

ManTech
International Corporation

Cleanroom Garment Silicone Contamination

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Cleanroom Garment Silicone Contamination

- Background
 - GSFC
 - Facilities
 - Hardware
 - Why silicones are bad
 - Cleanroom Garments
- Actions Taken
- Lessons Learned
- Results
- Questions

Background

- Facilities
 - SSDIF
 - Others
- Projects
 - HST
 - WFC Build Up
 - New Horizons
 - STEREO
 - JWST

Background

- Why silicones are bad
 - Creeping
 - Outgassing
 - Removal

Background

- Particle contamination Impact
- Molecular contamination impact

Background

- Type of garments we rent & number
- Distribution Process
- Gowning procedure

Background

- Cleanroom garment vendor was changed in December 2004
- In mid March 2005 one customer's off handed remark about an odor on the cleanroom garments prompted a rinse request
- Silicones have no odor, request was an effort to be difficult?
- Without any previous experience sampling garments, a random rinse of the material was performed
- Consulted materials branch at GSFC for procedure
- Additional rinses showed silicone
- "Crude" transfer test was performed also showing silicone

Actions Taken

Meetings were initiated with GSFC's Contamination Engineering Group and other interested parties

- Twice daily with 20-30 participants

2-3 different cleaning procedures were suggested by the laundry company but none proved successful

4 washes

Orange Cleaner

Dry Cleaning

10% of each batch of cleaned garments were rinsed

- Acceptable levels were undetermined

Garments were removed from facilities except DDL (no concern for silicone contamination)

- Signs posted warning of the issue

Samples of gowning rooms and other areas possibly contaminated were taken

- No evidence of contamination by garments

Additional Actions

- Other initiatives pursued
 - Samples from other converters and laundries were requested and tested
 - Industry expert was put under contract
 - Disposable garments secured and tested
 - ESD Characteristics were in question
 - Other contaminants/residuals may be of concern
 - Old COG garments tested negative for silicone and put into service

Continuing Actions

- As efforts continued
 - Small group of team members visited laundry looking for issues with their process and “smoking gun”
 - Work instruction to standardize sampling was initiated
 - Smaller “Tiger Team” was identified to facilitate process and decisions
 - Dry clean wash suggested and results were promising
 - 10% of 2 batches were tested and results negative
 - Last batch of 10% all were positive

Turning Point (5/23/05)

- All new, silicone free garments were requested from laundry service
- Samples from our laundry company's in house stock and other converters were tested
- ESD requirements were addressed
- "Tiger Team" concluded with identification of garments from an acceptable vendor that met silicone and ESD tests.
- On-site audit was conducted at converter with laundry service to observe process
- We have a verification procedure
- Last batch of booties were positive

Lessons Learned

- Investigation teams should be established with 6-8 members
 - Initial meetings with 20-30 members were difficult to manage
 - Comments and concerns from others in the organization should be funneled through team members
 - Members of the team should be from appropriate organizations

Lessons Learned (cont.)

- Never Checked transfer test to very level B

Lessons Learned (cont.)

- Ask the experts
 - We took the lead to investigate this matter and too many attempts were made to clean the garments at our request and direction
 - Laundry and industry expert advice and involvement is key and must be kept up

Lessons Learned (cont.)

- Sampling & cleaning plans & protocols should be established in a methodical and controlled manner and the capacity of the testing facilities assessed objectively
 - Facility cleaning procedure was ready for implementation when new information required a procedure rewrite
 - Standard sampling plan was not developed and implemented until well into the investigation process
 - Laboratory that normally processed 2-3 samples per day went to more than 20 per day overnight, without the infrastructure for the increase

Lessons Learned (cont.)

- Silicone issues in laundry were not well known at GSFC and in aerospace industry
 - Appears to be well known in other industries such as disk manufacturing

Lessons Learned (cont.)

- Establish limits
 - Only one project CC manager established an acceptable limit
 - Our criteria is “undetectable by FTIR”

Lessons Learned (cont.)

- Be prepared to examine all aspects associated with the initial problem
 - Disposable garments were not approved for use in ESD sensitive areas
 - ESD testing of proposed replacements had to be initiated
 - COG garments found unacceptable for ESD while more in depth testing of disposables revealed they were acceptable
 - Disposables had other contaminants such as DOP

Lessons Learned (cont.)

- Silicones are ubiquitous!
 - Hair gel, skin lotions, “Return to Flight” & other charitable organization wrist bands
 - Some adhesives and materials used on flight hardware
 - In consumables

Results

- Awareness of silicone issues in laundry and in other aspects of hardware processing was raised at GSFC
- Infrastructure and support of testing lab will be increased
- Protocol to verify garments at different stages will be instituted: from converter, during laundering, and upon arrival at GSFC
- Closer work with laundry and converter will result from the monitoring

Results

- Specification for laundry services and garments will be strengthened, including not only silicone contamination, but ESD as well as particulate generation
- All consumables will be tested for NVR before use in GSFC cleanrooms, including gloves, wipes, solvents, etc.
- Silicone found on face masks, we had a process to deal with them and it worked.

Questions

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