WHY MEMNON

Memnon is the leading name in protecting legacy media and content archives, enabling storytelling through partnerships with content custodians around the world.

In 20 years, Memnon has migrated 5 million hours of content. Our mission is to ensure that the world's content is preserved, discoverable and accessible. Without our help, irreplaceable content stored on physical media will be lost for good due to accidental damage, degrading beyond repair, or the obsolescence of the equipment needed to play legacy media formats

THE SILENT THREAT TO AUDIO AND VIDEO

In recent years there has been a noticeable shift in organizations attitudes around how they value their content and the increasing risks to content through format deterioration and machine obsolescence.

This has resulted in a considerable increase in requests and the demand for digitization. In the last 18 months, Memnon has migrated 650,000 hours of content and in the next 18 months Memnon anticipates migrating over 1.25M hours of content, equivalent to 30% of what has been delivered in the past 20 years. In the past year alone, we've quoted for over 7 million hours of audiovisual content to be migrated – close to double what we've achieved in two decades. At maximum throughput in our largest facility, that would equate to almost 30 years of 24/7 automated digitization.

Over time, physical multimedia formats, both analog and digital, gradually become unstable and ultimately degrade to the point of being irretrievably compromised. In recent years, we have witnessed a significant acceleration in the degradation of the magnetic tape which has been used to store this valuable archival content.

Added to that, legacy technologies such as VTRs are rapidly falling into obsolescence; working equipment is becoming increasingly difficult to source and maintain. Analog equipment – along with much of the hardware needed to play many digital formats – is no longer manufactured. The same goes for the spare parts needed to maintain what legacy hardware does still exist, making it difficult to keep those machines operational.

These factors add up to an ever-narrowing window of opportunity for preservation of content held on legacy formats. There is a general consensus amongst experts, including UNESCO and the EU, that this window extends only as far as the next five to 10 years – and for some formats even less. It is an accepted fact that head hours for VTRs will expire long before all content has been migrated.

MEMNON'S EXPERTISE

Twenty years ago, Memnon was born out of a realization that the looming threat to physical archives was not being addressed in any adequate or far-sighted way. There was an almost total lack of emphasis on the mass migration of at-risk collections to the file-based formats that would preserve their longevity.

Today, Memnon's mission is focused on safeguarding the historical, cultural and narrational import contained within these collections, before they are lost forever. It is at this meeting point that the goals of THE CUSTOMER and Memnon intersect.

To achieve our mission, we have invested heavily in the people, skills and tools that underpin the work that we do:

Technical & engineering expertise: our technological prowess sets us apart. We're experts at designing and building innovative customer-focused solutions that handle the library migration process for clients. That's why so many organizations trust Memnon.

Industry knowledge: we have a long history and proven track-record of handling and managing the most fragile and valuable media assets. Our company has been built by industry experts who understand our customers' needs inside and out. With a deep understanding of legacy formats, we have the insights and experience to solve clients' biggest challenges.

Full-service infrastructure: Our state-of-the-art facilities, enviable inventory of legacy and modern technologies, and engineering expertise are all unmatched in the market – all supported by our extensive partner ecosystem. And with years of experience delivering on-premises solutions for our clients, you can be assured that the video migration facility for THE CUSTOMER would be built to high standards.

Simplicity at the heart of our solutions: Our bespoke migration orchestration platforms, tried and tested processes, unsurpassed inventory of legacy hardware, ongoing technical support, and continuous research and development in the archive migration space mean we have refined our solutions to be simple and efficient

UNMATCHED INVENTORY OF EQUIPMENT AND SPARE PARTS

Memnon owns and maintains equipment and spare parts to ensure best quality and maintenance of the used legacy equipment. Memnon owns more than 3,000 playback machines and spare parts (including heads).

To secure an on-going operation, additional VTRs are available for swap-out for each format if mechanical problems occur. The Memnon Archiving Services is in the unique position of having broad experience in BOTH the older legacy equipment and the very latest technology.

COMMITMENT TO MAINTENANCE EXCELLENCE

The condition of the migration equipment is most critical for each project. Memnon puts considerable efforts to ensure the condition, maintenance and overall performance of the equipment meets the highest standards. Therefore, we operate only fully operational and professional equipment.

Memnon has a dedicated team of full-time staff for maintenance.

Machinery maintenance and operating routines are an important part of the Memnon workflow, supporting efficient operation and ensuring the highest quality migration possible. To ensure this, Memnon operates a 3-level maintenance plan.

LEVEL 1: OPERATOR MAINTENANCE Operators monitor the status of the equipment and perform checks every shift. Regular checks and cleaning are performed at least once per day.

LEVEL 2: IN-HOUSE ENGINEER MAINTENANCE Machines are regularly inspected and tested with measurement tools, and their number of hours in operation is also logged. Every player runs a digital timer centrally controlled by the Memnon ORKA system to flag maintenance requirements. Our maintenance engineers realize the operational servicing and daily maintenance requirement. Further, they monitor the runtimes and maintenance and overhaul schedules.

LEVEL 3: OVERHAUL AND SCHEDULED MAINTENANCE: We include periodic or incidental transport mechanism or head refurbishment. All equipment sent out to our off-site operations around the world is inspected before they are sent to our Memnon facilities.

OVERALL MAINTENANCE MANAGEMENT: This method of combining three levels of maintenance with trained operators, dedicated In-House engineers and specialist providers ensures targeted maintenance goals, a better policy than strictly following the ”manufacturer” maintenance program – designed for traditional postproduction studio conditions which do not correspond to the problematic of using playback machines for large-scale migration (only “reading”; “no “recording”). Finally, all repairs and maintenance operations are tracked and monitored in the Memnon asset management platform. The UID (Unique Identifier) of the machine used for migration is registered for each delivered file, which guarantees traceability to a possibly defective device.

PROPRIETARY ORCHESTRATION PLATFORM

Memnon uses fully scalable and modular concepts to allow for the right setups for individual contracts. We optimize the migration process based on each unique media’s characteristics. Our facility and production lines can all be reconfigured and scaled. Our modular system is the basis for our various off-site deployments around the world. A key factor for our success completing high volumes at quality standards is that we operate our own proprietary software for workflow and ingest management (called ORKA). In contrast to commercial workflow systems, it is specifically designed for large-scale migration projects and combines the physical workflow and carrier management with the digital file-based workflows as well as the business processes related to it.

CARRIER TRACKING CAPABILITY

We start each media format by scanning barcoded items into our software system. At that time, the items are inspected, and any potential issues are flagged for further inquiry. All results are logged in the metadata. By managing the item level processes with barcodes, we can provide detailed migration information and trace assets at any time during production. We trace and track every 1) configuration including players or scanners, transcoders, and servers though which the file moves, 2) every movement through each stop of the physical carrier, 3) every operator and operation of the operator in the system for full tractability and quality control.

ABILITY TO RESPOND TO SPECIAL CASES AND EXCEPTIONS

At times, carriers must be set aside because their condition does not allow any treatment under a ‘normal process.' There are very few conditions we are unable to address. These would be limited to extreme cases of degradation like blocking and pinning, or squealing tapes that cannot be baked.

Poor condition carriers will put aside into a group. These carriers will be aggregated and next steps for potential specialty treatment or repairs will be discussed with the Customer. No unbudgeted remediation action will be taken without written permission from the Customer. We will work together with the Customer to prioritize based on a combination of the perceived value of the content and the risk of the specific media.

The remedial action available for carriers with issues might include processes such as additional cleaning, baking, splicing and rehousing carriers. This process has minimal impact on throughput and maintains a high level ingest, however some carriers may show unreasonable or unsolvable difficulties which are not possible to be resolved. A carrier that cannot be repaired for commercial, physical, or technical reasons is identified as an ‘Exception’ in our database and the physical carrier is quarantined and failed. All details are available to our clients via an Exception Report detailing the issues. This report forms the basis of a triage process.

PROCESS CONTROL METHODOLOGIES

Memnon employs Process Control methodologies based on best industrial practices allowing us to reach a quality level well above 99%. Any deviation from our process control will trigger a check of the equipment involved, which will be replaced if needed.

We constantly apply our 3C methodology: "Contain, Cause, Correction". This means that when issues are found in quality (either internally or brought to our attention by the Customer), all affected carriers are set aside in the workflow to prevent delivery of problematic files. The cause of the problem is then identified and resolved before applying the correction to any affected files. If the issue affects files which have already been delivered, Memnon will reach out to the Customer with a list of problematic deliverables which will require re-delivery. From here, Memnon will prepare the re-delivery of any needed files and wait for confirmation from the Customer that the problematic files have been removed from their storage before commencing with re-delivery. If desired, Memnon and the Customer can establish a shared live document to track any quality issues found by the Customer in delivered packages. Otherwise, quality issues should be communicated through email. Memnon is open for business from Monday to Friday, 9am-5pm Eastern Time. Key account personnel will be available to the Customer during these hours.

COMMITMENT TO QUALITY CONTROL AND QUALITY ASSURANCE

As specialists in large-scale migration, our quality philosophy is taken from the industrial production paradigm in manufacturing, which aims at highest output while ensuring highest quality at a consistent level. Our emphasis is on faithful digital reproduction of the original and thereby maintaining the authenticity of archival materials.

WE DEPLOY A 4-STAGE METHOD FOR QUALITY MANAGEMENT.

Stage 1: Quality Assurance focuses on defect prevention including: project set-up and benchmarking, training, transportation; preparation; equipment maintenance etc. Critical elements are Pilot phases in which the end-to-end setup and process benchmark and acceptance testing is performed together with the client before going into volume production.

Stage 2: Quality Control is product oriented and focuses on defect identification. Detecting and identifying defects happens after the file has been created as a product of the migration process.

Stage 3: Our workflow system ORKA is at the core of our Process Control. The system monitors and controls every step in the end-to-end process. Every activity of the operator, status information from the equipment, processing data is logged and automatically managed. Any issue, violation of workflow or exceptions trigger an alert to the operations manager and an automatic exception handling process. Critical errors will trigger a stop of production for a root-cause analysis to identify, contain and correct any issue.

Stage 4: Another method we apply is Continuous Improvement. We operate a JIRA based ticketing system and wiki style knowledge systems to share issues and implement best practices across our operations worldwide.

QUALITY CONTROL

There are two elements to the Quality Control process for Data Migration. First is a validation of a successful copy. The contents of the object are compared to the copy of the object which has been created on our storage. Any discrepancies are flagged and resolved at this point to ensure that we have created a complete match of the object's content. If a discrepancy cannot be resolved due to the condition of the object, it is set aside in a quarantine area and communicated to the client in an exception report. The second is a review of the deliverable .csv inventory created for the object's contents. The inventory is opened and inspected to

ensure that all entries have created as expected when applicable. Any exceptions are set aside and brought to the attention of our software developers to employ a corrective action and create a new complete inventory file.

Memnon delivers file packages for each object. The digested files are integrity checked and validated before transfer to the central storage environment. All files are validated through an MD5 integrity check that at the reception into the central storage and further at delivery to ensure that no alteration or corruptions of the files have been done in the process between.

The Memnon facility-wide QC System covers post-ingest QC and pre agreed specifications and cost. The ingested files are checked for file structure and technical accuracy, and the standard Memnon QC workflow can include both automated and manual QC checks.

The content filename is first automatically checked against the imported inventory and a file header check is completed against the required header specification.

Under the Memnon standard manual QC process, the operator performs a five-point spot check; the file is checked at the beginning, end, and at three points mid-content in each file.

At each points the following evaluations are made:

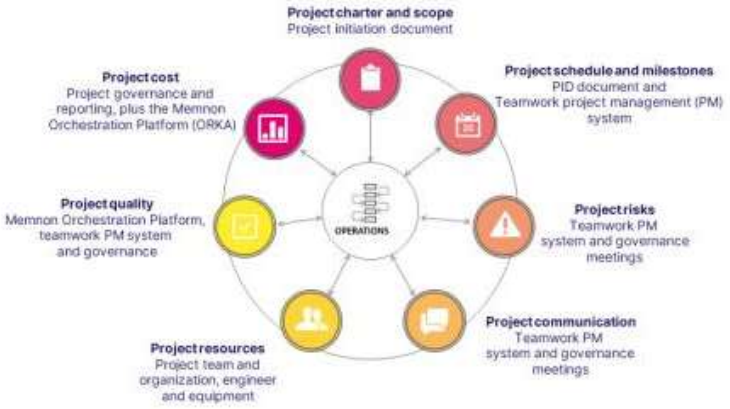
- Does the content match the title details or accompanying records?
- Does the file play smoothly and/or at the correct speed?
- Does the content look and feel correct - e.g. skin tones, grass or sky color, etc?
- Are there unwanted artifacts such as: excessive drop-out, ghosting, stuttering, or blocking in the case of images; and hiss, hum, buzzing or distortion in the case of audio?
- Is the aspect ratio correct e.g. images look unnaturally stretched or squashed?
- Does the audio match the video content, and is it too loud, quiet, or out of sync?
- Is the content / program complete, e.g. missing the beginning/end or has unexpected gaps or breaks?

As part of the Betacam family migration process the Sony ISR (Interactive Status Reporting) VTR reports are utilized to assist the QC process.

Each ingested file that fails QC is sent for a 2nd pass ingest and if unsuccessful, Memnon may attempt remedial work to the carrier or VTR. If further attempts are also unsuccessful the file is flagged as an “Exception” in our database. The file in error is placed in a separate folder and the asset record updated by the operator, stating the issues observed. The Memnon CSR will make all information available to you via a periodic Exception Report. This report forms the basis of a triage process.

EXCELLENCE IN PROJECT PLANNING AND SCOPING

A lot goes into ensuring our projects go without a hitch. That’s what makes Memnon the trusted digitization partner of the largest global broadcasters and institutions.



OUR PROVEN METHODOLOGY AND TOOLSETS

- Project initiation document and structure
- Documentation and Templates
- ISO9001 business process model design and documentation
- Project team and governance
- Proprietary Memnon systems, especially our Memnon Orchestration Platform designed for largescale digitization
- Toolsets:
  - Cloud-based teamwork project management system, including access for DIA
  - Operations management dashboard (PowerBI based)

OUR APPROACH TO ASSET AND DATA MANAGEMENT

Memnon limits Admin accounts to users on specific machines required and do not give them domain Admin access. Any user requiring Admin access to a workstation will need Admin elevation by an administrator. Client data: we can segregate out data if required. Client records can be deleted upon request. Our production storage is a RAID storage system. The storage is restricted to operators and can't be accessed from external locations. The Memnon central IT infrastructure and storage are based on datacentre graded equipment and high-performance storage and network infrastructure and UPS power protected. Files will stay in Memnon system up to the acceptance of deliveries by the Customer representatives. The system will be set up to automatically manage an acceptance and retention period of 45 days. If files are flagged as explicitly not approved, the retention period will be automatically extended, and the file flagged for further review of escalation in the process. Upon approval by the Customer, Memnon will proceed with the deletion of files from its central storage. This process is managed automatically by the Memnon Production Management System to ensure that no files are left over and follows secure data erasure procedures where data is overwritten with a data pattern before deletion of the file itself. Digital deliveries and file management are generally automatically managed by the ORKA.

PRODUCTION

MEDIA HANDLING

DELIVERY OF ASSETS

The Customer will work with Memnon to ensure the regular delivery of assets to Memnon's facility. For Memnon to hit the forecasted production targets, the customer must deliver batches of media at a cadence that matches Memnon's ingest speed. Regular reviews of this cadence will be discussed between Memnon and the Customer's Project Manager throughout the project.

Once the carriers have been prepared and are ready for delivery, the Customer's Project Manager will advise Memnon of the total number of pallets/bins and provide a full inventory listing of the media carriers including to the best of their ability the format breakdown.

Ideally Memnon will receive a full manifest tracking assets first to the individual box (and then pallet) – this will allow Memnon to ensure content is available to the Customer for emergency retrieval throughout the process if required. If the carriers are already barcoded, ideally the assets will be logged to a box with an electronic inventory provided to Memnon.

Memnon's Project Manager will liaise with the Customer's Project Manager to provide confirmation of receipt and any discrepancies during the inbounding process at the Memnon facility.

The Customer's Project Manager will be responsible for managing all comms. with Memnon around delivery (packing, collections, and deliveries).

Assets will be deemed ready for delivery when:

1. The agreed inventory has been picked and boxed (ideally by format).
2. Electronic Inventory list is available.
    - Ideally inventory manifests will be at item level i.e., a full list of all media carriers located in each but if this is not possible then the minimum requirement will be at box level.

OBJECT STORAGE AND SECURITY

STORAGE

On receipt of assets into the Memnon facility the manifest will be checked and reconciled with the inventory logged into the Memnon Orchestration platform 'ORKA'. Bins/pallets will be visually inspected, and any noticeable damage will be photographed and shared with the Customer's Project Manager. Any items noted to be damaged will be quarantined until the Customer's Project Manager has reviewed the documented evidence and advised how they would like to proceed.

From the time of receipt and initial logging at Memnon all further processes in the workflow will be logged creating a complete chain-of-custody report for each asset through the migration process until the asset is returned to the Customer.

Assets will be stored on the pallets/in the bins they are received. They will remain on their original delivery pallet/bin until they are scheduled for processing when they will be logged and enter the migration workflow. .

SECURITY

We run an ISMS. An ISMS (information security management system) provides a systematic approach for managing our information security.

This centrally managed framework enables us to manage, monitor, review and improve your information security practices. This is a constantly evolving process.

It contains policies, procedures and controls designed to meet the three objectives of information security,

Confidentiality – making sure only authorized people and devices can access the data.

Integrity – keeping data accurate and complete.

Availability – making sure data can be accessed when you need it.

This takes a physical form using an ISO27001 approach which establishes the above across Physical / Digital and management security policies, process and evidence.

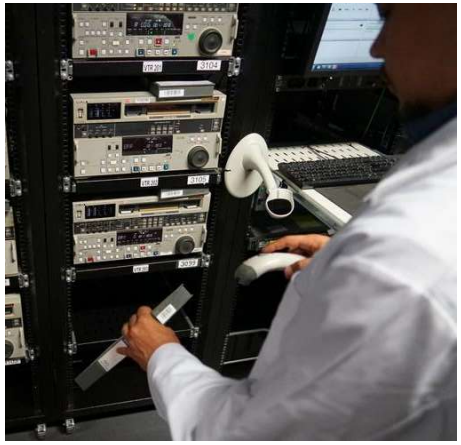
PRODUCTION ENVIRONMENT

Typical production environment requirements are akin to a standard broadcast MCR.

OBJECT TRACKING

Having a unique identifier (barcode) is critical to manage chain-of-custody, workflow and connect all associated metadata and processes.

If barcodes are available, the Memnon team will use those as often as possible. In the event that a barcode is missing or damaged, Memnon will affix a new barcode to the carrier as a unique identifier and to track the carrier throughout the migration process.



INSPECTION OF CARRIERS

Prior to migration each carrier undergoes a physical inspection to determine any potential issues. Our experienced ingest operators can identify types or stock that exhibit known traits and therefore might need remedial action. The carrier is physically checked for integrity and condition. The operator will also check for the presence of any residue or mold which can accumulate during storage.

Optical carriers (CD & DVD) are inspected for heavy scratching or wear and hand-cleaned with a microfiber cloth if necessary to remove debris prior to ingest.

FILE NAMING CONVENTION

Our recommendation is as follows:

The maximum filename length must be under 70 characters and should exclude special characters:

(no illegal windows characters in filename)

< (less than)

> (greater than)

: (colon)

" (double quote)

/ (forward slash)

\ (backslash)

| (vertical bar or pipe)

? (question mark)

* (asterisk)

…and spaces

The easiest filename would be [Barcode].mov and leave descriptive out. Metadata can be posted back via the barcode as a unique ID on the delivery manifest that can be delivered at some agreed upon cadence.

If more descriptive metadata is required, it is strongly recommended to keep the barcode in the filename to ensure each filename is unique.

If Title is required, we recommend keeping it within a few words as to not create a long filename which can cause issues with certain filesystems.

Special characters will be removed from the filename. Spaces will be replaced with underscores and/or hyphens. Duplicated filenames will be given a suffix.

METADATA.

Memnon offers robust and custom metadata to our customers. In the case that the customer requires us to catalogue and enhance metadata during ingest, we can provide intake and delivery manifests that meet almost any specific requirements.

SIDECAR METADATA

If required, a sidecar media info file can be provided as a part of the package to communicate technical details of the file. Other custom metadata schema can be requested if needed.

DELIVERY MANIFEST

A delivery manifest can be delivered at a predetermined cadence to describe the packages that have been delivered, usually this is in the form of a csv or xlsx file. Headers include but not limited to:

- Barcode
- Title
- Date
- File size

- Duration
- Checksum
- Ingest/QC Comments and status
- Physical bin/pallet

MIGRATION PROCESS - VIDEO

BARCODING AND TRACEABILITY

Once a batch of tapes is cleared for digitization, our operators will scan the barcoded items into our software system. At that time, the items are inspected, and any potential issues are flagged for further inquiry. All results are logged in the metadata. By managing the item level processes with barcodes, we can provide detailed migration information and trace assets at any time during production. We trace and track every 1) configuration including players or scanners, transcoders, and servers though which the file moves, 2) every movement through each stop of the physical carrier, 3) every operator and operation of the operator in the system for full tractability and quality control.

BAKING TAPES

In addition, a process of hydrolysis of the binder can occur on some tapes, typically in polyester-urethane (PEU)-based tapes. This is a chemical deterioration of the binder between the magnetic coating and its base. As a possible consequence, the tapes begin “chopping up” or sticking during playback. In turn, this causes additional damage because mechanical stress and tension on the tape increases considerably leading potentially to break of tapes. This phenomenon is called 'Sticky Shed Syndrome'. When tapes suffer from soft binder and sticky shed syndromes, the playback will suffer from significant dropouts and playback problems and affect the VTR head. Tapes with these problems are baked (Thermal treatment) before migration.

Baking is efficient for tapes exhibiting sticky-shed syndrome and relatively efficient for tapes that cause head clogs on playback devices (VTRs). Tapes are put in our specially designed heating chamber at a controlled temperature for 15 hours at 54°C and 30% relative humidity. This is a non-destructive treatment which we track and document using AtmoCONTROL technology, that is capable of closely managing the operation and temperature curve of the oven chamber. Acetate based tapes are not baked.

As the operator assesses each carrier, they will decide which tapes may require baking, although we do not expect it to be a regular requirement as the tapes are assessed to be in good generic condition. This practice has been extensively tested and implemented in many projects by Memnon.

Our processes are based on unique and proprietary practices and protocols as this is a delicate process. The temperature increase and temperature decrease period is controlled (several hours for increase and several hours for decrease) to avoid temperature shock to the tape media.

From experience, you will find below a list of tape brands that typically benefit from a baking treatment. Problems are mostly with analog Betacam formulations: Betacam Oxyde and Betacam SP. On digital Betacam formats, due to the next generations formulations used, SSS are less common.

POOR CONDITION CARRIERS

At times, carriers must be set aside because their condition do not allow any treatment under a "normal process". There are very few conditions we are unable to address. These would be limited to extreme cases of degradation like blocking and pinning, or squealing tapes that cannot be baked.

Poor condition carriers will put aside into a group. These carriers will be aggregated and next steps for potential specialty treatment will be discussed with you.

Any specific repair or special treatments are discussed with your Project Manager before performing such treatments. We will work together with you to prioritize based on a combination of the perceived value of the content and the risk of the specific media. As an example, U-matic tapes are high risk but only the client can tell us if the content is potentially valuable. The remedial action available for carriers with issues might include processes such as cleaning, baking, splicing and rehousing carriers.

This process has minimal impact on throughput and maintains a high level of ingest, however some carriers may show unreasonable or unsolvable difficulties which are not possible to be resolved.

We provide below examples of commonly failed items. This will not cover every possibility, and it is important to know that all failed items will be communicated with appropriate remediation recommendations & pricing for approval before any further action is taken.

- Blank or black tapes - Blank tapes are brand new from the manufacturer. These have never been recorded on.
- Black tape/Pre-stripe tape - These tapes have black signals, timecode, and silent audio on them. They were prepped for use, but no content was recorded.
- Mechanical playback issue – for example, with some tapes, the tension will bind up and the tape machine cannot progress the tape forward.
- Some remediations might include taking the shell apart, rehouse the tape, manipulating the tape, etc.

- Tape breaks - Typically happens at the end of the tape where it is connected to the hub. Here, an adhesive holds the tape it to each hub. With tape breaks, all the tape is sitting on one hub (not two). Tape breaks have the possibility of being repaired. We can open the tape shell, re-thread it, and apply new adhesive to the hubs.
- Moldy tapes - Memnon can use a set up contained within a sealed chamber for the safe cleaning of most mold tapes if required.

  Types of mold can usually be categorized into three different types (for remediation purposes):

  Inactive: Inactive mold is "dormant" and is ready to be cleaned off the tape. Inactive mold usually looks powdery and brushes off fairly easily, it remains hazardous to operators and must be handled carefully.

  Active: Sustained relative humidity levels above 60% and heat levels between 70-90 degrees Fahrenheit are conducive to mold growth. Some active mold blooms have hair-like filaments and some look a bit like cobwebs and will smear when touched. We look for patterned, fuzzy, thread-like or hairy-looking growths on the surface of the tape pack. Typically, these growths are white in colour on open reel tape although they may also be black, brown, or mustard-colored. Almost any type of coloration is also usually a sign of active mold.

  We try to distinguish mold from other types of visible contamination such as dirt or, in some cases, plasticizer exudation that appears on some polyester tapes.
- "Clean" i.e. no visible mold: Tapes without visible mold should ideally be prioritized to be digitized first, in order to transfer as much of the collection as quickly as possible, and to prevent any further spread/contamination to other parts of the collection. Although the tape, reel and box may look clean, it still needs to go through the remediation process because they have been stored next to tapes with mold. The possibility of mold is high even though not visible.

CLEANING

With regards to the cleaning of tapes (where needed), we have a large stock of video tape cleaners and can process Betacam family, U-Matic, VHS, and HDCAM. The process can be described as follows:

The tapes are wound, re-tensioned and cleaned using surface contact tissues. The Indelt model of cleaning machine for example has additional sensors which detect tape damage and holes in the tape. XML reports can also be provided as deliverable.

GENERIC WORKFLOW OVERVIEW