

# **INSTITUTE AND FACULTY OF ACTUARIES**

## **EXAMINERS' REPORT**

April 2015 examinations

### **Subject ST2 – Life Insurance Specialist Technical**

#### **Introduction**

The Examiners' Report is written by the Principal Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context at the date the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

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Chairman of the Board of Examiners

July 2015

## **General comments on Subject ST2**

The Examiners' Report covers more points than would be expected to get full marks. This is so that alternative approaches to questions by different candidates can be accommodated within the marking scheme. Candidates are expected to show knowledge of the relevant content of the Core Reading, but those who tailor their answer to the specifics mentioned in the question will score more highly than those who answer in a more generic way.

## **Comments on the April 2015 paper**

As with previous papers, questions that focussed on knowledge of the Core Reading were generally well answered. In some questions, such as 2 (ii), 3(ii) and 5(iii), candidates tended to focus on the generic ideas rather than applying them specifically to the particular situation. Similarly, where questions required candidates to think more widely or in more depth or detail, such as 3(iii), 4 and 6(iv), candidates often did not give particularly comprehensive answers. Candidates should use Examiners' Reports to practise applying their knowledge to the situations set.

**1** The contracts operate in a similar fashion with the following differences:

**Unit Price**

Under unit-linked (UL) the price will be determined by the value of underlying assets in the fund, with limited discretion applied by the life insurance company to the determination of this price.

Under unitised with profits (UWP) the unit price will be determined entirely by the life insurance company. It may be that the unit price is kept constant, and regular bonuses are applied by way of additional units. This is normally done annually. The number of additional units allocated is at the discretion of the company. Alternatively the company could increase the unit price at its discretion. This would usually be done on a daily basis.

Under either method, the additional units/price could include both a guaranteed increase and a bonus increase. Either the guaranteed or bonus increase could be zero.

**Terminal Bonus**

Although for both types of business, the benefit payable (e.g. maturity, death) will be based on the value of units (depending on any other guarantees) for UWP there may be an additional payment of terminal bonus. This is at the discretion of the company.

**Surrender Value**

Under UL, the surrender value is normally the bid value of units at the date of surrender less any explicit surrender penalty, with no discretion given to the company. Under UWP the surrender value will also start from the value of units, but a market value reduction (MVR) may be applied. The size of the MVR is at the discretion of the company. There may be one or more dates on which the MVR is guaranteed not to apply.

**Charging structure**

Under UL the charging structure (e.g. annual management charges, allocation rates) will be explicit. Under UWP charges may be explicit but could also be taken implicitly through the bonus rate declarations.

**Other**

UL products are likely to provide a wider fund range and hence investment choice. The UWP product may provide the benefit of smoothing of returns.

UWP bonus additions may include sources of surplus other than purely investment surplus.

*This question was fairly well answered by most candidates, with stronger candidates focussing immediately on the differences rather than just giving product descriptions. In addition stronger candidates were clear about the discretionary nature of with profits business and commented on terminal bonuses.*

- 2 (i) The premium is broadly set by the following equation of value:

$$G\ddot{a}_x = (S + f)A_x + I + e\ddot{a}_x$$

This is equivalent to:

$$G\ddot{a}_{x:t} + G(D_{x+t} / D_x)\ddot{a}_{x+t} = (S + f)A_{x:t}^1 + (S + f)(D_{x+t} / D_x)A_{x+t} + I + e\ddot{a}_{x:t} + e(D_{x+t} / D_x)\ddot{a}_{x+t}$$

Rearranging:

$$G\ddot{a}_{x:t} - (S + f)A_{x:t}^1 - I - e\ddot{a}_{x:t} = (D_{x+t} / D_x)[(S + f)A_{x+t} - G\ddot{a}_{x+t} + e\ddot{a}_{x+t}]$$

$$(D_x / D_{x+t})[G\ddot{a}_{x:t} - (S + f)A_{x:t}^1 - I - e\ddot{a}_{x:t}] = (S + f)A_{x+t} - G\ddot{a}_{x+t} + e\ddot{a}_{x+t}$$

Deduct cost.

$$(D_x / D_{x+t})[G\ddot{a}_{x:t} - (S + f)A_{x:t}^1 - I - e\ddot{a}_{x:t}] - C = (S + f)A_{x+t} - G\ddot{a}_{x+t} + e\ddot{a}_{x+t} - C$$

Which is equivalent to:

Retrospective formula = prospective formula

Defining all terms.

- (ii) The total profit made is given by:

Earned asset share – surrender value (= EAS – SV)

This can be split into:

$$(EAS - SV') + (SV' - SV)$$

Where  $SV'$  = prospective surrender value on the original premium basis.

The first part represents the profit made to date.

The second part represents the capitalised value of the profit that will arise in the future from any difference between the original premium rate assumptions and the surrender value assumptions.

In this case, the surrender value basis is the same as the premium basis and so the second term is zero. Therefore the profit arising on surrender of these contracts reflects the difference between actual experience and what was assumed in the original premium basis.

If actual experience has been better than expected, a profit will be made on surrender (or vice versa). For example, due to higher investment returns, lower expenses or lower mortality.

At very early durations, earned asset share may be negative e.g. due to the initial expenses being larger than the premium. In such cases, a loss will be made on surrender since the minimum surrender value that can be paid is zero. After this early duration, the first part of the above expression should lead to a profit being made assuming that there is a profit margin loaded into the pricing basis. However, the company is forgoing any profit that might be expected to emerge in the future.

In addition, if the actual expense cost of surrender is lower than the expense loaded into the surrender value then a profit would be made here. Profit could be defined as surrender value minus statutory reserves, and hence profit emergence would depend on that relationship.

*Part (i) was not well answered by many candidates, with only the strongest spotting the key step of needing to consider the premium derivation. Generally candidates were not able to demonstrate understanding of the relationship between the retrospective and prospective viewpoints, which is a fairly basic actuarial concept. Although many candidates were able to give formulae for the retrospective and prospective calculations, these were not always stated clearly (including definition of notation) and correctly. Part (ii) was better answered on the whole, with many candidates covering the difference between surrender value and asset share. Stronger candidates also stated examples of where actual experience may have differed from assumptions.*

- 3** (i) This product will be attractive to those people who may not be able to access life insurance currently due to medical conditions or age. It is unlikely to be attractive to those who are in good health as the product will be expensive relative to those that are underwritten.

The low sum assured would mean that it is unlikely to be attractive to people who already have significant levels of life insurance either through life insurance policies already purchased or through employment benefits. Similarly, the low sum assured will also mean that it will be unattractive to people who have significant savings relative to the maximum sum assured or to those who are financially sophisticated.

As a result, this product is most likely to be attractive to elderly people or to those in relatively poor health or to those who are not particularly well off. The most likely customer need for this contract is to pay for funeral bills.

- (ii) This contract is unlikely to be suitable for the insurance intermediary market as they are unlikely to want to sell this contract due to the low premium size, which will not support high commission payments, and will not match their target market.

Also the contract is very simple so there is little scope for an insurance intermediary to add value in the sales process. The insurance intermediary channel may encourage anti-selection, and hence the company may wish to avoid this channel anyway.

It is unlikely that this contract will be suitable for tied agents with the pricing including insufficient allowances to support tied agents similarly for a direct sales force. Further, the target market is quite vulnerable and might be intimidated by a face to face sales process. Aggressive sales pitches are likely to lead to reputational damage. It may however be suitable to sell using a partnership model – for example with a supermarket or trade union.

Direct marketing would be appropriate as this is a simple product although telesales is also likely to be too intimidating for this target market. Whilst internet sales would be a cost effective method research would be needed to see if sufficient numbers of the target market would consider operating on-line.

The most likely direct marketing methods would be:

- Mailshots
- Press advertising
- Television advertising

Television advertising might be reasonably cost effective as the target customers are unlikely to be at work and so cheaper daytime advertising could be used.

There is likely to be less anti-selection using direct marketing.

- (iii) This would be an added selling point, i.e. it would increase the marketability. Customers would be confident that the benefit would be at least equal to the money they had paid and this could increase sales volumes. However, it would reduce the profitability of the product on a per policy basis and so would require an increase to premiums which could offset the attractiveness and would accelerate the point at which the guarantee bites. The company would need to estimate the overall impact on total profits.

The lack of underwriting will mean that the mortality assumptions will have to be conservative (high) leading to relatively high premiums increasing the chance that the premiums could exceed the sum assured or equivalently, accelerating the guarantee bite.

Beyond the point where total premiums are greater than the sum assured, only the investment return earned on the premiums received is available to cover expenses and the cost of the earlier additional death cover and to provide a contribution to profit.

However, without including this feature, there is a risk of complaints from beneficiaries at the point of claim that the contract was mis-sold due to there being perceived poor value. Such complaints would lead to additional costs and there could be reputational damage. So building the “return of premiums”

feature into the product reduces this risk, and helps demonstrate that the company is treating customers fairly.

Reserves would be higher under this proposal and hence available capital needs to be considered.

Administration/systems requirements are more complicated. An alternative, but perhaps administratively simpler, would be to stop collecting premiums once they had accumulated to the sum assured.

The company should consider what competitors are offering for similar products. The company may need to introduce this feature to maintain market share, or use the new feature to differentiate itself from competitors.

The return of premiums guarantee may give rise to higher new business, which may contribute to additional capital and administration strain.

*Part (i) was generally answered well. In part (ii), stronger candidates focussed on applying the knowledge of distribution channels to the specific product. Those who only listed the features of each channel failed to score well in this part. Basic marks in part (iii) were obtained by most candidates but only the stronger ones identified that the new guarantee only affected the benefit paid later in the contract. Very few candidates demonstrated understanding that higher premiums would accelerate the guarantee biting point or mentioned that the guarantee may be perceived as being fairer to customers.*

#### **4 Profitability**

As the product is unit-linked, the company will want to ensure that the charges overall will be able to cover the expenses incurred including any commission paid to distributors and to provide a profit margin which meets the needs of the providers of the capital used to write this new business e.g. shareholders allowing for expected mortality and withdrawals and allowing appropriately for any taxation.

Different profitability measures may be considered, e.g. net present value, internal rate of return, discounted payback period. No future premiums will be received, so the only on-going charges will be the annual management charges and policy fees.

The insurance company will need to estimate the future expenses and demographic experience, which may be difficult if this is a completely new type of product and so may need to include high margins in the charges taken.

The company needs to decide on the extent to which the product will contribute to general overheads of the company and the period over which it wishes to recoup the product development and launch costs. The company also needs to cover switch and claim expenses as there are no explicit charges covering these items. Estimates of the amount of new business expected to be sold will therefore be required, to help set overhead/fixed expenses.

### **Marketability**

The charges need to be marketable, i.e. sufficiently attractive to policyholders. A lower level of charges will enhance marketability.

Guaranteed charges are more attractive than flexible charges. Expected unit price growth is only affected by charges to a secondary extent. The relative transparency of different types of charge can also affect the marketability of products. For example, a low allocation rate may be less attractive to policyholders than a higher annual management charge, even if the overall amount of charges taken is the same. If the charges are easy to explain then this will enhance marketability. The charges and charging structure may depend on the distribution channel used.

### **Competitiveness**

The charges would need to be attractive relative to those of its competitors although the degree to which competition is important may depend on how the product is marketed and distributed. The company's historic fund performance compared to its competitors will also be a deciding factor. If this is very good, it may be possible to impose a higher charge than otherwise.

### **Financing requirements**

The company needs to consider the financing requirements arising as a result of the charges decision. Unless the company has substantial capital resources the company would want to minimise the funding requirements under the product. For example, the company might want to set the allocation rate at a level which would enable the company to recoup all (or most) of its initial expenses (including any commission).

### **Risk characteristics**

The company needs to consider the risks inherent within the chosen charging structure. The company will receive lower annual management charges if investment performance is poor. A higher relative weighting towards the annual management charges and policy fee (rather than the charge taken via the allocation rate) increases the persistency risk under the product. The most efficient charging design would be to match the expenses incurred as closely as possible. This matching would be both in terms of timing and nature.

The annual management charge could be a good match to any fund-based commission or investment expenses (expressed as a percentage of the unit fund). The annual management charge may have some implicit hedge against the inflation of other maintenance expenses (provided investment returns are broadly in line with inflation). However, a better match would probably be the policy fee if this is defined as increasing with inflation (in line with a given index) year on year. The risk of loss on early surrender is partially mitigated by the initial charges. The degree to which the company decides to mismatch its charges (and hence increase the risks) depends on the risk appetite of the company.

### **Onerousness of guarantees**

The insurance company needs to decide whether to guarantee the charges or whether they can be varied at its discretion (e.g. variable annual management charge). Variable (rather than guaranteed) charges will mean lower capital requirements.



**Sensitivity of profit**

The company would want to test the sensitivity of the profit for the product. In particular, how sensitive the product is to variations in growth in unit prices and any sensitivity to persistency and any sensitivity to new business mix. The more matched the charges and expenses, the lower the sensitivity of profit.

**Extent of cross subsidies**

The company would want to consider the extent of any cross subsidies between policies particularly between large and small policies. For this product this is likely to be achieved through the initial allocation rate. It may also consider cross-subsidies between different unit fund choices. So it may decide to apply different annual management charges to different investment funds, e.g. to reflect differences in investment costs. The company would want to minimise cross subsidies to reduce risks from differing new business mix.

**Administration systems**

The company needs to consider the extent to which its existing administration system can cope with the charges chosen. In particular, whether it can easily cope with variable charges or charges varying by investment fund. This will depend upon the products sold currently and in the past.

**Consistency with other products of the company**

The company should consider consistency with its other products. In particular, it might wish to avoid setting charges that would encourage lapse and re-entry from existing business.

**Regulatory requirements**

The company must adhere to any regulatory requirements that apply and consider any professional guidance. For example any caps on the level of charges that can be applied or the requirement to treat customers fairly.

**Overall**

The insurance company must strike a balance between the above, often conflicting, factors – particularly marketability and profitability.

*The question was not answered as well as could be expected for a product design question. Those who scored well did so by structuring their answer round the various topics in the solution above (as per the Core Reading), applying them to the specific product and expanding on each to an appropriate degree based on the number of available marks and the wide range of factors needing consideration. No additional marks were gained where candidates described at length the mechanism of pricing itself (i.e. how it would be done) rather than the factors to consider.*

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- (i) Assumptions required are:
- Discount rate (or valuation rate of interest)
  - Unit fund growth rate
  - Inflation of expenses
  - Consumer prices index inflation
  - Partial surrender rate
  - Full surrender rate
  - Number of switches per annum
  - Average annual management charge/assumed future mix of funds
  - Maintenance expense
  - Investment expense
  - Claim/termination expense
  - Switch expense per switch
  - Mortality rate
  - Tax (if applicable)
- (ii) To calculate the non-unit reserve, need to consider cashflows on a year by year basis. In the first year, the projection may be done on a month by month basis. The method uses a discounted cash flow approach.

First need to project forward the non-unit cashflows under this product i.e.

- Charges received (i.e. annual management charges, switch fees and policy fees)
- Less expenses (maintenance, investment and switch)
- Less the cost of benefits in excess of unit fund (i.e. additional death benefit)

The projection needs to be performed on the reserving basis.

Some of these cashflows will require the projection of the unit reserve over the period. This needs to be done allowing for unit growth rate and annual management charges. It also needs to allow for partial surrenders and may allow for full surrenders, if permitted. The non-unit fund cashflow projection may need to be performed on a policy by policy basis.

The next stage involves determining the last projection period in which net cashflow is negative. Set up an amount at the start of that period which, allowing for earned investment return over the period, would “zeroise” the negative cashflow. This amount is then deducted from net cashflow at the end of the previous period. The process continues working backwards to the valuation date, zeroising in the same way. If the adjusted cashflow at the valuation date is negative then set up a non-unit reserve equal and opposite to that negative amount. Could have negative non-linked reserves under certain circumstances.

- (iii) The company may start from the pricing assumptions, or from the assumptions used at the previous valuation.

It is likely that the supervisory valuation assumptions will need to be prudent and hence should include an appropriate margin for adverse deviation. Assumptions will need to reflect the regulatory regime and any professional guidance. The statutory assumptions would not want to be arbitrarily different from the previous valuation assumptions.

### **Unit fund growth**

May start with a risk-free rate, probably based on government bonds of suitable term. The rate could vary according to the asset mix of each unit-linked fund. So could be based on the average actual holdings at the valuation date or be based on historical trends using past data. Prudence would require a lower unit growth rate.

### **Annual management charge**

This could be based on the actual average charge for funds based on actual holdings at the valuation date. Or could use an average applied over an historic period. A lower rate would be prudent.

### **Demographic assumptions**

Use recent own demographic experience based on investigations and adjusted for known or expected future changes. For surrenders (full or partial), a prudent assumption will likely be higher than best estimate given that it will reduce the future fund charges in excess of expenses and cost of benefits (assuming this excess is positive). The mortality assumption is not such a key assumption given that the additional death benefit is small and the mortality rates are likely to be low. May use standard mortality tables adjusted for experience. A higher than best estimate assumption will be prudent.

### **Switches**

The number of switches will be based on recent experience for this product. It may be prudent to assume more than two switches per annum, depending on the relationship between the switch costs and charges.

### **Expenses**

Use recent expense investigation i.e. the expenses allocated to this product. Need to allow for expected in force volumes to capture the spread of overhead. Need to identify switch expenses separately, or they may be incorporated in investment expenses. A higher than best estimate expense assumption is prudent.

### **Inflation**

Need to consider the main drivers for expense inflation – likely to be salary inflation. Use market and economic indicators and ensure consistency with the unit growth and discount rate assumptions. For the policy fee, need to consider market indicators such as the relevant current and expected future consumer prices index. Prudent to assume higher expense inflation and lower consumer prices inflation (for the charges).

**Discount rate/valuation interest rate**

A lower rate is more prudent. Likely to consider yields on the assets backing the reserve. Likely to use a risk-free rate based on government bonds.

**Tax**

Based on current tax rates and expected changes.

*Parts (i) and (ii) were generally well answered, though some candidates listed product features in part (i), e.g. allocation rate, in addition to assumptions required and scored no marks for these additions. In part (ii), stronger candidates included details such as using a policy by policy basis. Part (iii) was not as well answered, with only the stronger candidates covering what prudent meant for each assumption and covering all assumptions identified in part (i).*

- 6** (i) Underwriting is required to protect the company from anti-selection, e.g. by ensuring that its underwriting standards are at least as stringent as others in the market. It is also required to ensure that risks are rated fairly and to ensure that actual mortality experience does not depart too far from that assumed in the pricing. In particular, manage the risk that mortality is heavier than expected. Underwriting is also important for this product as mortality is the most significant risk.

It is used to assess prospective customers against the company's required standard of health and thus identify substandard lives and determine the most suitable approach to deal with such lives.

For example, decide whether to decline prospective customers, defer/postpone decision or offer non-standard terms, such as an addition to the premium for the additional risk, reduction to the level of life cover for the additional risk or impose an exclusion clause on the policy.

It may be a reinsurer requirement or result in reduced reinsurance premiums.

It may be a regulatory requirement.

Underwriting at application stage may protect reputation at claims stage (i.e. reduced number of declined claims).

- (ii) Expenses associated with medical underwriting would reduce. The marketing director may feel that this expense saving would outweigh any increase in claims costs and therefore either potentially increase profitability or allow lower premiums to be charged.

The removal of underwriting may make the product more marketable as people are more inclined to take out policies with no underwriting, which can be seen as time-consuming and this will make the application process simpler and invasive. Overall this may increase sales.

Some insurance intermediaries may recommend companies with a lower level of underwriting (which again can lead to increased sales). Higher sales should lead to further increased profit.

He may be aware of a change in regulation on the horizon which removes the ability to apply underwriting. This may be in line with competitor practices and may be more appropriate for any proposed new distribution channel (e.g. internet/direct marketing).

- (iii) The same premium will now apply to all policyholders of a similar rating characteristic, irrespective of their health. However, the company will still be able to vary premium rates by other non-health related rating factors e.g. age and sex.

There is a possibility that other underwriting could still be done, e.g. lifestyle questions. May consider varying premiums by factors other than age/sex as a proxy for health e.g. postcode / sum assured / occupation etc.

The company will need to price for the expected business mix in terms of the expected levels of health (and thus mortality) within each pricing model point taking into account any changes in distribution channel or target market and this may need to be based on a worst case scenario. However, also need to consider competition as still want premiums to be competitive.

They will need to monitor the mortality experience carefully to ensure that it is in line with expectations and reprice regularly if required. The business mix may change over time if premiums are more attractive to a certain cohort of policyholders.

There is a need to understand the market well, and may do further market research before making the change.

They will be able to allow for lower expenses to reflect the removal of medical underwriting and change the per policy expense loading if the company expects the volume of sales to change.

Lapse assumptions need to be reassessed. But may need higher overall pricing margins due to uncertainties over new business mix and future mortality experience. They may need to re-price any options. The suggestion could affect reinsurance premium rates.

- (iv) Pricing/data risk is increased because the company won't have experience relevant to the non-underwritten product. This is also relevant to valuation (reserving) assumptions.

There is a risk that new business mix (within each pricing model point) is not as expected. There may be a greater than expected proportion of policyholders who are a high mortality risk to the company e.g. from lower socio-economic groups who are unhealthier than average policyholders. Similarly, there is a

risk of lower average premiums / lower sum assureds than currently if the mix of business has changed.

Mortality risk may be higher if the average health of policyholders changes since this may increase areas of mortality risk such as model and parameter risk. Similarly there may be a shift in persistency risk e.g. the existence of underwriting may have meant persistency was lower.

The reduction in expenses may not be as high as expected, or the new expense levels may be higher than expected. Implementation or development expenses may be higher than expected.

Anti-selection risk is materially increased e.g. from policyholders in ill-health who are able to get life cover at a cheaper rate than elsewhere assuming that the rest of the market retains some medical underwriting. Actions of distributors: salespersons may encourage anti-selection.

However, there is no longer any risk of non-disclosure or fraudulent statements by policyholders in relation to medical conditions. There is a risk of lapse and re-entry from existing policyholders who have special terms on their current policies.

Volume of new business risk: sales may be much higher than expected and customer services may not be able to cope with demand or capital strain might be too high.

Competition risk: there is a risk of losing new business sales if competitors actively target the healthier lives by offering them lower premiums which in turn will increase the expected average mortality of the remaining lives.

Reputation risk may increase, e.g. more blanket exclusions and declined claims.

- (v) There will be simpler sales systems as one price will be offered to all and simpler administration systems as no need to record rating terms. However administration systems would need to change which would require additional training of administration and claims staff which would incur implementation costs. All marketing material and other literature may need to be amended for the different target market.

There will be an impact on reserving basis as experience (mortality and persistency) will need reviewing and likely to need to increase reserves and also may need greater reserving margins for uncertainty. Given the likely reserve increase there needs to be sufficient additional capital available or the company will need to find additional capital to support this.

If they previously had in-house underwriters, will need to make them redundant which will incur costs, potentially reduce staff morale and company reputation.

Although underwriting costs would be reduced, will incur more costs relating to monitoring of business mix/experience costs. Sales volumes may increase and this may reduce per policy costs as fixed costs are spread over more policies. There unit costs will need to be reviewed considering all these factors.

The company may consider changing the sales channel as the product will be simpler e.g. consider direct marketing, which may impact the relationship with existing distribution channel.

They are likely to need to renegotiate terms with reinsurers which may mean reinsurance is not available, or available only at a higher cost. They may need to recruit more staff into new business administration areas to cope with large numbers of applications and may strengthen other forms of underwriting e.g. financial. They will need to consider any regulatory implications.

*Parts (i) and (ii) were generally well answered, with most candidates considering both the cost reduction and potential increased sales aspects of part (ii). Part (iii) was not answered so well, with only the stronger candidates identifying that other rating factors could be used and that there would be a greater need for ongoing monitoring. Part (iv) was better answered, with candidates first identifying the risks then expanding the description for each. However, only the stronger candidates seemed able to appreciate the practical implications in part (v).*

## **END OF EXAMINERS' REPORT**