Memorandum by Salvation Army Trading Co Ltd (SATCoL) and The Nonwovens Innovation and Research Institute (NIRI) based at University of Leeds

1. SATCoL is the trading arm of The Salvation Army in the UK and has been an active and innovative member of the textile recycling industry for the last 16 years. These comments will, therefore, be confined to this area although some of the concepts may be transferable to other materials and industries.

Background

2. The textile recycling industry is operating in much the same way as it has for the last 20, 30, 40 years or more; (collect, sort, distribute, dispose). However, as with the rest of the waste industry they have, to use a medical analogy, been treating the symptoms rather than tackling the real cause of the disease.

3. SATCoL has been working with NIRI Ltd, a University of Leeds spin-out company and Oakdene Hollins Ltd for the last 2-3 years to try to identify the disease and the root cause. (Recycling of Low Grade Clothing Waste; Defra Contract Reference: WRT152, submitted October 2006 and the source of some of the data in this submission).

4. We noticed that, as a nation, we concentrate so much on waste that we miss the point that it is the original design that defines this waste. In short, we design most products with a cradle-to-grave approach, which often translates as a cradle-to-bin-approach.

5. We postulate that if products were designed with a cradle to cradle, rather than a cradle to grave, approach we would begin to create more "sustainable" garments providing other options for use at the end of life. In terms of the full-life-cycle these products could, therefore, have several "lives". This would include: re-use, recycling back in to fibre and thence in to new clothing products, up-cycling (into more valuable products) and also, provide a means of extending the life of existing products before they are disposed of.

6. We believe that if this concept was embraced by product designers, materials scientists, engineers and the retail sector, and therefore, "handled" correctly, waste collection costs could also be reduced as the originator of the product would need to take a greater responsibility for their design and engineering decisions.

7. A consequence of this could be that retailers or manufacturers might be required to collect their own used products from customers prior to reprocessing and remanufacture. The end-of life vehicle directive in the automotive industry is an example of change that has led to improved sustainability through revised product engineering and design practices.

8. To significantly improve environmental sustainability at the end of life of our clothes, better linkage between design, technical and retail decision-making is required. This will impact on raw material selection, fabric manufacturing, product design and assembly and retail specifications.

Understanding Today's Symptoms

9. However, it is instructive to understand the symptoms and how we might approach them today as this will assist in developing a cure. Table 1 summarises the UK's buying and disposal routes for clothing.

	'000 tonnes	**%**
Sales (2003)	1,865	
Thrown in Rubbish bin	**1,165**	**63%**
Collected for reuse & recycling	**324**	**17%**
Reused in UK	41	
Exported from UK	200	
Recycled in UK	**62**	**3%**
Unusable	21	

Source: Recycling of Low Grade Clothing Waste, DEFRA, WRT152, October 2006.

Table 1 Disposal Routes for Clothing

10. To highlight just two or three of the lines of this table.
    - we dispose of over 1 million tonnes every year into our rubbish bins
    - we only collect about 17% for recycling or reuse and
    - UK industry only turns 3% of this into “new” products
11. Simply put, each of us in the UK buys about £600 of clothes per annum and discards £400 worth!
12. Today our unwanted clothes are discarded and reclaimed in a variety of ways as outlined below but all have their challenges and do not address the root cause of the problem.

Reuse

13. The “value” stores today account for about 25% of UK clothing sales and therefore, compete directly with the Charity Shops on price. This means that today only 50% of a charity shops profits come from the sale of second hand clothing.
14. In addition these value products do not have the durability needed for secondary re-use. So this route will not treat the symptoms for much longer.
15. However, large quantities of clothes are exported for reuse to “developing” countries and sold at prices commensurate with that countries cost of living. However, as many of these nations now belong to the EU it is expected that their affluence will grow and the demand for second hand goods will be transferred firstly to the new “value” store products and then to more durable quality items. This means that today trading is being carried out in a potentially declining market – this of course may also eventually jeopardise the infra-structure for clothing collection in the UK.

Restyle

16. Several organisations have tried to commercialise the concept of adapting second-hand clothing into “new” items and many beautiful pieces of clothing have been produced. But due to economics (this is extremely labour intensive and only really works as a “cottage industry” with minimal overheads) less than 1% of the available discarded items are used. It is, however, a very useful PR tool, but for practical purposes, commercially it really is another ineffective medicine!

Recycle

17. The textile recycling industry in the UK used to employ tens of thousands of workers, but today it has just a few hundred. Much is down to economics but decreasing availability of certain “raw” materials, such as wool and the increasing use of mixed man-made blends also play their part. In this industry, clothing is mechanically separated (pulling) and fibres are extracted from the fabrics to enable industrial products such as mattress padding, carpet backing, automotive sound insulation, furniture padding and wiper cloths to be made; but only 62,000 tonnes pa is used in this way, hardly a drop in the ocean when you consider the 1.2 million tonnes potentially available. Although garments are sorted to some extent prior to the pulling process, the result is a highly heterogeneous mixture of different fibre types and colours, which is of course a consequence of the original garment design and limitations in the pulling machinery.
18. Today there has been a serious decline in mature markets, and a decrease in suitable raw materials for the traditional markets mentioned above. Much of this is due to an increase in the consumption of synthetic fibres in value-clothing products, which enter the waste stream, difficulties in garment disassembly, and extremely limited technical innovation within the recycling industry.
19. Some initiatives have also been developed to enable the recycling of synthetic fibres such as polyester extracted from garments back in to fibre-form for producing new garments by polymer extrusion; however, this involves exporting raw materials over long-distances to access Far Eastern manufacturers.

Creating New Markets

20. NIRI at the University of Leeds successfully developed laboratory samples from non-wearable low quality garments extracted from the current garment waste stream in six main areas – some of these provide potential for up-cycling of clothing waste into more lucrative market areas.
    - Non-structural composites
    - Functional automotive components
    - Building/construction boards
    - Thermal insulation
    - Hydroponics - growing media
    - Clothing
21. There is, however, a lack of investment in this area, possibly due to deficiencies in our understanding of this complex subject but the momentum needs to be maintained. From this work it is quite clear that we need to treat our waste raw materials like virgin raw materials in terms of the engineering and design of new products.

Specifications & Formulations

22. The main factors influencing the use/selection of virgin materials are:
    - technical performance-cost quotient.
    - technical specifications and the need to meet standards.
    - compatibility with manufacturing processes.
    - continuity and consistency of supply.
    - marketing.
23. Currently, in general terms, the selection of raw materials and the design of consumer products made from these raw materials (e.g. clothing) are centred on meeting the specific requirements in terms of appearance, technical performance and economics i.e. cost that determines fitness for purpose in use. Generally, there is little or no attention paid to the consequences of these decisions at the end-of-use. When virgin raw materials are considered for manufacture there are complex specifications and formulations that have to be met to meet product performance requirements. When dealing with waste fibre materials intended for relatively high-value products, the same considerations should apply. At present, waste fibre materials tend to be poorly specified in quantitative terms but this can be addressed.
24. These are just some of the technical considerations.
    - Variation in fibre dimensions.
    - Physical properties of the fibre components including blends.
    - Contamination – unwanted chemicals, particles and debris.
    - Consistency of supply – volume, fibre blends, conformance to specifications.
    - History and traceability.
25. Owing to the heterogeneous mixture of collected second-hand clothing addressing these technical considerations is a challenge but is not intractable. To stimulate greater demand for recycled fibre raw materials we will need to upgrade our recycling processes and improve UK collection and sorting procedures so that we can apply similar specifications as for virgin raw materials.
26. For example we will need more complex sorting regimes based on fibre specifications rather than appearance.

27. This means we will:
    - need new mechanical processes
    - have to develop manufacturing specifications at the initial design stage
    - evolve smart labelling systems to aid automation of these processes but also to add traceability to a garment – enabling the source of the original raw material, processes used etc. to be identified. This is important to major retailers wishing to increase the amount of recycled fibre they use.
    - provide process monitoring to ensure the genuineness of all methodologies employed.
28. But of course all of this is a short term stop gap.

Required Interventions

29. We need to completely re-examine how we design and fabricate clothing by considering their primary, secondary and even tertiary uses. Earlier we indicated that one of the barriers to effective recycling is the difficulty in disassembling a garment to produce a homogeneous product for further industrial use. We need to consider alternative manufacturing methods, opportunities for making garments composed of a single fibre composition rather than a blend, different methods of garment construction and assembly – thus fuel a change from cradle to grave to cradle to cradle thinking.
30. There are of course numerous factors that influence the true resource management of textiles but nearly all are influenced by design decisions. To instigate more effective resource management we need to establish that recycled fibres, if extracted, processed and specified properly for use in new products, can be a valuable resource. From our work so far, we believe that performance products made from recycled fibres are on the horizon.

Ways to address knowledge gaps

31. Establishing approaches for increasing the homogeneity of fibre composition (targeting 100% mono-compositions) to simplify sorting and end of life fibre separation and recycling processes.
32. Development of cost-effective processes for separating and reprocessing of cotton-PET blend fabrics and other heterogeneous fibre blends containing two or more dissimilar polymers.
33. Development of methods to reduce the impact of colouration, fabric chemical finishes and coatings (e.g. water repellents and flame retardants) on the fibre separation, reprocessing and recycling processes for the constituent fibres.
34. Proof of concept studies on the use of recycled fibre or polymer components as feed stocks for industrial manufacturing processes e.g. fibre extrusion and textile processing.
35. New garment design techniques that consider both the cost-effective *assembly* of the garment prior to the point of sale and its *disassembly* at the end of life. This will need to consider alternative methods of garment construction and approaches to seaming and joining, stitch less joining methods, potential for induced failure of components at the end of life, automated rapid assembly and disassembly techniques.
36. Alternative techniques for constructing embroidered logos that facilitate rapid removal at the end of life by practical means.
37. Development of SMART labelling systems that ensure in-use and disposal protocols are communicated to maximise opportunities for disassembly, reuse and remanufacture at the end of life.

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