Utilities have a commitment to establish and maintain material control programs to assure the safety and reliability of generation facilities. Economic considerations demand that shelf life for a limited life item be maximized without affecting plant safety. This presentation will focus on the positive changes and best practices in regards to chemical control and shelf life programs including industry best practices surrounding shelf life and storage of components with age sensitive parts (i.e., Circuit Boards and Power Supplies).
With the current focus on cost control, costs associated with shelf life expirations is typically significant to each and every plant. While shelf life cannot be avoided, this presentation will discuss consistent practices regarding all aspects of chemical control such as:

- Product approval
- Labeling requirements
- Storage requirements
- Performing and maintaining chemical inventories
- Process for managing excess, obsolete or expired chemicals.
The purpose of the Chemical Control Program at Duke Energy is to evaluate, select and approve chemical products to be procured and used by Duke Energy employees and contractors while at the same time taking into consideration the impacts to both the individual and company during the entire life cycle of the chemical.

The nuclear chemical control program includes all requirements contained in the corporate chemical control program as well as business unit specific requirements.

The procurement/approval parts of the chemical control program do not apply to business units who do not procure products through the Duke Supply Chain systems, e.g. Commercial Renewables. However, e-TRAC is still used as the repository for all SDS.

Chemical evaluation, selection and approval is a critical aspect of Duke Energy’s overall chemical management program.
The selection process balances the needs of the end-user by selecting the best performing product while considering the concerns for personnel health and safety, protection of the environment, protection of plant equipment and economical impacts to the company associated with shelf-life and disposal costs.

Takes into consideration;
• Market Availability
• Cost to Procure
• Current Company Contracts

Management of an approved list of chemicals by EHS enhances regulatory compliance, minimizes personnel health hazards and exposure, controls environmental issues, reduces liabilities across the enterprise, and reduces costs through produce standardization.
New Products are Considered for Approval When:

- They correct a problem or provide an improvement with performance or EHS criteria
- The current approved product is no longer available from the manufacturer
- Market conditions change significantly (cost or availability)
- A new market function has been identified for which there is not an appropriate approved product.

If an equivalent chemical already exists in the SDS depository (e-TRAC), the requestor will be directed to use the equivalent unless it meets one of the criteria stated above.

Approved chemicals products are associated with a single stock code in Maximo and CAS. 1 Stock Code = 1 Mfg. P/N
Procurement of Chemical Products:

- Chemicals must be reserved through the business units Work Management System.
- Stocking levels are determined by shelf life and historical usage.
- Supply Chain is responsible for the procurement of all chemicals (Purchase Order / Contracts) with the exception of chemicals procured by the Fuels Procurement.
  - Only approved chemical products can be specified in contracts issued by the Fuels Procurement group.
- Credit cards cannot be used to procure chemicals unless it meets “emergent” criteria.
- If there is a need to use a chemical product containing a banned constituent, the requestor must have approval from the highest level of site management (i.e. Business Unit VP for asbestos).
Receipt of Chemical Products:

- Storekeepers / Material Handlers must verify the chemical product being received matches trade name, size container, part number, manufacture, etc. as specified on the PO.
- Any updated SDS provided with the shipment are emailed or sent to EHS in Raleigh.
- Chemical containers that do not have a legible label or a label with adequate hazard warnings must receive a chemical control label.
  - Note: Nuclear Supply Chain is required to place a chemical label on all chemicals received.
Storage and Segregation of Chemical Products:

- Facilities that store less than 30 gallons of flammable/combustible chemicals (i.e. safety cans, aerosols, etc.) do not have to utilize a flammable cabinet.
- Chemicals must be stored in designated locations to ensure compatibility.
- Do not store chemicals near a storm drain or sanitary sewer where an accidental release could occur.
- Separate storage locations are required for the following:
  - Nitric Acid
  - Sulfuric Acid
  - Hydrogen Peroxide 35%
  - Hydrofluoric Acid
  - Hydrochloric Acid
  - Explosives
Benefits of a Single Chemical Control Program:
- Prevents duplication of chemical products in inventory
- Limits the number of stock codes associated with chemicals that perform the same functions.
- Surplus inventory can be transferred between facilities which reduces the cost of disposal
- All SDS are located in a single repository (e-TRAC), including chemicals brought on site by contractors
Control of Products / Equipment with limited Shelf Life:

• The process for maintaining and controlling shelf life activities must meet requirements of EPRI 1022959, Guidelines for Establishing, Maintaining and Extending the Shelf Life Capability of Limited Life Items.

• Generally the service conditions when the item is installed in the plant are more severe than the conditions encountered while in storage awaiting use in the plant. An underlying assumption is that the shelf life of an item should be established such that its qualified life or service life is not reduced by the length of time in storage.
Shelf Life Program

Control of Products / Equipment with limited Shelf Life:
- Monthly reports are generated that provide a 30-60-90 day look ahead for all items identified with expiring shelf life
- Chemicals / Equipment with expiring shelf life are reviewed by Supply Chain. Engineering determines if shelf life can be extended using the EPRI Guidelines.

<table>
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<th>Expiration Date</th>
<th>Stock Code</th>
<th>Q</th>
<th>UTC Number</th>
<th>UTC Qty</th>
<th>UI</th>
<th>Lead Time</th>
<th>Order By Date</th>
<th>Catalog Description</th>
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<td>xxxxx</td>
<td>8</td>
<td>EA</td>
<td>12</td>
<td>3/19/2019</td>
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<td>1</td>
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<td>xxxxx</td>
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Separating the junk from the valuable

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<tr>
<th>CatId</th>
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<th>PartNumber</th>
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<th>QtyMin</th>
<th>QtyMax</th>
<th>UsePast</th>
<th>UseYtd</th>
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All seven (7) were not issued to the plant but scraped due to Shelf Life
Make sure that actual usage from total usage (including scrap) is understood

Everyone can be different

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>PartNumber</th>
<th>Description</th>
<th>On-Hand</th>
<th>Min</th>
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<td>03572050-xxx</td>
<td>BOARD CIRCUIT ADC/DAC</td>
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<td>1</td>
<td>1</td>
<td>0</td>
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</tbody>
</table>

Are you aligned? Missing age sensitive components or no age sensitive components?
Capacitors are more prone to age related failures than any other subcomponent. Aluminum Electrolytic Capacitors (AECs) have a design which is more sensitive to age related failures. For this reason, the AECs are generally held as the problem when a power supply / circuit board fails.

Overtime, age sensitive subcomponents go through changes that result in variations in the subcomponents performance. These changes are the results of various factors, such as operating temperatures, ambient temperatures, radiation exposure, vibration, etc. Also, aging of one subcomponent, could lead to additional stresses for another subcomponent.
A recent Paragon project which included testing warehouse stocked Circuit Boards that were determined to be critical to plant operations by engineering. Two trends were identified:

**Previously Repaired:**
A poor repair, albeit from poor work instructions or procedures, lack of training or technical experience or just a lack of attention to detail, can contribute to increased failures.

**Improper Storage and/or Age:**
While the industry developed and implemented the vast EPRI corrective action, that action has only been in place a short while (+/- 5 years). It is widely understood that the longer a card sits unpowered the more likely it is to have issues when powered up down the road.
Benefits of Extending Shelf Life through Repairs / Refurbishment

- Parts and Equipment with limited life components can be repaired for 50% of replacement value
  - If cost to repair / refurbish is less than 50% of replacement cost it is sent offsite for repair
  - In house repairs are not as common as they once were
- Parts and Equipment with limited life that are no longer manufactured can be refurbished to like new condition. This avoids internal costs such as:
  - Equivalencies
  - Engineering Change Packages
  - Removal of Obsolete Inventory
  - Purchase of Replacement Inventory
Identifying and flagging future repairable components:
Control of Products / Equipment with limited Shelf Life:

- Installed Equipment containing products with limiting shelf life items expiring are identified through the site’s Preventative Maintenance programs.

- Efficiency Bulletin: 17-03a Value-Based Maintenance
  - Through the implementation of value-based maintenance tools, station maintenance budget required to maintain high levels of equipment reliability is expected to be reduced by at least 25%
  - When changes are made to PM tasks that extend frequency beyond the normal service life recommended by the vendor, a healthy technical conscience requires that the basis of these changes be retained so this information is readily retrievable