



**Book Restoration Project**  
at the  
**Sundarayya Vignana Kendram Library**  
Hyderabad, India.

Prepared for

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and  
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1. Cromwell / INRECON initial recommendations, September 26, 2000

## Introduction

A Consortium of North American Universities and several U.S. research libraries was formed in April 1996 by the University of Chicago in conjunction with the South Asia Library Project of the Committee on Institutional Cooperation to acquire and make accessible the private Urdu collection of Mr. Abdus Samad Khan in Hyderabad, India. The rare library collection is considered one of the world's finest for early Urdu periodicals and printed materials, and includes books, journals, newspapers, reports, pamphlets, manuscripts and personal papers in languages of India. The Consortium planned to microfilm the collection to make it available to scholars around the world, and on completion of filming, to maintain the collection in India.

The consortium purchased the collection and located it in the Sundarayya Vignana Kendram Library in Hyderabad, in central India. This facility was established in memory of the late Sri Putchalapalli Sundarayya, a renowned national liberation fighter. Today, the Research Library is a major depository for Telugu written heritage. In addition to Khan collection, the library holds volumes of rare printed books and valuable papers including Telugu and English material written concerning activities in India from the 12th through 20th centuries. The total library collection now exceeds 80,000 volumes.

On August 24, 2000, the SVK Library was badly damaged when flooding occurred in Hyderabad. Floodwaters burst through windows of the library and completely submerged the entire collection of books and manuscripts. Over the course of one half hour, the water level in the library rose to the ceiling.



Co-ordinating the recovery effort, Dr. Atlury Murali of the University of Hyderabad called for any available resources. On behalf of the consortium, Mr. James Nye of the University of Chicago began to assist and jointly, decisions were made to immediately move the entire collection to any available freezers.

Cromwell Restoration Ltd. is Canada's largest property restoration company, providing a wide range of restorative services. As the industry leader in Canada, Cromwell has pioneered a number of unique and proprietary restorative processes and technologically advanced restoration procedures, which are in demand across North America. Cromwell technology includes state of the art Thermal Vacuum Freeze-Drying and Molecular Sieve drying processes for the reclamation and restoration of paper materials damaged by water, fire or contaminants. Cromwell is a subsidiary of INRECON.

INRECON is the largest property restoration company in the United States, and offers property restoration services nationwide. As part of a complete property restoration service, INRECON supplies Cromwell Technology wherever required.

Through press releases on the Internet, the staff at Cromwell learned of the flooding in Hyderabad. On September 25, 2000, a team of representatives of INRECON and Cromwell met with Mr. Nye in Chicago to discuss restoration opportunities for the rare Khan collection. Following the meeting, the team made recommendations and proposals to prevent further deterioration of the collection, and in the following weeks, an action plan was developed.

INRECON and Cromwell proposed to share in the cost of a recovery team to travel to India to inspect the collection and to co-ordinate recovery and restoration, in exchange for opportunities to introduce Cromwell Technology to India. The consortium agreed, and on January 8, 2001, Marshall Oliver and Gary Bird, both of Cromwell Restoration Ltd., traveled from Vancouver, Canada to Hyderabad.



Over a five-day period, the Cromwell team inspected the collection, the majority of which was located in freezers. A portion was located in coolers, due to a shortage of freezer space, and many books had been distributed over the top floor of the library for air-drying. During this time, Archivists, Librarians and others interested in document restoration procedures traveled to Hyderabad from neighboring cities and towns to meet with the Cromwell team. A day-long



seminar ensued, hosted by the SVK Library, during which the Technology available from Cromwell was introduced, and restoration procedures were explained. Workshops were held to train the volunteer staff at the library, and the process of restoring 80,000 books and journals began.

A variety of delicate sensing equipment including moisture probes,

hygrometers and temperature sensors, necessary to accurately assess the condition of the collection were carried from Canada. The volunteer library staff was trained in the proper use of this equipment, and as the sensors proved to be invaluable, they were donated to the library by Cromwell, permitting restoration to continue. Additional equipment intended for use at the site was not accessible, due to luggage lost in airline transit. At this writing, the missing equipment has not yet been located.

After returning to Canada, a procedural video was commissioned at Cromwell's expense and completed copies will be formatted for use in India and will be delivered to the SVK Library, ensuring that rotating volunteer staff continue to receive adequate training. An outline of the video has been included within this report.

The foregoing restoration activity now undertaken by volunteer staff in Hyderabad will ensure reclamation of the smaller portion of books air-dried on location. The greater percentage of books, presently in frozen storage must be considered separately. The following report will address the necessary procedures and will outline the costs associated with the restoration project ahead.

We recognize that with very limited resources, such a large quantity of damaged media would be extremely difficult to salvage from a water-filled library. All remarks within this submission refer to present condition under extreme circumstances. We acknowledge an outstanding effort by all parties to date, and confirm that without their actions, the collection would be in far worse condition.

## Assessment of Air-Dried Books

At the time of inspection, approximately 5,000 books were situated at the roof level of the SVK Library, many opened and spread on the floor for drying. The balance were arranged in shelving units relocated from the basement level. These books vary greatly in degree of mould contamination, deterioration, acidity, and deformation. We understand these books were all stored in the cooler at +2 degrees Celsius. Likely, the deterioration and mould growth occurred while the books were located in the cooler, with physical changes such as deformation and changes in acidity occurring after transport to the roof level. While exposed to sunlight, mould activity will likely be dormant, however embrittlement, damage from ultraviolet rays and exposure to pollutants will be accelerated.



When these books are relocated to indoor storage, mould growth will be reactivated due to high ambient relative humidity, as infestations are well established. While located at the top floor for drying, rapid deterioration due to mould growth is substantially arrested, however permanent damage is occurring due to exposure to the elements.

At the time of our inspection, approximately 9,000 books were located on metal stacks and on tabletops in the basement level. These books had apparently been air dried at the roof level and then returned to these stacks. Mould growth was evident in many of these volumes, and present conditions were ideal for these infestations to thrive.

## Assessment of Air-Dried Books returned to Canada

Back at home, our Laboratory Conservator, Mr. Ludek Stipl has been examining three volumes released to us for assessment under controlled conditions.

Following is an excerpt from his preliminary findings:

### CONDITION REPORT

DATE: January 30, 2000  
 OBJECT: Book, No. 3 ("Molvi Mohammed Bin.....")  
 MATERIAL: paper (machine made), cloth  
 DATE: C 1880  
 SIZE: 19.5 X 13.5 cm  
 TYPE: Sewn (pamphlet) binding without glue, soft paper covers,  
 Cloth spine cover  
 CUSTOMER: SVK Library, Hyderabad, India

FRONT COVER: surface dirt / grime, ink stain (lower right)  
 Mould (white)  
 Crease (top left)

BACK COVER: surface dirt / grime  
 Mould (white, green)  
 Tear (top right)  
 Old repairs (mending, top left)

SPINE: surface dirt / grime  
 Mould (white, black – aspergillus niger)  
 Cloth spine cover – partly detached, brittle, torn,  
 Mouldy  
 Sewing broken, sections loose

PAGES: pH 4.5 to 5.5 varies with page location  
 Mould growth (white – on pages adjacent to front  
 and back cover)  
 Mould growth (green, black - aspergillus niger) near  
 edges and spine  
 Adhered pages (prolonged exposure to moisture  
 and mould)  
 creased pages (top left – about 1/3 of entire book)

ODOUR: musty

We have observed three different mould varieties and, have tentatively identified one of them. We attribute the variable pH in part to varying qualities of paper used in manufacture and the flushing effect of water during flooding, however we note the greatest extremes where pages were open for air-drying.

The air-drying procedure used to date is dramatically deteriorating the pH level, and increasing exposure to a variety of pollutants from combustion of fossil fuels, including:

- Sulphur dioxide
- Hydrogen sulphide
- Chlorine and nitrogen compounds

At this stage we are not prepared to comment on de-acidification as we do not yet completely understand the composition of the fibre used to manufacture the paper in the these books. We do however recommend the use of acid free, alkaline reserve paper, or tissue sheets, to reverse the affects of rapid acification by pollutants. We recommend the use of inexpensive photocopy paper that is at least acid free and at best alkaline reserve 7.5 to 8.5. These letter size sheets can be cut in halves or thirds using a paper cutter, and inserted where appropriate. This procedure will combat the acification taking place without changing the properties of the book paper. Caution must be used to prevent additional strain on the binding due to over stuffing.

Additional precautions could include the use of acid free storage boxes, or shelf liners, but this will likely be costly.



## Assessment of Books Stored in Coolers

Approximately 20,000 books were stored in the cooler at +2 degrees Celsius. This environment appeared to be used to store a wide variety of food items, many of them with coarse packaging materials. The cooling operation is dependent on constant air movement, and continual re-distribution of airborne particulates was evident. These books have been exposed to all manner of dust, grains, spices and dirt. We are concerned that this exposure to bacteria and contaminants will exacerbate the deterioration of paper and cause rapid changes in acidity.



As moisture-sensing equipment had not yet arrived, we could not establish actual moisture content. From our experience, we determined the individual pages were holding considerable amounts of moisture. Every book we inspected in this area appeared to be saturated.

Visible signs of accelerated mould growth were evident. Conditions in the cooler would permit a slow but continuous growth. Although accurate determination of mould species was not possible, we believe these colonies represented active growths of *Aspergillus*, *Penicillium* and *Stachybotrys*. Deterioration of spines and covers was advanced. Much of the adhesive used to secure bindings and covers has likely failed, consumed by the moulds.

We recommended these books be moved from the cooler to the freezer or alternately to air-drying facilities immediately, and Dr. Murali has now confirmed they have been air-dried. These books should be segregated from any other books or collections to prevent spore distribution. Suspected mould types are injurious to humans and should be handled as little as possible. Handling should only occur when protective measures are in place, and by persons who have received the training provided on video.

## Assessment of Books Stored in freezers

We understand that approximately 1,600 crates of books are stored in the freezer, and we observed from the crates we saw that there were approximately 20 to 30 books per crate on average. We estimated there were approximately 40,000 books in this area alone. Subsequent to our inspection, Dr. Murali confirmed that approximately 60,000 books are now in frozen storage after movement of some books back to the library for air-drying was completed. During our inspection, we had limited access to the books in the freezer, as the crates were stacked out of our reach. We believe the books that we could inspect were generally representative of the condition of all the books in the freezer.



The books had been packaged in plastic crates measuring approximately 18 inches x 24 inches x 8 inches high, with some additional crates measuring 15 x 15 x 8. The crates used are ideal for the purpose. Books were loaded into the crates in blocks of five or six with separator sheets between the blocks. These blocks were placed in the crates so that the books lay horizontally. Generally, the blocks of books cannot be separated, and from our experience, we determined the books were close to saturation prior to freezing.

Considering the circumstances following the flooding, the packaging and storage of books in the freezer is excellent. A moderate percentage of the books are deformed and isolated sporulation has begun, however we could not detect any evidence of infestation or significant deterioration by mould. A controlled environment during restoration will eliminate the possibility of spore colony reproduction. We recommend that the individual crates be sealed in plastic bags to reduce deterioration due to air movement in the freezer, and due to airborne particulates (to a lesser extent than found in the coolers). We acknowledge however, that this will be a difficult task to complete. As an alternative, large sheets of plastic could be draped over the crates. Any reduction in exposure to airborne particulates would be desirable.

We have also recommended that crates of books be consolidated where possible, to reduce freezer storage costs, however we were told that consolidation is not possible as the books are frozen solidly into the crates.

When freezing paper materials for stabilization, the goal is to freeze the unbound moisture as quickly as possible. The rate of cooling will influence the structure of the frozen matrix. If the water freezes quickly, the ice crystals will be small. This may cause a finer pore structure in the ice crystals, and less if any, damage to the paper materials. If freezing is slower, ice crystals will grow from the cooling surface and may be much larger, in some cases, causing additional deterioration. Slowly forming ice crystals can permanently damage the paper matrix. The freezers chosen for this project combined rapid air movement with low ambient temperature, and we believe that the wet books froze relatively quickly.

## **Assumptions**

In reviewing the available restoration methods, we have made the following assumptions:

- A. The value of the eighty thousand-volume collection exceeds a financial value, as the majority of books are irreplaceable.
- B. The urgency in completing restoring of the collection is driven by the continuing cost of freezer rental, and the possibility of continued deterioration. The urgency of proceeding with microfilming is not a factor in determining restoration method.
- C. The collection must be returned to a condition that will permit its continued use by scholars in India.

## Discussion of Alternate Drying Methods

Following is a review of the possible drying methods, including those introduced in our report dated September 26, 2000.

### 1. Air Drying

Once mould was discovered on the books stored in coolers, the decision was made to attempt air-drying. As additional freezer space was not available, air-drying was considered the only practical means of arresting the mould infestations. Wet books were carried to the top floor of the SVK library and distributed across the floor in open position. The surfaces of individual pages have been exposed to the air, promoting evaporation of moisture from the paper. This process has been successful in causing dormancy in the mould activity, and in evaporating the moisture. Unfortunately, irreversible deterioration has occurred because of this drying method, including embrittlement and ultra-violet damage. Deformation caused by rapid and uneven drying is manifested as cockling, and can be reversed to an extent. Volunteer staff have now been trained in restorative procedures utilizing available methods. The result is as good as can be expected. Exposure to pollutants is of great concern as well. We noted that many of the vehicles operating in Hyderabad are fueled by either diesel or a mixture of gasoline and oil (two-stroke engines). Pollution from exhaust emissions was evident and is a concern relative to the paper acidity. During training sessions on site, this factor was not emphasized, and we suggest all restoration staff view the training video once it arrives. In the meantime, we recommend a review of the video outline included in this report.

Air-drying under high humidity conditions is an incomplete procedure, after which the books continue to be unstable. Please refer to "Handling and Storage of Books after Restoration" for additional information.

We are told the books initially selected for refrigeration and subsequent air-drying were either replaceable, or of lesser significance. Fortunately, the permanent damage is limited to books in this category. We cannot recommend this method of drying for the balance of the collection.

### 2. Vacuum freeze drying

Vacuum freeze-drying or lyophilization is the process of drying frozen materials by sublimation and desorption at low pressure (high vacuum) and at subzero temperatures. Lyophilization cycles consist of three phases: freezing, primary drying, and secondary drying. In Hyderabad, the first phase has already been completed.

During the primary drying phase, sublimation of ice crystals occurs. In the secondary drying phase, the moisture diffuses from the matrix of the paper and is desorbed from its surface. This process is highly suitable for

reclamation of delicate paper materials, however, textblock sublimation occurs at an extremely slow rate. Thermal Vacuum procedures described below are more appropriate to the task of restoring large libraries.

### **3. Thermal vacuum freeze drying**

As the name implies, the application of heat to the books, while in a sub-zero vacuum, accelerates the rate of sublimation. Cromwell has developed Thermal Vacuum equipment and facilities capable of delivering exceptional results with large libraries damaged by saturation. Using this method, a Thermal Vacuum unit is capable of completely drying a load of books over a 7 to 10 day period. Load size will vary according to the size of unit selected, and could approximate 1,500 to 2,000 books per load. We anticipate good results using this process for restoration of the SVK Library collection.

### **4. Molecular Sieve Drying**

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The need for Molecular Sieve drying is not indicated.

### **5. Temperature flux drying**

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## Conclusions

Thermal Vacuum Freeze-Drying is the only alternative available to achieve the results set out in the Assumptions of this report. Any delay in proceeding with restoration will increase total project cost, due to the monthly cost of freezer rental.



## **Health and Safety Guidelines**

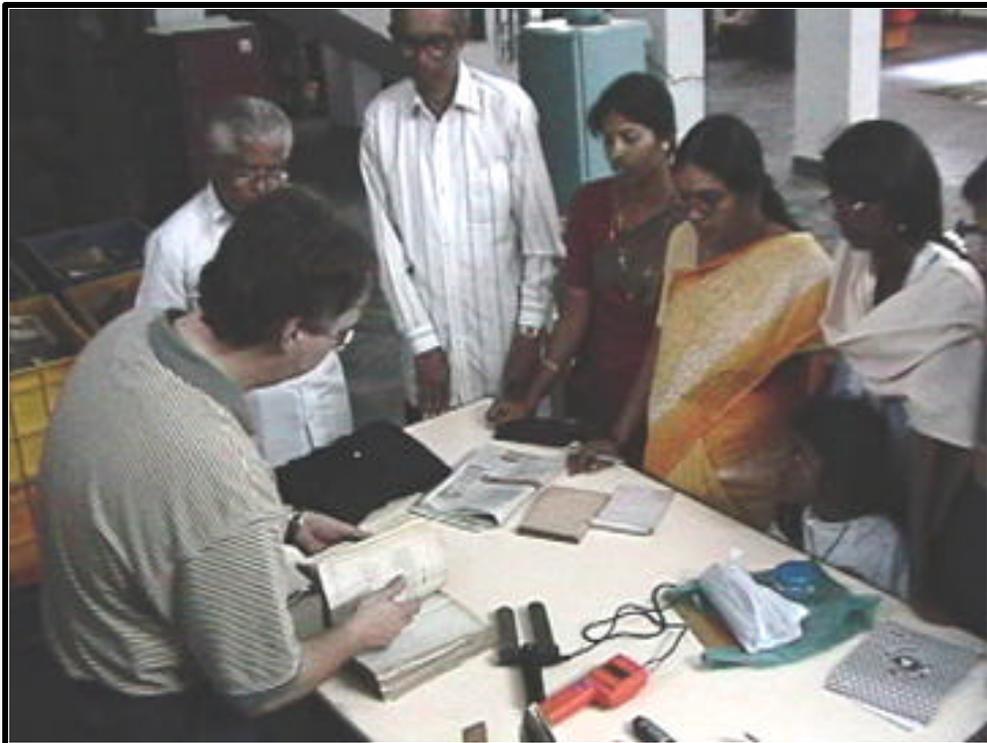
The SVK Library management should establish minimum safety requirements to be observed by all persons, including volunteers who become involved with the project. In situations where volunteers are present for extended periods, the absence of an employer / employee relationship can cause difficulty in the maintenance of minimum standards.

- Work spaces should be free of dangers, obstacles or electrical hazards
- Design of work stations should incorporate the comfort of the worker (availability of seating, table height, lighting) and should consider the risk of injury from performing repetitive tasks
- Protective clothing including masks, glasses and gloves should be in abundant supply
- Daily cleaning of work spaces should be performed

## Restoration procedure for Air-Dried Books

While in Hyderabad, the Cromwell team provided hands-on instruction and training to enable volunteers to proceed with restoration of air-dried books. The following restoration procedure has been prepared to ensure that new and replacement volunteer staff are able to receive a similar level of training, ensuring consistency in the restoration project.

- Refer to guidelines for cleaning of structure and shelving prior to returning restored books to stacks
- Refer to guidelines for Handling and Storage of books after restoration, to prevent future deterioration
- Refer to Health and Safety Guidelines to limit human exposure to moulds through inhalation, ingestion and skin contact
- Refer to Instructional Video for this project



## Outline from Cromwell's Video for Document Restoration in Hyderabad

- **General Examination** - Establish the overall condition of each book before proceeding. Heavily infested books should be treated in controlled space, to prevent distribution of microscopic spores
- **Check Moisture Content** – Given an average relative humidity of approximately 65%, and adequate airflow, the moisture content in the paper should drop to between 10 and 15% over a ten-day period. It will not be possible to reduce moisture content further using this drying method. Pockets of isolated moisture should not exceed 20% in any portion of the book. Books that do not meet this requirement have not completed initial drying and should be returned to the drying area. (refer to “Humidity Control” as the final step in this process)
- **Removal of Binding** (cover) if appropriate – Many of the books stored in coolers prior to air-drying have likely deteriorated to the point that the binding must be replaced. Before removing the binding, look for markings or titles that should be preserved. When removing the binding, use a sharp knife with a straight cutting edge or ruler. Take care not to cut the adjacent pages. Cut away the front and back covers, and then cut away the cloth spine cover without stressing the spine. To preserve a binding title, cut away the unwanted portion of the cover and seal the portion to be retained in plastic or under clear tape. This title information will be referred to when rebinding is performed and then will be discarded. Dispose of damaged bindings into a container with a closing lid to prevent further contamination. Persons removing damaged bindings should not progress to the next stage until the work area, tools and hands have been cleaned of mould dust.
- **Examination of Text Block** – inspect between the pages for signs of mould growth. Typically, the growth will be predominant on the outside pages closest to the cover, and adjacent to the spine.
- **Treatment of Mould** - If mould is visible on a page, the adjacent pages must be treated as well as the affected page(s). Any page to be treated should be dampened with Sodium Hypochlorite (household bleach of 6% strength) diluted at the rate of 1 cup per gallon (diluted to 10% by volume). The bleach solution should be discarded 8 hours after mixing it with water, so mix a quantity you can use up in an 8-hour period. Be aware that Sodium Hypochlorite can drastically affect the pH level of the paper you are treating.

- **Visible mould** should be wetted with bleach solution, applied with a cotton swab (Q-tip) on small growths and with a sponge on larger growths. Be sure to wear protective gloves while working with bleach, and take care not to splash it in your eyes. Protective glasses or goggles are a good idea if you are working with bleach for extended periods.
- **After wetting the paper**, remove the moisture again using a warm iron. You'll have to experiment with iron temperature. If too hot, you'll discolor the paper, and if too cool, the wetted pages will not dry quickly.
- **Straightening** - Once you have wetted and dried all evidence of mould between the pages, wrinkled or buckled pages can be flattened or straightened using a warm iron. Flatten three or four pages at a time starting at the bottom, and progressively flatten groups of pages. Flatten the top pages last.
- **Adhered pages** - At any time in the above procedures, separate pages that are adhered together, slowly and carefully. Use the dull edge of a knife, or a similar thin object to release the surface tension. If the pages won't separate, apply some heat from the iron and try again. In extreme situations where the pages will not separate, some trimming may be required.
- **Edges and Spine** - Now the three edges and spine need attention. Look for any evidence of mould and wet these spots on the edges or spine with bleach solution. You can use a small stiff brush (like a tooth brush) to work the solution into the edges of the entire book if needed. Now remove the moisture from the wetted paper or cloth spine with a warm iron.
- **Sanding the spine and text block edges** - The next step is optional but can greatly improve appearance, and can remove additional mould spores. Using a piece of sand paper wrapped over a small block, sand the three edges of the book while pressing firmly down over the entire surface of the book. Don't allow the sandpaper to separate the pages. Sand the face of the spine (if the cloth spine cover has been removed). The dust you sand away could have mould spores in it, so clean up the desk top after each book.

- **Pressing** – Books can be loaded into the hand press in groups of similar size. If books are different sizes, a small book could make an imprint in the cover of an adjacent larger book. When placing the books in the press, be sure to leave the spine protruding out beyond the edge of the press. The spines should not be compressed within the press, as damage could result. Length of pressing time and degree of pressure will vary with the extent of swelling. Some books will require light pressure 2 or 3 hours and others will require increased pressure for up to 24 hours. Hand tightening of the press is all that is required.
- **De-acidification** – Pollutants in the air have affected the books that were air-dried. Vehicle emissions are a primary cause of the acidity coming in contact with the pages. Acidification will deteriorate the paper and shorten its life. To combat this problem, place acid free or alkaline reserve paper or tissue sheets between the pages, particularly where there are signs of browning, discoloration or embrittlement. Take care not to stretch the spine by overstuffing the book with too many sheets. If possible, place at least 10 sheets evenly spaced through each book, located where pages were open for drying. We recommend the use of inexpensive photocopy paper that is at least acid free and at best alkaline reserve 7.5 to 8.5. These letter size sheets can be cut in halves or thirds using a paper cutter, and inserted where appropriate. This procedure will combat the acidification taking place without changing the properties of the book paper. This procedure may not be required if the book has limited value. Conversely, this process may extend shelf life for many years.
- **New cover** – rebinding – If the cover has been disposed of, rebinding will be required. If the binding title has been preserved, it must be inventoried with the book until binding is completed.
- **Humidity Control** – As indicated previously, moisture content within the restored books must reach a low of 5 to 6 % in order to prevent a re-infestation of moulds. Until stabilization at low humidity is completed, careful monitoring is required. Absolute containment from the books to be freeze-dried and from unaffected materials (such as newspapers stored at the basement level) is imperative.

## **Restoration Procedure for Books in Coolers**

- Books in refrigeration at temperatures above freezing should be moved immediately to frozen storage, or alternately should be air dried and treated as indicated above.

## **Restoration Procedure for Books in Freezers**

- Books stored in freezers at minus twenty degrees Celsius are in no danger of major deterioration at this time.
- Recommendations for improved storage conditions have been made under “Assessment of Books Stored in Freezers” within this report. The opportunities for restoration will be enhanced if exposure to contaminants in the freezer can be minimized.
- We recommend that all books be retained in frozen storage until suitable Thermal Vacuum Freeze-Drying facilities are available to receive the collection.

## Handling and Storage of Books after Restoration

Using the methods for mould remediation described in this report, we can expect good results with the air-dried books, however there are some risks. Mould eradication in the SVK collection would ideally be performed under controlled conditions (low humidity environment) by qualified personnel using a biocide formulated for the purpose (containing unstable hydrogen peroxide). The realities are that the scope of work is far greater than available facilities, and use of hydrogen peroxide by volunteers is dangerous. Our makeshift solution to the problem includes uncontrolled and insufficient drying, exposure to ultraviolet, and treatment with household bleach, which can affect alkalinity in the paper stock, as the bleach reverts to salts.

Some mould varieties are reproductive by their root systems alone, in which case, eradication of the fruit or spores does not ensure extermination of the reproductive system. Our treatment does not ensure extermination of the entire root system. In order to ensure long-term success, the air-dried books must achieve average moisture content of between 5 and 6 % (considered an industrial quality of measurement) in the near future. If this moisture content is not achieved consistently we can anticipate new sporulation within the air-dried books, and our efforts will have been wasted.

In order to achieve 5 to 6 % moisture content, logically the books which are presently being dried to 10 to 15 % moisture content must be placed in an environment having a sustained relative humidity of less than 5%. In brief, the air-dried books are presently unstable, and should not be re-introduced to the primary collection. Given the prevailing humidity conditions in excess of 60% RH in Hyderabad long-term dehumidification is necessary to complete the recovery of the air-dried books.

For the remainder of the collection (presently frozen) the recommended Thermal Vacuum Freeze-Drying process will ensure a stable product being returned to the stacks. On completion of restoration, some form of humidity control should be established to extend the collection life. As the acquisition and operating costs of dehumidification equipment are considerable, additional sources of revenue must be identified if this goal is to be achieved. Please refer to "Other Applications for Dehumidification Technology" within this report for more information.

In the temporary absence of humidity control, we recommend that every possible precaution be taken to protect the collection, including:

- Location well above ground level for protection against flooding
- Installation of air filtration to reduce exposure to pollutants
- Review of natural lighting and light fixtures
- Use of acid free shelf liners on all wood shelving
- Issue of re-useable or disposable cotton gloves when handling delicate materials by library patrons

On completion of restoration, we recommend the collection be protected until all repairs, renovations or construction in and around the library is completed. New construction and the resulting concrete dust at the roof level will continue to have a negative impact on air quality, and on paper acidity.

## **Cleaning of Structure, Shelving and Equipment**

All surfaces initially exposed to flood waters should be cleaned with a 6% bleach solution diluted to 10% in water, and we understand that much of this cleaning has already been completed. We wish to point out that areas such as doorframes, trims, casings or moldings can trap moisture and create environments for bacteria to thrive. These areas should receive special attention at floor level. In addition, all floors throughout the library should be wet cleaned weekly with the same bleach solution until the mould remediation project is completed.

All library shelving should be thoroughly and repeatedly cleaned with the bleach solution throughout the remediation project. Migration of spores through the stacks is a concern. Repeated cleaning of surfaces in contact with books is appropriate. Mould spores are not soluble in water, and can be readily dispersed in water. Damp cloths are a suitable means of collecting spores, and can be rinsed and used repeatedly.

## Cost Estimates

The cost of document freeze-drying can be estimated in two ways, by unit cost, and by volume. Unit costs are most applicable when a variety of services are being provided. For example, based on a library of 60,000 books the unit cost of one volume requiring vacuum freeze drying, ozonation, biocide injection, fibre realignment and cleaning would range between \$5 and \$8 US depending on severity. Using an average cost of \$6.50 per book, a 60,000-volume library could cost \$390,000 US to restore.

A similar library treated by vacuum freeze-drying and minimal additional treatments, if estimated by volume could approximate \$60 US per cubic foot to restore. Using this estimating method and assuming ten books per cubic foot, total restoration cost would be \$360,000 US.

A similar library restoration project at The Stanford University Meyer Library flood involved over 50,000 volumes. The use of the Lockheed Missiles and Space Company vacuum chamber for freeze-drying was estimated to cost \$340,000 US. Other additional costs included frozen storage, labour, trucking and supplies.

The Khan collection is located a great distance from any freeze-drying facility, and transportation of either books or equipment is necessary in order to perform the project. At Cromwell / INRECON we believe the transportation costs of 60,000 books maintained in a sub-zero environment would be more costly and a greater risk than transporting thermal vacuum freeze drying equipment. Regardless of project location, the cost of freezer rental must continue until freeze-drying begins. We have estimated freezer rental costs to be \$15,000 to completion.

## Cost Estimate – Freeze Drying in Canada

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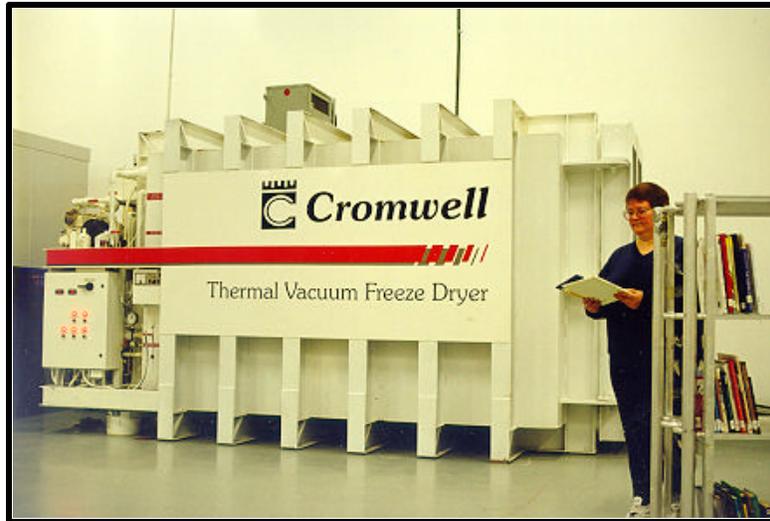
**Estimated total** **\$ 422,000 US**

## Cost Estimate – Freeze Drying in India

[Contains propriety information removed from the public version of the report.]

**Estimated total**

**\$ 383,000 US**



## Proposal for Freeze Drying Services

The Cromwell / INRECON experience on this project to date has been positive. While our involvement has been without remuneration, and while our contribution has included the donation of valuable equipment, the cost of a training video, and the sponsorship of airfare and related expenses, we have received benefits in exchange. We greatly value the opportunity to assist, and recognize an opportunity to market our products and services overseas.

We understand the funding problems facing this entire project and acknowledge that in order to save the books, money must be raised in India and in America. We also believe the abundance of volunteer labour in Hyderabad is a valuable resource which, with proper training and guidance could participate in the restoration project, and reduce the costs substantially. In exchange for the continued opportunity to participate and gain exposure, we offer the following proposal:

Subject to a satisfactory commitment from the Consortium of Libraries, Cromwell / INRECON is prepared to make available a portable thermal vacuum freeze dryer for shipment to India. Rental of the equipment would be necessary to offset capital costs, operating costs, depreciation and lost revenue potential. Any cost relating to the delivery of equipment must be paid by the Consortium, including shipping, trucking, tariffs, or fees of any kind. Any cost incurred by Cromwell / INRECON on the project would be reimbursed by the Consortium. Any management, technical or other labour provided by Cromwell / INRECON would be charged to the Consortium at normal rates. The equipment would be made available for a 10-month period if necessary (2 months shipping from Canada, 6 months operation and 2 months return shipping to Canada) with all shipping and delivery costs paid by the Consortium. Following is a preliminary estimate of costs for this proposal:

Rental of Thermal Vacuum Freeze Dryer 10 months @ 20,000	200,000
<i>Does not include technical labour – replaced by Cromwell training</i>	
Cromwell / INRECON Management and Training Labour	40,000
<i>Estimated cost of providing necessary training</i>	
Overseas shipping and frozen storage	20,000*
Return overseas shipping	20,000*
Trucking and tariffs	8,000*
Freezer rental	15,000*

**Estimated Total Cost of Proposal \$ 303,000**

\* *Shipping, trucking, tariffs and storage costs are beyond our control. Estimates are preliminary*

This estimate is an **Eighty Thousand Dollar Reduction** from the cost of Thermal Vacuum Freeze-Drying identified earlier. We believe that through donations and support from the business community, some of the shipping, trucking and freezer rental costs can be further reduced.



## **Other Applications for Freeze Drying Technology**

Freeze drying technology permits moisture removal in many applications. Food products for example, are commonly preserved using freeze-drying technology. With minor modifications, a freeze dryer could be adapted to multiple uses, including uses that may be of interest to Agriculture or the Military.

We believe that government officials in India may have an interest in participating in the Hyderabad Library Restoration Project in exchange for access to Thermal Vacuum Freeze-Drying equipment technology.

Perhaps on completion, the equipment could remain in India permanently as the property of the military, or the agriculture department of government, or as a joint venture with Cromwell / INRECON. Perhaps the Rental costs of the equipment could be applied under a formula toward purchase of the equipment.

## **Proposal for Dehumidification Services**

Earlier in this report, we discussed the need for humidity control for the Khan collection. One possible means of achieving this goal is to attract participation from government officials who may wish to have access to dehumidification technology.

## **Other Applications for Dehumidification Technology**

As with freeze-drying technology we believe the opportunities for access to dehumidification technology are worth considering. Dehumidification is utilized on a large scale in industry from shipping to agriculture, and today plays a significant role in the protection and maintenance of delicate electronics, machinery and equipment for the military.

## **An Action Plan**

Dr. Murali and Mr. Nye have both indicated that fundraising is ongoing. If this report and its recommendations are acceptable, we believe the necessary funding will be more readily obtained with this road map and cost estimate in hand. We will be pleased to participate in any way possible to ensure the success of the project.

## Acknowledgements



In the hours and days following the flooding on August 24 in Hyderabad, Dr. Atlury Murali, with the support of Mr. Sambhi Reddy and a very large number of volunteers, decisions were made that limited the extent of damage to approximately eighty thousand books. Quick action and logical decision-making by Dr. Murali's team meant the difference between a total loss of the entire collection and a damaged but restorable collection. The huge compliment of volunteer staff provided an invaluable service that can be measured by the very existence of this collection today.

Mr. James Nye from Chicago, Dr. David Magier from Columbia, and Ms Rebecca Moore from the Center for Research Libraries provided valuable information and resources to steer the reclamation effort in the right direction. The practical solutions provided to problems of limited freezer space, packing methods and logistics turned a disaster into something manageable.

On completion of the initial inspection by Cromwell / INRECON on January 10, all recommendations made to Dr. Murali were implemented immediately.

The Library Consortium was generous in permitting Cromwell / INRECON to participate in the evaluation phase of this project. The opportunity to introduce Cromwell Technology to India, and to put our skills to work overseas is appreciated.

## Appendix 1

September 26, 2000

James H Nye  
 Director  
 South Asia Language and Area Center  
 The University of Chicago  
 Fax 773-702-1309

Dear Mr. Nye;

Thank you for taking the time to meet with my colleague, John Stagl of INRECON, and I on Monday.

As discussed, Cromwell and INRECON are affiliated companies, and Cromwell Technology and INRECON'S resources are available to assist with the document reclamation project in Hyderabad, India. During our strategy meeting, we offered the following recommendations:

1. We understand the majority of documents are in frozen storage, however some are presently stored in coolers (above zero degrees Celsius). All documents should be frozen as soon as possible. This could be achieved by lowering temperatures in the present storage facilities, by locating alternate storage facilities, or by moving refrigerated trailers to the site. For optimum results, the material should be flash frozen prior to frozen storage. Refrigerated trailers may not have the capacity to effectively lower the storage temperature, however it may be possible to maintain a sub-zero temperature once achieved in a freezing facility.
2. Documents presently stored in coolers and freezers should be encapsulated in plastic to prevent "freezer burn". This can be achieved by individually bagging each carton of documents, with a positive seal at the bag opening. If desired the documents could be repackaged into boxes at the same time, in which case, the documents should be bagged first before boxing.
3. Documents should be inspected as soon as possible to identify the most appropriate drying method(s). The possible methods suggested were vacuum freeze drying, thermal vacuum freeze drying, molecular sieve drying and temperature flux drying; in addition to the conventional methods you have previously considered. Other methods might be proposed after the documents are inspected.
4. All precaution should be taken to discourage the growth of molds and mildew during this storage phase, and during any contemplated restoration.
5. The respective Embassies should be consulted to determine your opportunities for temporary relocation of some or all documents to this continent. Is it possible to consider restoration in established facilities?

We recommend that items 1 and 2 above be acted on immediately, and that a detailed inspection of the documents be performed as soon as possible in order to determine the least invasive and most cost effective restoration procedure. If desired, we are prepared to attend at the site without fee (with reimbursement for expenses only) to evaluate the condition of documents. We would then be in a position to recommend the most appropriate stabilization and restoration procedure(s), and if desired to assist with preparation of a protocol for the restoration project. Where possible the local labor forces should be utilized to minimize labor cost.

We understand other experts may be involved in this reclamation and we would welcome the opportunity to share our experiences for the benefit of the project. If we put our heads together, the optimum result will be achieved. We ask that all proprietary information disclosed to you be held in strict confidence.

Please let me know if I can provide further information, or be of further assistance.

Yours truly,

Marshall Oliver  
 Manager, Technical Services  
 marshall@cromwell.ca