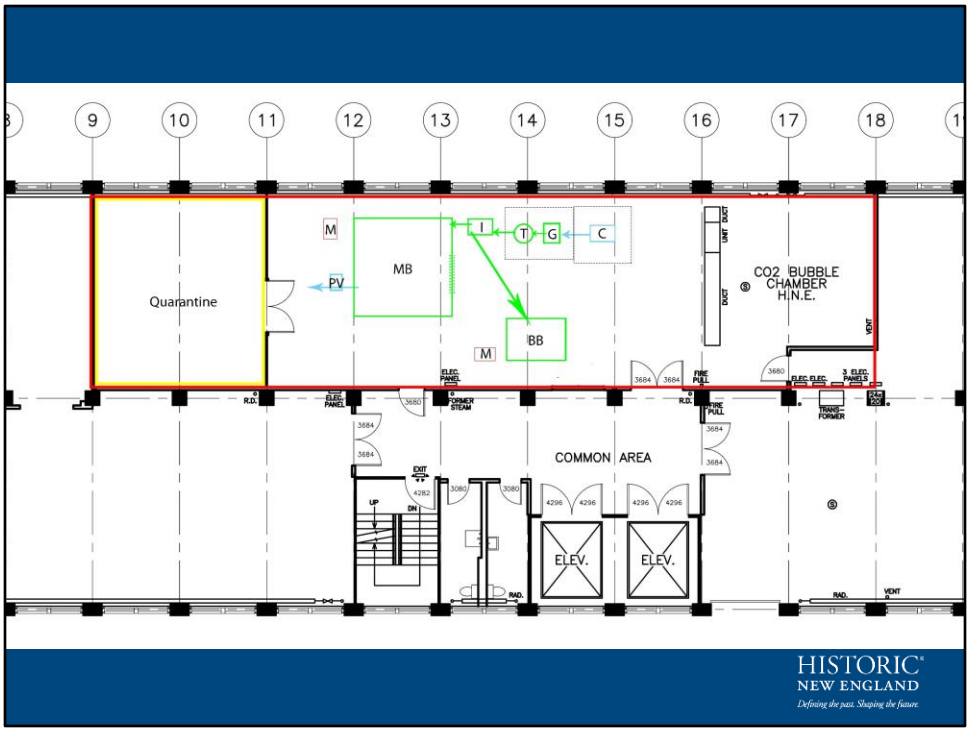


So the key objectives we established when we realized we had the funding to both expand and improve our system were to recreate the same sized bubble, make it tighter so it can handle static anoxic treatments and bring in the nitrogen generator eliminating the need to purchase gas and rent tanks.

The first physical expansion stage of this project is now complete and it nearly doubles our footprint from 1,100 to 2,000 square feet which will allow for the chamber, its components and a “Baby Bubble” for smaller scale treatments.



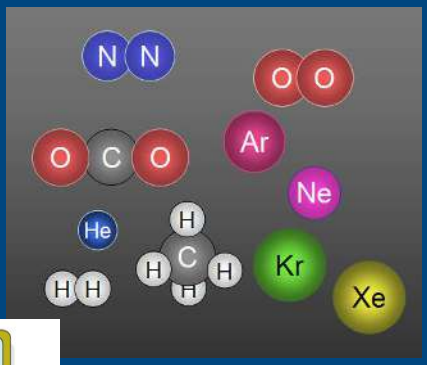
This show the expansion in our floor plan

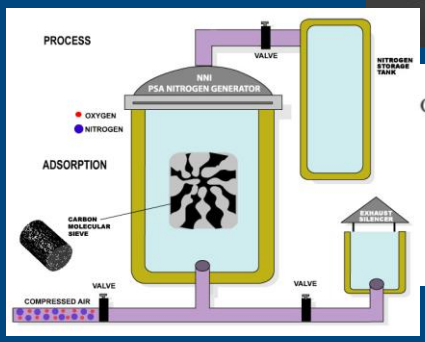


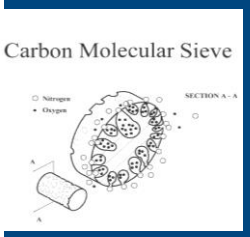
This expansion allows us to continue CO_2 treatments uninterrupted until our Nitrogen comes online at which point we will mothball the old system keeping it in working condition as a backup. We also took advantage of this build out to include a larger 440 square foot committed quarantine to hold objects pre-treatment. In this slide you can see the setup as it will be.

Here you see the from right to left to right the air compressor, Nitrogen generator and buffer tank that were brought into the space just three days ago. Both the air compressor and generator require special training which I have not received yet so I'm afraid I can't go into too much detail on how this all operates.

- **Air Composition, by Volume:**
  - 78.1% Nitrogen
  - 20.9% Oxygen
  - 0.93% Argon
  - Trace gases







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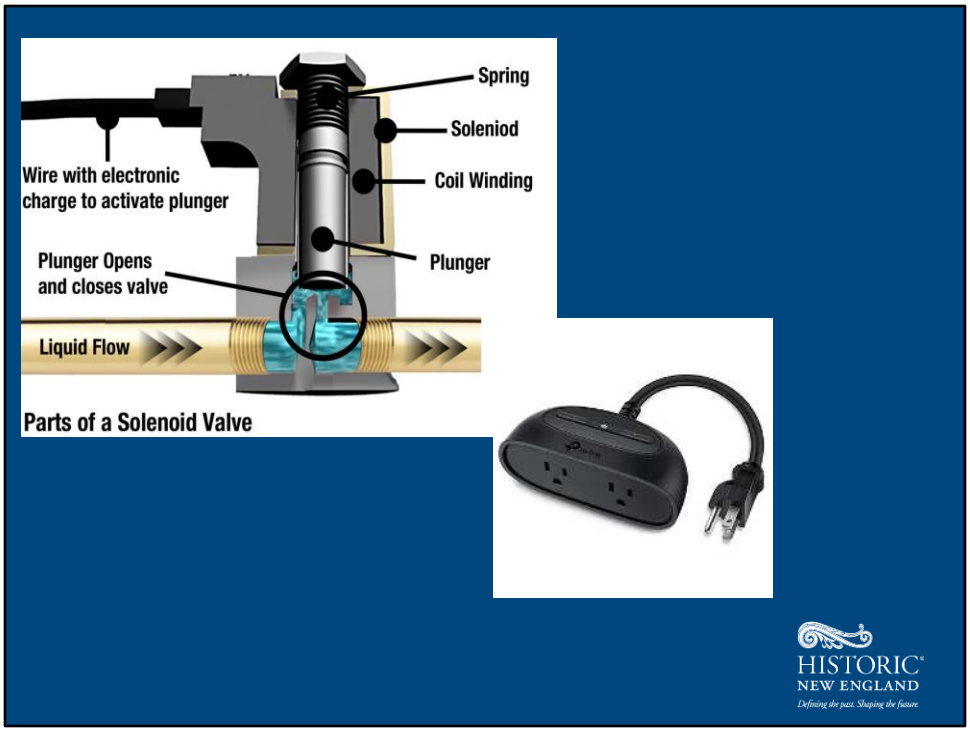
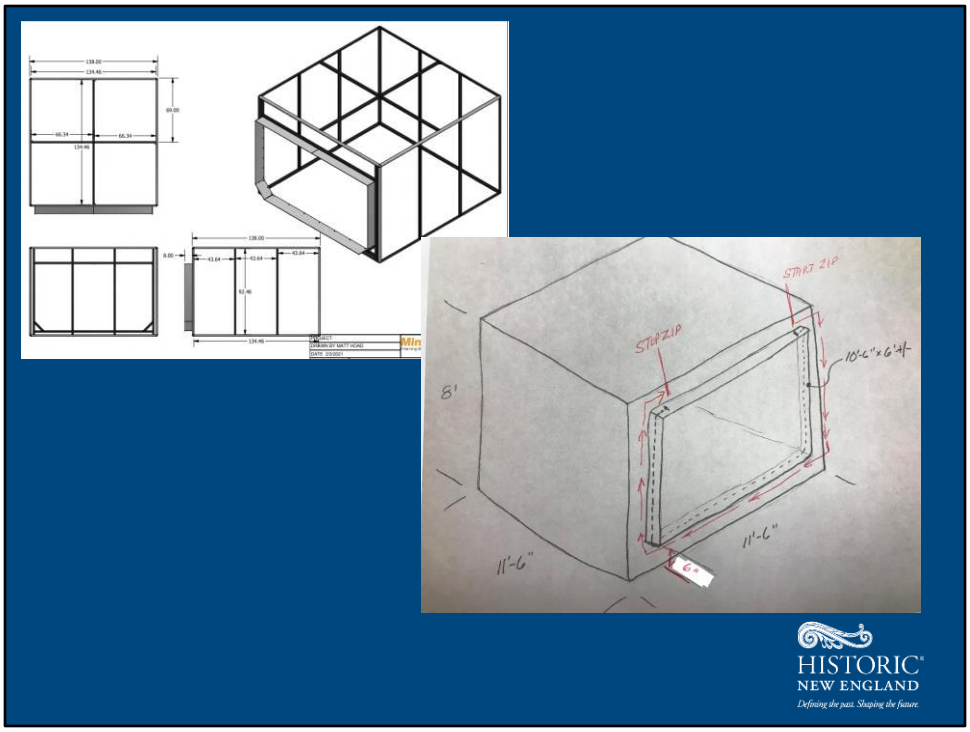
This nitrogen system uses the process of adsorption which is the process of atoms, ions, or molecules adhering to the surface of the adsorbent.



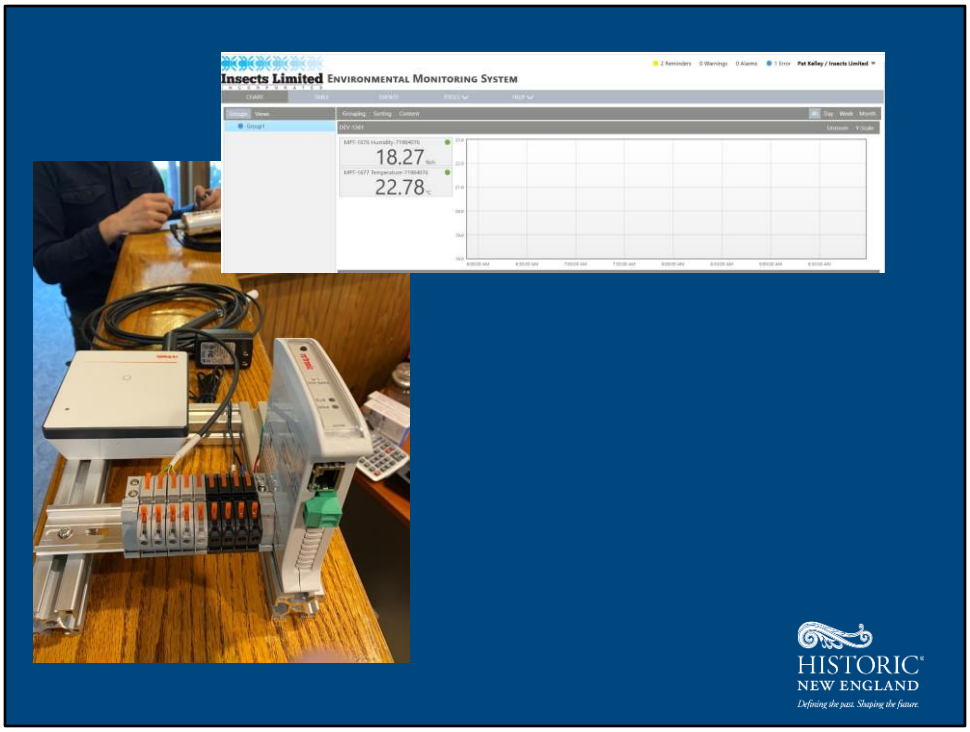
Here is a diagram of the valve we will be using to accomplish our remote gas addition. The only difference is that we are introducing gas rather than liquid. The control of this valve is accomplished with a smart outlet and the cellphone app that comes with it.

This customized humidification system put together by Pat Kelley again hard to fully illustrate with images takes the pressurized and dry nitrogen coming from the nitrogen generator and splits the stream of gas into two separate hoses. The first hose runs through specialized jet nozzles that are mounted beneath deionized water in a water chamber. After the humidified nitrogen runs through the water, it leads to a second dry blending chamber. The second hose from the nitrogen generator runs directly into the blending chamber. Both the humidified nitrogen and the dry nitrogen flow can be changed manually with brass knurled knobs that are finger adjustable. By simply increasing or decreasing the flow of dry vs humidified gas, you can dial in whatever RH you want going into the bubble. This system has been specially designed to allow for pressures up to 10 psi for a strong flow in the relatively large space of the bubble. If something goes wrong and pressures in either of the chambers goes over 10 psi, relief valves are built into the top of each to make sure that the pressures in the chambers does not reach a dangerous level.



The bubble fabrication is not yet underway but here are some drafts from our colleague Bill.

The membrane material VaporBlock® Plus™ 20 is a seven-layer co-extruded barrier made from state-of-the-art polyethylene and EVOH resins VaporBlock® Plus™ 20 is more than 100 times less permeable than typical high-performance polyethylene vapor retarders. And here is an imasg eof the three track zipper design.



Lastly The monitoring system will allow for Temperature Relative Humidity and O_2 to be monitored in person or remotely using cloud technology.

This project is far from over and there are many details to be worked out as we come closer to final install in late spring or early summer and I look forward to sharing more when it's finished.