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SCOPE MEMORANDUM
Citigroup – European Credit Derivatives Review
Operational Risk

Entity under Review:	Citigroup London
Target:	Credit Derivatives products
Planning Start/End	09/06/2005 – 09/23/2005
Examination Start/End:	10/31/2005 – 11/18/2005
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NED Event #:	

Background

Rationale and objectives of the operational risk review:

The Citigroup Credit Derivatives business carries a high level of inherent operational risk primarily due to the complexity of transactions, continuing volume growth, and introduction of new products. Complex derivative transactions require complex booking to reflect the trade terms, cash flows and settlement attributes. The risk is exacerbated by high dependency on manual processes due to fragmented and dated infrastructure. [REDACTED]

The Operations department developed a technology plan to address the challenge of operating this high risk business with substandard infrastructure. Part of the plan addresses shortcomings in legacy credit derivatives systems such as GK and STORM by migrating single name credit derivatives products into the Calypso system. Calypso is a vendor derivatives and credit derivatives trade capture, risk management and back office system. It is now operational both in New York and London, and, according to Risk Management, has substantially reduced the manual processing relating to the single name business. To address the needs of synthetic CDO business, the PT (Portfolio Trading) system was developed and is now being implemented in London. Despite these initiatives, both Internal Audit and Market Risk Management have recently documented significant shortcomings in the existing support infrastructure and raised numerous concerns about the business's capability to deal effectively with growth in products and volumes, especially for more complex products.

Since the infrastructural issues are self-identified by and transparent to management, the objective of the operational risk review is to assess the effectiveness of on-going remediation efforts for trade capture and processing and assess a potential impact of the technological improvements on the control environment. Therefore, a significant focus will be placed on the evaluation of the institution's progress in the implementation of the existing technology plans and any other projects involving upgrades or enhancements of the processing infrastructure.

¹ This activity is widely recognized by industry, and specifically mentioned in the internal infrastructure review.

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Planning Phase Results

Business overview

The Citigroup Global Credit Markets group is headed by Chad Leat. The business has recently reorganized and now consists of four major business lines – Fixed Income Capital Markets², Global Credit Trading, Structured Credit Products, and Emerging Markets Credit Trading.

The Global Credit Trading desk is a result of a merger of single name CDS trading with Bonds and Cash Credit products. It is further sub-divided into Distressed debt, US Investment Grade, US High Yield, and Eurobonds desks. The responsibility for Global Credit Trading is shared by two business co-heads, David Pichler (New York trading), and James Higgins (London trading). Based on the IA data as of October 2004, monthly trading volume of single name credit products and CDS indices in London was in the range of 400 - 1000 new deals.

Structured Credit Derivatives business in London is headed by Alan Shaffran and is organized along the following product areas:

- Correlation Trading (previously Portfolio Trading). Mitch Janowski (New York) has a global responsibility; Keith Crider manages London desk. The desk is involved in structuring and trading principally bespoke leveraged credit derivatives based upon multiple reference entities; trades take the form of first-to-default baskets and synthetic CDO tranches with varying degrees of subordination, CDO “squared” (CDOs of CDOs), and i-Boxx indices. Based on IA statistics as of October 2004, the desk’s trading volume was 20 trades per month.
- GSCP Syndication (previously Structured Products & Repackagings) is involved in bespoke derivatives and repackaging of securities using special purpose entities.
- Credit Structuring (previously CDO Origination) handles origination and distribution of managed and static synthetic CDOs.
- Structured Financing/TRS/Exotic CDS is managed by Anthony Nahum.
- Contingent Credit is a new unit. The scope of activities is not yet known to examiners.
- Synthetic ABS Trading is a global business managed by Chris Carman (London). It deals in repacks and structured repacks, total return swaps, options and asset swaps.

Global Emerging Markets Credit Trading is globally managed by Carey Lathrop. The European desk is involved in Central and Eastern European bonds and CDS.

Derivatives Operations - Europe

Derivatives Operations, Europe generates and matches trade confirmations traded by the London Credit Derivatives Desk (LCD), the Hong Kong and London Emerging Market Desks, the London and Hong Kong Equity Derivatives desks. It also provides valuations to clients. The organizational structure of the Derivatives Operations, Europe consists of four sections:

- The Confirmations Generation group ensures that confirmations are generated for all trades that feed the core settlement system OASYS;
- The Confirmation Matching group handles confirmation matching. This includes verbal, fax or e-mail confirmations, as well as matching signed hard copy confirmations;

² Fixed Income does not involve credit derivative trading and is not part of our review.

Restricted F.R.

- The Customer Valuation group provides clients with current valuations either through the Delivery on the Web (DOW) access or by e-mail notifications.
- The Warrants and OTC Derivatives section within Exchange Traded derivatives settles premiums corresponding to OTC options confirmed by Derivatives Operations, Europe.

Derivatives Operations - New York

The CIB Derivative and Structured Products Operations Department, New York is responsible for processing all of Citigroup Global Markets (CGM) derivatives globally, all of the Citibank derivatives for North America, and Citibank London Fixed Income (FI) derivatives. Product lines include interest rate, equity, commodity, and credit derivatives. The Business activity is recorded on 10 different legal vehicles. The majority of the products are processed on OASYS (On-line Arbitrage System). The primary responsibilities of the Derivatives Operations Department are divided amongst the following three units:

- **Confirmations**- the unit is responsible for generating and matching the confirmations for all of the CGM products globally, all of the Citibank products in North America, and the Citibank FI trades in London and the Emerging Markets.
- **Settlements and Processing** - the unit is responsible for processing, settling, funding, and reconciling all trades for CGM. In addition, they process all Citibank trades for North America and the Citibank Fixed Income trades for London. Reconciliation of cash, settlement, and general ledger activity is processed on various platforms with different process flows. The cash reconciliation utilities based in Buffalo, London, and New York produce a series of exception reports to highlight potential issues. Derivatives Operations then manually researches and resolves any cash and general ledger breaks.
- **Institutional Margin** - the Collateral Margining Unit located in New York, calculates, manages and settles margin and collateral requirements in accordance with the bilateral agreements exchanged between the firm and its counterparties. The Unit calls and reports missed/disputed margin calls for derivatives trading for CGM and Citibank. Where collateral is required, it is calculated by the Credit Officer, and initial margins are entered into the trade capture system, which is picked up by the Collateral Monitoring Department in New York, who is responsible for collecting the collateral, and monitoring it on an ongoing basis. Reconciliation of collateral accounts is performed daily by the group who reports the total number of disputed calls, credit exposure totals, and counter party exposure. Collateral for European Structured Products and Emerging Markets is maintained and monitored in New York. A daily disputes report of margin requirements between CGM and counterparties is generated by CMG and provided to European Credit Center in London.

Current Infrastructure

Key trade capture systems for European Credit Trading and Structuring business are Calypso, MACCA and Portfolio Trading (PT). Calypso is a new system that has been implemented for single name default swap trading. It provides a single point of entry for trades and is interfaced with the back office systems. It also has risk management functionality for pricing, curve and risk management review. All other single name structured products are captured in MACCA, until they become available in Calypso. MACCA supports asset swaps, bonds, futures, and asset swap hedges. It is a stand alone system and relies on a number of reconciliations to ensure accuracy and completeness of trade processing. Until recently, Portfolio Trading deals were entered on paper blotter by front desk, and then booked into the back office system OASYS. This process is now supported by PT, which operates under a development version in London, and is close to release

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in US. PT is used as a trade capture and risk management application. STORM is used as a risk management and pricing tool for convertible bond options and default swap products, and OASYS is used as a Back Office system.

For Emerging Markets, all trades are booked in STORM and OASYS. The systems are not interfaced, and the trade capture requires separate entries. Reconciliation is performed by Product Control for positions and Trade Support for contractual terms.

Infrastructural issues and control issues cited by Risk Management

In June 2005, Citigroup Market Risk Management updated senior risk management on the progress made on Credit Derivatives infrastructure support and control issues identified during the recent market events (downgrades of General Motors and Ford). Their analysis highlighted significant concerns regarding the infrastructure supporting Global Structured Credit business. Risk management concluded that the current infrastructure is barely sufficient to accommodate the existing CDS businesses, but is insufficient for the planned business growth.

[REDACTED]

IA

The internal audit coverage and testing were found comprehensive.

[REDACTED]

Specifics for Internal Audits conducted in 2004 - 2005 in London and New York are summarized below:

London

The European Credit Derivatives business was covered by two relevant IA reviews.

1. Internal Audit conducted a review of European Credit Derivatives business in October, 2004 and rated the area Satisfactory. [REDACTED] *Satisfactory, it noted in the report that any expansion of the business or change in business activity will require a commensurate investment in systems and staff. The satisfactory rating also reflected the fact that the business made a decision to restrict their trading activity with the limitations of current infrastructure. Key issues identified by audit*

³ With respect to the review of the London activities, the review team will conduct a separate review to determine if any aspects of London activities contributed to those issues.

Restricted F.R.

included the Control Self assessment processes and business continuity (both areas are not in the scope of our exam).

The audit covered front office desks and related support functions including sales, systems and technology, market risk management, credit risk, legal and compliance, and product control. Operational aspects included trade capture and system reconciliations processes, completeness and accuracy of data used by Product Control, trade reconciliations between front office and back office systems, completeness and accuracy of ISDA documentation and the accuracy of trade confirmations.

2. The most recent audit of Derivatives Operations Europe was conducted in July 2005 and rated the area Needs Improvement. It covered controls in the area of trade confirmation generation and matching, and position valuation. Other areas included system access controls, continuity of business and controls surrounding core processing applications. A major business issue identified by audit related to a growing number of unconfirmed trades.

New York

North America credit derivatives activities are covered in two audit reviews:

1. North America Credit Derivatives and Emerging Markets Credit Derivatives. The review was conducted in February 2005 and rated controls as Needs Improvement. IA noted weaknesses in spreadsheet controls, pricing and risk management control, price verification procedures, and confirmation controls.

2. CIB Global Markets Ops – Derivatives and Structured Products operations. IA conducted its review in April 2005 and rated controls as Needs Improvement. Coverage included a review of trades processing, funding, reconciliation and break investigation, settlements, confirmation generation and matching and margin/collateral management. Coverage of technology included a review of system access, continuity of business and controls surrounding core-processing applications. Based on the Risk Appraisal Process (RAP), particular focus was placed on the Operational, Legal/Regulatory, and Technology Risk families. The scope covered the period of May 2004 to January 2005.

Infrastructure and Control Issues Identified by IA

Internal Audit has identified a number of significant issues related to infrastructure including trade capture, confirmations, cash reconciliations and margin processing that rely on ineffective and/or highly manual processes. Management indicated that there are more issues in New York than in London or Asia, primarily due to inadequate infrastructure and higher volumes. During our onsite phase, we will seek to better understand identified issues and improvement efforts.

Trade Data Capture

Internal Audit cited control vulnerabilities around trade adjustments to CDS trades. The Operations Department has the ability to enter trade adjustments without maker checker controls, leaving the firm exposed to inappropriate or inaccurate trade input. This issue was expressed as a less severe workpaper comment in the April 2005 audit of New York Derivative & Structured Products Operations, and was not included in the formal audit report. To address this vulnerability, Operations management has agreed to introduce trade adjustment controls, either

Restricted F.R.

manual or systematic. Audit monitoring as of June 2005 indicates that this process may be relocated to London and Audit plans to follow-up with London Operations on the issue.

♦ Confirmations (New York and London)

As with many of its peers in the industry, Derivatives Operations has experienced a severe backlog of aged unsent and unmatched confirmations, and this issue was cited as one of two Major Business Issues in the 2005 audit of New York Derivative & Structured Products Operations and a major business issue in London.

Cash Reconciliations (New York)

A Major Business Issue has been raised in connection with cash reconciliations. The investigation and clearance process fails to prevent a significant number of unreconciled items from aging. As of February 2005, 15,000 cash breaks totaling \$1.4 billion were aged greater than 30 days of which 38.5% (5,780 items) were related to credit derivatives. 6,700 cash breaks were outstanding greater than 180 days. While these totals evidence a major issue, it is important to note that the net position of the cash breaks is a \$35 million credit and 40% of the 15,000 breaks were related to intercompany transactions. The reconciliation process is largely centered in New York and covers equity, interest rate and credit derivatives.

Primary causal factors observed for such breaks include trade capture defects, poor processes around intercompany reconciliations, and Hedge Fund assignments. Of the 5,780 cash breaks related to credit derivatives, 64% (3,704 items) could be attributed to trade issues and 37% of these (1,382 items) were directly related to assignments.

Corrective action for cash reconciliations

To address the reconciliation backlog, management has committed to five action steps.

- A dedicated backlog team of 13 employees has been established to resolve aged outstanding items.
- Quarterly target levels and management action triggers have been established
- Hedge Fund assignments and counterparty participation in DTCC are now being tracked – led by Sales and Trading.
- Procedures to streamline reconciliations of intercompany differences have been drafted.
- Implementation of Cash Break Workflow System was scheduled for July, and will be used to track cash break investigations.

♦ Margin and Collateral Management (New York)

Audit identified four issues related to the margining process.

- The margining process does not effectively identify and report contracts that enter the process without a valid price. Of 250,000 open contracts, approximately 1,100 did not have a price. Management committed to ensuring all price feeds have current market prices, and plans to coordinate with Financial and Technology to develop reporting.
- The Derivatives Margin Unit only performs spot checks on 5% of the portfolio. Management agreed to implement a systematic process.

Restricted F.R.

- Approximately 1,200 contracts are not linked to Master Agreements in OASYS. In response, management agreed to develop a report to Credit, Legal and Trading on trades without Agreements.
- Disputed margin calls are not being consistently reported and documented. In response, management agreed to develop capacity to flag disputes in OASYS.

Audit monitoring, as of June 2005, indicated that all these issues remain outstanding.

Areas excluded from the European Credit Derivatives review

The continuation of the review will be limited to the review of the credit derivatives business in the European region, which is the primary focus of the review. The review will not cover the credit derivatives business in the New York region, which is the primary focus of the New York review. The review will also not cover the credit derivatives business in the Asia-Pacific region, which is the primary focus of the Asia-Pacific review.

- Inter-system reconciliations processes will not be part of the scope. System reconciliations between front office and product control systems, as well as product control and the general ledger systems are conducted daily and monthly by Product Control both in New York and London. Internal Audit reviewed the process in both locations and concluded that it is properly managed. In London, the product control team conducts reconciliations between STORM and OASYS, Calypso to OASYS, Front Office system for bonds to P&L system (ETPL), General ledger (Solar) to Sub-ledger, and ETPL to the integrated risk management system (Riskmaster).

Areas recommended for inclusion in the review of New York credit derivatives operations (in coordination with OCC)

The review will include the review of the credit derivatives business in the New York region, which is the primary focus of the New York review. The review will also include the review of the credit derivatives business in the Asia-Pacific region, which is the primary focus of the Asia-Pacific review. The review will not cover the credit derivatives business in the European region, which is the primary focus of the European review.

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Exam Questions/Objectives/Procedures

♦ Trade Data Capture

General Question:

Does the current infrastructure allow for timely (T+0) and accurate capture of the trade economics by Front Office? What is the extent of manual interventions or duplication of trade

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data to feed risk, accounting and P&L engines? Are adjustments to CDS trades subject to dual (checker/maker control)?

Rationale:

Currently, the business relies on processes with multiple trade entry inputs, disparate systems and spreadsheets, which introduces the risk of errors or delay trade capture so that timeliness and accuracy of trade capture becomes an issue. Both Internal Audit and business management identified operational issues resulting from the inadequate trade capture infrastructure. In addition, Internal Audit (New York) cited control vulnerabilities around trade adjustments to CDS trades and indicated that this process is relocating to London.

Specific questions:

a) Trade flows in Calypso

- What Calypso's functionalities are currently used and what is the timeline for migration the remaining single name products? What is the timeline for the remaining phases of the project?

Rationale:

Calypso is implemented in stages with the ultimate objective to replace both front office trading systems, STORM and MACCA. The implementation is scheduled in five phases over a two-year period. At the time of the 2004 audit in London, only Phase I of the project was completed and was limited to single name credit default swaps only (initially, phase I was to include the migration of single name CDS hedges, i.e. bonds, interest rate swaps, asset-backed swaps, total rate of return swaps, and FX transactions.) The IA analyzed 3 months of trade data to test transaction input controls, and assessed the adequacy of interface controls. It noted no exceptions. Given the sufficient IA coverage, our questions will be answered through interviews with management, review of transaction flows and implementation plans, and transaction walk-through. No transaction testing will be performed.

b) Trade flows in PT:

- How is a trade capture accomplished in PT? What products are currently covered and what are still pending? What are the system constraints that management already identified and how do they affect the effectiveness of the trade capture? How are initial and projected cash flows captured in the system?

Rationale:

PT is a front office system of the correlation book which is close to be released in the U.S. In Europe, PT operates under a development version, which, according to risk management, has significant production problems. Risk management also expressed a concern that even when in production, PT and the underlying models will be slow, fragile, and near the limits of current technology. Risk management also indicated that for marking the portfolio, Financial Control relies on outputs from PT, which are not always reliable and/or justified. Finally, trade entry of synthetic CDOs is described as manual and time consuming, as the typically large reference portfolios must be captured. Internal Audit did not review the PT deal

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capture functionality in 2004, since at the time of audit this functionality was not live. Our review will include the walk-through for major products processed through PT, interviewing personnel to get an understanding of transaction flows and system constraints, and reviewing a documentation related to the process of the business sign-off.

Procedures (for all trade capture questions):

- Review the list of credit derivative products that the institution is authorized to trade.
- For each traded product, determine the required number of points for trade input provided by front office, middle office and back office staffs.
- As reference data and counterparty assignments have in many cases made up a large portion of errors, assess the institution's efforts to control the amount of errors from these sources.
- Find out if middle office and back office staffs are responsible for any inputs, the types of inputs and the defaults.
- Determine how initial and projected cash flows are captured and monitored
- Interview management to understand how checker/maker controls are implemented for trade adjustments, cancel and amends.
- Request and review management reports to analyze data concerning measuring trade capture.

Some of the statistics to be considered include the following:

- o Number of trade entry errors, delineated by data field;
- o Number of errors by trade type;
- o Percent of errors by counterparty or counterparty group;
- o Timeliness of trade capture;
- o Incomplete trade data capture;
- o Timeliness of resolving trade input errors;
- o Number of manual blotters outstanding;
- o Trade volume against limits that may be in effect;
- o Impact of high volume days on risk indicators.

♦ **IT/MIS**

Question:

What is the extent of manual processing utilized in the credit derivatives business? What products and functionalities are supported by spreadsheets? What systems require multiple trade inputs? What processes are slotted for further automation and what is the time line for implementation of these projects?

Rationale:

Excessive manual processing may increase the number of errors and inhibit processing and reporting efficiency. Larger volumes or unanticipated asset types may overextend systems and contribute to errors. Risk Management and Internal Audit expressed their concern over inadequate support of the credit derivative business, excessive reliance on manual processes due to fragmented systems, and heavy use of spreadsheets. Recently, business management increased its focus on addressing infrastructural problems and created a plan, with the input from all control functions, to identify and fix relevant issues. Our review will focus on understanding what products and processes management slotted for further automation, along with the proposed solutions and timeline.

Procedures:

Restricted F.R.

- Assess the level of manual spreadsheets, and efforts made to limit their usage. Review whether additional controls are in place where manual input occurs.
- Review flow charts and assess the amount of manual breaks.
- Determine whether trade inputs and amendments are fed to risk management and P/L systems on an intraday basis.

Question:

What groups are required to sign-off of Calypso and PT projects prior to going in production?

Rationale:

According to IA, each IT project is formally tracked and progress is reviewed in weekly business meetings (meetings are not documented). Once all business requirements are delivered, business will formally sign-off on a project. It is not clear, however, what, if any, other groups such as Product Control, Internal Audit or Risk Management are involved in the sign-off process. Since both Calypso and PT have pricing and risk management functionalities, and systems' output is used by groups other than front office, it would be logical to assume an involvement of those stakeholders in the sign-off process.

Procedures:

- Interview management to obtain an understanding of project management and the sign-off process.

Question:

Can the institution efficiently process settlements for both periodic and special events? What are the steps needed for preparation of the periodic index rolls?

Rationale:

Dependence on manual processes and increasing deal volumes may stretch staffing resources and impact trade processing under the normal circumstances. In addition, credit events and periodic market events such as periodic rolls of credit derivative indices (which involve the restructuring of underlying portfolios) can pose additional challenges for trade processing and settlement processes.

Procedures:

- Review procedures regarding special credit events. If such an event has occurred, obtain documentation and system trade records, and compare to procedures.
- Discuss roll procedures with front and back office.
- Collect trading volumes for day prior, roll day, and day after to assess impact of roll day on volumes.
- Collect net and gross positions outstanding in the previous index versions (version 4,3,2,1) and ongoing trading volumes of these contracts.

♦ **Staffing Resource and Qualifications**

Question:

Are staffing and skill levels appropriate to handling the products, as well as the existing and projected transaction volumes?

Rationale:

The retention of qualified staff has been a challenge and cited by banks as a major reason whenever there is less-than-optimum performance. Insufficient level of knowledge and staffing may lead to increases in processing or reporting errors and expose the institution to higher operational and reputational risks. LA (both New York and London) commented on the increased stability of key staff over the last few years and the positive impact on the level of understanding of risks and controls facing the business. Examiners will continue the dialog with management to understand whether any particular area experiences resource constraints, especially those with the high level of key person dependencies.

Procedures:

- Obtain turnover ratio.
- Review current and budgeted staff levels and discuss with management the adequacy of staffing for existing and projected activities.

APPENDIX 1 – IA data for confirmations

New York data:

As of February 2005, the timing of audit testing, the firm had 6,400 unconfirmed trades aged over 30 days within its equity, interest rates and credit derivatives products. Subsequent to the audit, monitoring revealed the problem persists, as the number of confirmations aged over 30 days increased to 10,081 as of June 2005, a 57% increase over the period.

Of the 6,400 aged outstanding confirmations, approximately 10% were outstanding greater than 180 days (80 unsent and 618 unmatched). Credit Derivatives account for a material portion of confirmations aged over 180 days, representing 86% of unmatched confirmations (534 items) and 31% of unsent confirmations (25 items).

Audit testing (of all derivative types) revealed the following causal factors⁴:

- 52% of unsent items exhibited late trade bookings or amendments. Information amended included rate details, counterparty names, business day conventions, day count basis, early termination clause information, trade terminations, block trade bookings, and partial terminations.
- 43% of unsent items and 50% of unmatched items were delayed due to communication breakdowns between the Front Office and Operations.
- 25% of unsent items and 33% of unmatched items were delayed due to counterparty assignments.
- 78% of unmatched items revealed unresponsive counterparties.
- 70% of unmatched items were referred to the Front Office, however via ineffective means of communication (email, spreadsheets, or verbally), leaving the Front Office lacking sufficient information.

Corrective action for confirmations

To address the confirmation backlog, management has committed to a number of actions steps involving a combination of technological solutions and process improvements.

- Management Action Triggers are being developed to improve oversight.
- Tracking of outstanding confirmations is migrating to OASYS Web from CMS. Credit derivatives completed its migration in June.
- Derivatives documentation is being automated through implementation of Scrittura system designed to enhance confirmation generation and matching.
- DTCC for Assignments adopted and live.
- Calypso is being implemented for credit derivatives.
- Formal escalation procedures with communication standards to functional areas such as Business and Legal are being developed.

London data:

⁴ Citigroup Audit and Risk Review Report #2005-R9604-1, CIB Global Markets Ops, April 22, 2005. Audit tested unmatched confirmations aged greater than 30 days and unsent confirmation greater than 7 days across all derivatives products.

Restricted F.R.

The average number of unsigned aged confirmations for credit derivatives beyond 30 days has substantially increased, from 1,342 in April 2004, to 3,260 in April 2005. Primary causal factors are lack of timely counterparty responsiveness, lack of fully automated confirmation tracking tools, trade amendments and increase in trade assignments, and resource constraints.

Corrective actions for confirmations:

According to IA, the majority of correction items have been implemented. They included a control procedure to evidence regular review of the trade modification report, and an implementation of REMUS, a new confirmation tracking tool.

APPENDIX 2 – DESCRIPTION OF SPREADSHEET PROCESSES
(per European Credit Derivatives IA #2004-R6916)

EMCD Desk uses two bespoke spreadsheets. **OvernightRolls.xls** which is used to manage balances on the Turkish lira nostro accounts and **FIBA Margin.xls** which is used to monitor collateral against open option positions. The spreadsheet is manually populated but takes some direct feeds from Reuters. The desk assistant must be notified of cash flows that must be reflected in the spreadsheets, however, there are no controls to ensure all relevant data is included in the spreadsheet. Also, the spreadsheet is not subject to formal change controls and has not been independently reviewed and documented to ensure it is operating in line with expectations. This issue was documented as a workpaper comment. Audit agreed that there are strong secondary controls to ensure that errors arising from unauthorized changes made to the spreadsheets will be identified promptly by Operations and the number of cash flows include in the spreadsheets are small.

The ESCP desk uses Excel and Access tools including the following:

- **Creditbook** – produces preliminary portfolio structures and calculates various statistics and descriptive data
- **CurveGen.V3.2** – used to assign curve figures to positions in Portfolio Trader, and
- **Graphite management systems** – used to feed risk tools and reports for the desks ABS portfolios

IA finding related to the insufficient logical controls (password protection) over these spreadsheets.

Management comment:

Creditbook (a primary tool for Structures) is not business critical for trading business. The Structurer's duties do not include adding positions or risk managing. In terms of basic spreadsheet controls, the data resides in a database, not the Creditbook itself. The underlying database is password protected.

CurveGen – is not password protected. Also, management noted that they are currently running the functionality of CurveGen in parallel with PT and do not expect the life of CurveGen to extend past mid October.

Graphite management system is used as a risk reporting only and is not the primary books and records of the ABS CDO business. Reconciliation is performed against production systems monthly by Middle Office. Weekly risk reports produced by Graphite are compared by the Middle office and Front Office between the current and previous reports to highlight major differences.

RISK ASSESSMENT DOCUMENT SEPTEMBER 2006

OPERATIONAL RISK (MARK SCAPP)

Overall Inherent Operational Risk	Board and Senior Management Oversight	Policies, Procedures & Limits	AMS Reporting & Monitoring	Inter-risk Controls & Audit
Considerable	Satisfactory	Satisfactory	Satisfactory	Satisfactory

1. Inherent Operational Risk

From a people perspective, the degree of risk is moderate given that the firm has demonstrated across all sectors the ability to refine and enhance governance models, handle the level of complexity commensurate with its products and provide a high degree of transparency in financial reporting and disclosure. The firm has quality people at the senior levels and has been able to replace any departures with even better staff. The one area that demonstrates a considerable amount of inherent risk is in the degree of human interaction involved in transaction processing which increases the potential for heightened operational risk. For example, over the past year, several information security incidents involved human intervention. Many IT enhancements are aimed at automating processes to reduce manual intervention, including AML processes.

The firm now has robust new product approval policies in place corporate-wide and this ensures consistency for assessing risks involved in structuring and distributing products. The firm operates in a very competitive market and is committed to funding various technology initiatives that will provide greater efficiencies.

Execution, delivery and process management channels are viewed as complex, and have high level of staff experience and knowledge. Across the firm there are technological complexities, many of which have been self-identified by the firm. There are numerous technology initiatives currently being undertaken by management.

2. Operational Risk Management and Controls

Overall, operational risk is satisfactorily managed. The firm continues to enhance its processes, including those related to internal audit, business resiliency, and the execution of risk control self assessments. The firm's overall control environment is operating effectively. Management attention is focused on improving information security deficiencies. More generally, strengthening the firm's technology infrastructure is a major strategic initiative. Management is approaching these initiatives appropriately and the execution of each will determine future efficiencies. As noted, management has also made enhancements to Audit and Risk Review (ARR). The initiatives (principally tied to the firm's Five-Point Plan program) have included business monitoring by audit staff; an increase in staff levels and timely report issuance. Lastly, the managing of the firm's SOX404 process is effective.

Information security remains a concern, but appropriate actions are being taken. A number of improvements made during 2005 including, the development and substantial completion of 2005 IS plans, the release of monthly IS metrics, and the creation of a detailed remediation plan (also referred to as "Project Fast Track"). The remediation plan includes steps needed to put an enhanced incident management response program in place. Our 2006 review of information security currently underway will provide the details of how much success has been achieved.

Board and Senior Management Oversight

The management of operational risk is satisfactory. The new Chief Operations and Technology (O&T) Officer has demonstrated significantly more influence within the business sectors in order to accomplish initiatives in information security and overall technology. The developing partnership that has formed between O&T management and the firm's business heads to formulate together key strategic initiatives has been a key difference in strategy. The firm's Audit and Risk Review Committee has demonstrated a high degree of involvement towards understanding the issues surrounding information security and other technology projects. The firm's use of audit sub-committees as a way to discuss business issues with appropriate staff is acknowledged as having a positive effect on sharing issues and looking for resolution. This is viewed as a best practice. For business resiliency, senior management's commitment to achieving the requirements of the Interagency Sound Practices Paper is readily apparent. This was verified during our last joint review with the OCC. Lastly, the board and senior management are viewed as providing effective oversight in the establishment of an operational risk capital framework. Our follow-up benchmarking exercise of Citigroup's AMA framework (conducted in 2005) confirmed that senior management remains committed to this endeavor.

Policies, Procedures, and Limits

The firm's policies and procedures for operational risk are considered satisfactory. The firm's Operational Risk Policy and RCSA requirements are largely effective. The firm has undertaken a full review of the RCSA process in order to promote better consistency. The newly rewritten RCSA policy sets corporate level standards for risk identification and control testing. Further, management is putting a technology solution in place to allow for RCSA data aggregation and trend analysis. During a recent exam, the CPC team concluded that Citigroup's RCSA process is satisfactory. Technology initiatives related to the RCSA enhancement process will be the subject of continuous monitoring.

Risk Monitoring and Management Information Systems

While the IS program undergoes significant upgrades, management produces quarterly deliverables and has implemented a process of reporting progress against a plan. Further, IS metrics are now regularly generated. As noted above, internal audit has enhanced its business monitoring, and shortened its audit cycles (largely in response to the weaknesses identified in Japan the previous year). Activities that give rise to operational risk (including RCSA results) are effectively monitored.

Internal Controls and Audit

Overall, the firm's system of internal controls satisfactorily covers operational risk. ARR adequately tests and reviews the effectiveness of internal controls and information systems. In addition, ARR's meeting staffing targets, and an RCSA process that is continuing to be strengthened with better technology solutions and more robust training efforts are positive developments.

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