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Sector call – Platinum Group Metals Services

Friday, 15th March 2019

Operator: Good morning, ladies and gentlemen and thank you for standing by. Welcome to today's Sector Call PGMS Conference. At this time, all participants are in listen-only mode. There will be a presentation followed by the question and answer session, at which time if you wish to ask a question, you will need to press star and one on your telephone keypad and wait for your name to be announced. I must advise you that this conference is being recorded today, 15th of March 2019. I would now like to hand the conference over to our speaker today, Martin Dunwoodie. Please go ahead, sir.

Martin Dunwoodie: Thank you, Nadia. Good morning everyone. I'm Martin Dunwoodie, the Director in Investor Relations for Johnson Matthey and I'd like to welcome you all to our call today. This is the latest in our series of calls to give you more detail on our sectors and of strategy to deliver sustained growth and value creation. As usual, we will not be giving a trading update as part of this call. I'm pleased today to welcome Jane Toogood, Chief Executive for our Efficient Natural Resources sector and Mark Bedford, Managing Director of Platinum Group Metal Services, a sub-sector of Efficient Natural Resources and that will be the subject of today's call. With that, I'll hand over to Jane.

Jane Toogood: Thank you, Martin and thank you all for joining the call today. You may recall this time last year I spoke to you about our Efficient Natural Resources sector, which helps our customers more efficiently use, transform and transfer scarce natural resources across a range of industries. Today, we're going to talk about how Platinum Group Metals Services - or PGMS - delivers on those objectives.

I'll start by giving you an insight into the importance of platinum group metals for JM; market dynamics and why we have a strong competitive advantage before Mark talks more about our services. I'll then conclude before opening up to Q&A. Hopefully, you can see all the slides on the webcast and you can navigate through these yourself as we talk.

So turning now to slide 3.

JM's been a world leader in platinum group chemistry for decades. Our competitive advantage is underpinned by our unique depth of knowledge and understanding of platinum group metals - or pgm for short - that stems from our 200-year history, the foundation of which was our gold assaying business formed by Percival Norton Johnson in 1817. Fast-forward to today, assaying is still a critical part of PGMS, but we're much more than that. We're world class technology company and our expertise in PGMs has been pivotal in making us the company we are today.

So for those of you who are less familiar with platinum group metals, let me start by giving you a brief reminder of what they are and why they're important to us. There are six platinum group metals: platinum, palladium, rhodium, ruthenium, iridium and osmium. JM *refines* all six metals and we *use* all of them with the exception of osmium. Platinum group metals have a number of unique properties which include high conductivity, high melting points, and unique catalytic properties, which means the metals are unchanged by the reactions they catalyse. These properties make pgms extremely valuable for use in a wide range of consumer and industrial products. For example, in automotives, jewellery products, glass, pharmaceuticals, healthcare, and in many electronic devices including mobile phones and computers. In fact, between 20% and 30% of all modern materials depend on in some way on pgms for their production.

In terms of the uses of platinum group metals within our sectors today in Efficient Natural Resources, we use pgms in our Catalyst Technologies business to manufacture catalyst, which our customers use in the production of a range of bulk chemicals such as oxoalcohols and petrochemicals. In Clean Air, pgms are used in metal salts, which we use to make washcoats. These washcoats are then applied to substrates for the production of autocatalyst. In Health, pgms are the foundation of this business and today they're still used in oncology drugs including cisplatin and carboplatin. With New Markets, we fabricate precious metal wires and tubing used in the production of medical devices including cochlear implants, catheters and stents, and over the longer term, there will be additional opportunities that will leverage the competencies we've developed in precious metals, and I'll touch on this later on.

The diversity of these applications illustrates the importance of platinum group metals. Their special properties make them hugely valuable across many key global markets. However, supply of these precious metals is scarce. I'll talk more about the supply and demand dynamics on slide 4.

If you move to the next slide, in terms of primary supply, areas known to be rich in pgms include South Africa and Russia. However, supply of pgms from primary sources is declining as mining becomes more difficult and capital-intensive. In fact, we hit peak platinum supply over a decade ago. In terms of other key pgms, palladium and rhodium, the palladium market is currently exceptionally tight as the market is in structural deficit and we don't see an end to this tightness in the near term. By contrast, rhodium is a small illiquid market and any short-term misalignment between supply and demand can have significant consequences for price and physical availability. We expect that demand for both platinum and palladium will rise over the next 5 to 10 years, with demand for palladium rising faster than the platinum. The main driver for demand is the adoption of stricter emissions legislation, particularly in China where palladium demand for autocatalysts could double in the next decade.

All of these dynamics mean that while supply of pgms through secondary sources is already important, it will become *even more so* as this primary supply declines. To put some numbers around this, it's been estimated that over the next decade, the proportion of pgms coming from secondary recovered and recycled resources is going to increase from about 25% today to around 35% to 40%. And this is where JM comes in. As a global leader in secondary refining, we're well positioned to respond to these trends, which I'll talk more about over the next few slides.

So turning now to slide 5.

By way of a reminder and to help frame Platinum Group Metal Services in the context of the wider sector, we've previously said that we expect Efficient Natural Resources to deliver market leading growth in the medium term. Specifically, sales increasing 1% above growth in the markets in which we operate, with the exception of PGMS, which will grow at low single-digit over the medium term. PGMS represents around one quarter of Efficient Natural Resources' sector sales, around £250 million in revenue, the split of which is roughly 50:50 between internal and external customers.

We offer our customers a holistic service. We refine, we trade and we hold metal. And, we also fabricate precious metal products. Our customers trust us and have confidence in our ability to manage all of their metal needs. In addition, the nature of the PGMS business is such that

it's generally delivers negative working capital and generats attractive returns above the Group target. However, as we've talked about previously, we're currently experiencing working capital challenges due to unscheduled downtime that we had last year, something I'll talk more about shortly.

Although we don't run PGMS for growth, don't underestimate the strategic importance of this business. It provides a secure supply of pgms for JM and our customers. And going forward, the biggest advantage is that as primary supply declines, we're well positioned to meet the needs of our internal and external customers from secondary sources.

And this is why we're investing around £100 million into our refining capabilities over the next three years, which is within our existing capex guidance. We're applying our science, technology and deep understanding of pgms to improve the efficiency and resiliency of our refining assets. We're adopting improved techniques within our existing refineries - resulting in efficiency gains and therefore freeing up some capacity. In our US refinery, we've increased capacity by several hundred thousand ounces. And in China, our capacity has increased by a similar amount, putting us in a strong position to ensure security of supply in the region over the medium and long-term and service the expected demand increased we've mentioned. Once completed, our overall refining capacity would have increased between 20% and 30% to over 5 million ounces per annum.

Our current capacity is adequate to service our internal needs and our investment acknowledges the need to improve the efficiency and resilience of our existing assets. It puts us in a strong position to be able to support the increased demand we anticipate over the next 5 to 10 years from both JM businesses and externally. Whilst it's difficult to predict pgm demand beyond 10 years, our capacity expansions are modular and flexible, we're able to quickly adapt and add to our existing capacity, mitigating the risk of stranded assets in the future in the event of demand falling. So before we talk more about our core activities within PGMS, I will now spend some time discussing our competitive advantage on slide six.

Slide six now. JM is a world class technology company and cutting-edge science is at the heart of what we do. We have a spine of technology that runs through our sectors and PGMS, it's no different. We're leaders in precious metal chemistry and with our deep understanding of the metallurgy of pgms, we turn technology expertise into value for our customers. This expertise has enabled us to develop a suite of efficient processes for secondary refining and fabrication, some of which are proprietary to JM. And Mark will touch on what we do in fabrication a little later on. To give you an example of a key process, decorating key PGM is particularly challenging for refiners. The chemical similarities between elements that are close to each other on the periodic table such as Rhodium and Iridium or Platinum and Palladium makes chemicals separation very difficult. We apply appropriate techniques for specific JM and this enables us to refine to a market rate purity of over 99.95%. And of course, we continually look for ways to make our processes more efficient. We want to deliver better product more efficiently for JM and our customers.

Our ability to turn science into value is driven by our deep understanding of our customers' needs. We're a trusted partner and this trust has been built over many years, which makes it very hard to replicate. Many of our customers have been with us for over 50 years. They come back to us time and time again because they know they're being treated fairly and they can trust us to accurately assay their materials.

In PGMS, we manage platinum group metals through their lifecycle of refining, purification, product manufacture and recycling. We have a large-scale flexible offering. As the world's largest secondary refiner, a significant volume of metal flow through our business in various forms. To give you a sense of the scale of our operations, we have around £5 billion worth of metal flowing through our refineries every year. We would estimate that we have more than doubled the capacity of our nearest competitor and a segment share in secondary pgm refining of around 40%.

Our significant scale means we can offer an integrated service with precious metal management to our customers. We're essentially a one-stop shop for our customers' metal needs. We can also deal with pgms in many forms and our customers know that we have flexibility to provide them with metal as and when they need it, and in the desired form, whether that's sponge, metal ingut or grain. We can also supply metal in many different quantities from tiny amounts to multiple tonnes. In summary, our unique combination of size and flexibility puts us in a very strong position in the market.

As I've described, PGMS has a huge strategic importance as it ensures an uninterrupted supply of pgms; around a third of our metal for internal purposes is from our refining business. Our ability to manage our own metal circuit means we are largely protected from an overreliance on other market players and outside refiners. And this is particularly important for Clean Air, PGMS's largest internal customer. PGMS ensures Clean Air has a reliable cost-effective source of raw materials. This is essential for the operational efficiency of this business, particularly at the moment given Clean Air's strong growth, and helps to minimise supply chain risk.

Ultimately, the role of PGMS goes beyond a secure and sustainable source of critical raw materials and value-added products to JM and our customers. Our recycling and refining business is one of the most successful examples of a "circular economy". And, in a world where we're seeing greater emphasis on circular supply chains, this is a real differentiator. Typical examples of products managed through a closed loop, or circular economy, include pgm gauzes used in the nitric acid fertilizer industry and platinum fabrications used in the manufacture of glass. And longer term, our leadership and technology expertise in PGMS will support us in the development of some exciting opportunities, for example, in recycling of lithium ion batteries in cars. Although the metals involved are not pgms, we can use the skills and competencies from our other metals recycling activities and apply them here. Refining and recycling is part of JM's DNA and given the number of batteries that are likely to be available for recycling, this will be an opportunity for the mid-2020s and JM is evaluating now whether and how we should enter this market. I'll now hand over to Mark to talk through our specific activities within PGMS.

Mark Bedford: Thanks, Jane and good morning everybody. Turning to slide seven, there are three core activities within PGMS which collectively provide the complete integrated service offering to our customers, which Jane has described. Around two thirds of our sales come from refining and chemical products, the recycling and refining of platinum group metals and the production of chemical compounds. Around 25% is our fabrication business, which is the fabrication of metal products for our own and our customers use. Finally, the remainder is precious metals management. This business manages our metal trading activities on behalf of JM and our external customers. And I'll talk through these core businesses in more detail.

So moving on to slide eight and starting with refining and chemical products, JM is a secondary refiner. Put simply, we refine metal that's already been used. Globally, we have four refining

operations. These include our refineries in the US, in China as well as our UK refineries in Royston and Brimsdown. We also use refined pgms to produce various chemical compounds. We offer our customers a choice of around 200 chemical compounds ranging from simple platinum or palladium nitrates to very complex organometallic compounds. I'll now talk more about our recycling and refining process.

So moving to slide nine, we take scrap which contains pgms and generates refined metal in three forms; ingots, grain and sponge. Sponge, which is a powder form of pgm metal, is the most common because it can easily be transformed into other products such as catalyst. There are five stages in the refining process and the first is the collection of scrap from various sources globally. We work with a network of collectors and semi-refiners who collect, aggregate and sometimes transform some of the scraps into a form which is easier to transport. The scrap is packaged and it's sent to one of our refineries.

The biggest single feed of scrap, around 40%, is from spent autocatalysts. Other sources include spent catalyst residues used in petrochemical sector, from electronic scrap and also from jewellery scrap. We also receive scrap internally from Johnson Matthey. For example, if any autocatalyst doesn't meet our strict quality criteria, we will scrap and recycle the precious metal it contains. We then need to determine the pgm content within the scrap, which brings me on to the second stage, which is evaluation. Evaluation is a process of taking a representative sample from the bulk material, which is then assayed to determine precious metal content. This is technically very challenging because of the need to isolate small samples of material, sometimes as small as 10 grams, which are representative of a bulk, which may be an excess of a hundred tonnes. The materials of refining may contain 20 or 30 separate elements requiring analysis to parts per million level. Doing this right is important in building trusted relationships with our customers.

Once the material's been evaluated, the scrap is combined into batches for smelting. In smelting, the material undergoes a high temperature fusion in which the material is melted at over 1200°C for around 12 hours. This produces a melt which consists of two layers; a slag containing mainly non-metals and a bullion containing the pgms. Next, the bullion goes on to a chemical leaching process. This further concentrates the pgms and removes any gold and silver. And that leads us to the final stage, the chemical separation of pgms. This is a highly complex multistage process that converts pgms into their final forms. Revenue in refining industries generates from the service we provide. We have a service charge for refining the metal, which is independent of the metal price. Our job is always to recover as much metal as we can for the customer and we guarantee an amount to return. If we recover more than the contracted amount, then we may have a small metal gain, which is of course metal price-dependent.

Moving on then to slide 10 which covers the fabrication part of our business. In this space, we provide a range of fabricated pgm product based on metal wise and sheets for numerous and markets. Our products, which are inert and have high strength, are unequalled in their resistance to corrosion from both the atmosphere and from chemicals. For example, we make pgm wire, which is used in airbag initiators, in gas sensors, in cars. Our rhodium foils are applied within digital mammography scanners used in cancer screening. And we supply pgms using a range of ignition products that are being developed by our expert metallurgist. The final activity within PGMS is precious metals management. Precious metal management

comprises on metal trading activities which because of our size and scale means we act to the central metal liquidity, both for our internal and external customers. We're one of the largest players in the physical pgm market and would estimate around a third of global supply passes through our hands every year.

The business is small in terms of sales, but strategically important because it underpins the entire PGMS business. It also enables us to deliver a valuable service for our external customers. For example, we could hold metal on behalf of customers and use that metal in our business or for our own purposes. This helps our working capital since we don't need to buy that metal ourselves. And we'll touch on this in further detail in the next slide. In addition, we can offer customers flexibility in terms of metal return. For example, a customer who may have an outturn in the United States can choose to have metal returned in United States or in the UK. The customer also has flexibility over the type of metal return, whether it'd be sponge, ingot or on paper, the digital transfer. The breadth of activities means that we have the capability and flexibility to meet all our customer's requirements. And with that, I'll now hand back to Jane.

Jane Toogood: Thank you. So turning to slide 11 as I mentioned earlier, PGMS is strategically important: It has unique competitive advantage, generates attractive returns and generally delivers negative working capital. Let me just now explain the working capital dynamics in more detail. When we refine metal, we're contractually obliged to return to the customer on a specific date. If we refine the metal before the specific date, there's period of time when we can use the metal for our own purposes before we're contractually obliged to return the metal to the customer. Similar to the customer metal I referred to on the previous slide, this also reduces our working capital needs. However, as we've talked about previously, there were some challenges in the business as a result of the unscheduled downtime in our refineries last year. As a result of that downtime, we were unable to refine metal and return it in time to meet our contractual obligations. And because of the significant volume of metal that flows through our refineries each week, around a hundred million pounds, this leads to what we call "backlogs". As you know, these backlogs are also sensitive to increases in metal prices that you've seen for some time now.

Of course, we can always improve efficiency and resiliency of our refineries and we're investing for exactly that. But we believe we have a business that's adequately sized and therefore as a consequence, it takes time to work through the backlogs. As a result, in order to meet our customer obligations, we either buy or lease metal to return to them. If we buy metal, this increases our working capital and if we lease metal, this impacts our interest costs. For those customers that lease metal with us, high lease rates, which we're currently seeing can lead to a change in customer behaviour. For example, customers are encouraged to reduce the metal balances they hold with us and lease it into the market and earn a return on that metal. This, in turn, increases our working capital requirements.

The UK's withdrawal from the European Union does also have some effects. We've been working closely with both our customers and suppliers for some time and had been building inventory so we can continue to serve all of our customers effectively no matter what the outcome. As we said before, we anticipate that over time the backlogs will reduce and we'll update you on that when we get to the full year results in May.

So to conclude on slide 12, JM is a great business for JM. In our field, we are the market leader in terms of technology. It's a business that generates attractive returns, which should be beneficial for our working capital. And our expertise, technology and competencies underpin the wider group and are crucial to our future success. Our global ground is built on a strong heritage and we're excited about our opportunities, which I look forward to updating you on in the future. I hope that's been helpful. And with that, we're happy to take questions.

Q&A

Operator: Thank you. Ladies and gentlemen, we'll begin our question and answer session. As a reminder, if you wish to ask a question, please press star and one on your telephone keypad and wait for your name to be announced. The first question comes from line of Charlie Webb from Morgan Stanley. Please ask your question.

Charlie Webb (Morgan Stanley): Hi there, guys. Just one from me around your comments you made on battery recycling. Perhaps you can help us, you know, what expertise can you take from your business that would differentiate you in that market? What type of returns do you think such a business could do? Are there high barriers to entry or not? And what size of investment would be required for mid 2020s should you decide to go down that route?

Jane Toogood: Okay. Thanks for the question. It's probably a little bit early to answer some of those questions. So in terms of expertise, I mean clearly, we've got really deep knowledge of metallurgy, of chemical separation of metals. We're brilliant at that. So this is very relevant in the context of recycling metals. In terms of the market, I mean you said there about mid-20s, which I talked about in there, if you look at battery materials and what's going to happen in that market, it is going to be some years yet before that market is really growing significantly. So at this stage, we're really evaluating that opportunity. So in terms of the answers to your other questions, it's a bit early to make any further comments on that. Okay.

Charlie Webb: Sure. Thank you.

Operator: Thank you. The next question comes from line of Neil Tyler from Redburn. Please ask your question.

Neil Tyler (Redburn): Yes. Good morning. Thank you. One question on the fabrication business, please. The expertise that you hold in metals handling and processing, that I suppose has given rise to that business. How do you value that IP in relation to the value of the metal? I suppose my question is if the metals prices were to be either lower or higher longer term, particularly if they're lower, does that undermine your expertise or do you think lower metals prices would conversely perhaps open up further fabrication opportunities for the business? Could you give us sort of 5-to-10-year view from here?

Jane Toogood: Yeah. I'll try and answer that question. I mean, basically, the expertise is very much in metal handling, processing. It's all real competitive advantage and actually included in our name, I mean we offer a service in producing fabricating products from this. In a sense, I mean these metal prices move. Then obviously that does change people's ability to use these metals in different applications. But fundamentally, we're well-positioned irrespective of what goes on with the prices. Perhaps, Mark would like to add a couple of comments?

Mark Bedford: Yeah, I think one of the things we're thinking about in the fabrication business is we do have a range of products where they have perhaps rather low intrinsic metal contents but very high added value. We mentioned early on in the call something like an airbag initiator wire. You know, that is an incredibly fine wire, which is almost invisible to the naked eye; you supply it in kilometres and kilometres. It has some really very, very high added value but quite a low intrinsic content. So in a way, the fabrication business in particular, it's to some extent the revenue and the value we derive from it is rather independent to the metal price because the intrinsic metal content of these products can be quite low.

Neil Tyler: That's helpful. Could I perhaps just follow up in that case and ask you whether there are, you know, markets that you have, you know, you've discovered recently or investments that you've made that, you know, potentially would give rise to new markets for, you know, for your expertise.

Jane Toogood: I mean, if you look across JM and we have a business in fuel cell that's quite an interesting area that's growing at the moment and is at a relatively early stage of development. So it's a relatively small base. It's developing quite interestingly, particularly in China in terms of that market. I mean given the intrinsic properties of the metal, there will always be opportunities to use them in different things as science and technology develop. So I would want to come any specific opportunities, but if anyone's going to approach anyone, they'll approach JM about it because we're so deeply knowledgeable about this and because we offer this one-stop shop approach. So we are always talking to people who are exploring ways of using these metals. And Mark mentioned a few in his presentation. Perhaps you could just go a little bit further.

Mark Bedford: Yeah. I mean there are new applications for pgms coming along. I mean, I think a great example of something we have at the moment, we are developing an ethylene scavenger which is based on a palladium catalyst. What this does is essentially extend the shelf life of fresh fruit and vegetables on the shelves by scavenging ethylene from packaging. This is an example of where our research centre came up with an excellent low temperature of palladium catalyst and we applied it to what is a completely new field for this kind of catalysis. So these applications can come up from time to time and it's a case of leveraging our catalysis knowledge to something which might in this case be completely new.

Neil Tyler: Thank you.

Operator: Thank you. The next question comes from line of Tom Wrigglesworth from Citi. Please ask your question.

Thomas Wrigglesworth (Citigroup): Thank you very much. A couple of questions from me if I may, and forgive me because I had to jump off the call at one point. In terms of your refining and chemical products, how much of the sales there is directly related to consignments to your role as a consignment stockist versus, you know, just a business of actually processing pgm scrap. Secondly, around that, obviously if I look at the size of recyclers in pgm markets, I think you'll think in totality there about 23% of the total market give or take. What's your pricing strategy? Are you purely passive in pgm pricing markets or do you just react to customer responses? I mean, could you give us a little bit of colour as to how if the prices move higher and lower, how you respond to that or if you're proactive in participating in the market? Thank you.

Jane Toogood: Okay. I think what we'll do is we'll take the second question first and I might ask you to clarify what you meant by the first question. I can point you with a couple of things you might've missed in the presentation in terms of the numbers though. So Mark, if you can take that second question.

Mark Bedford: Yeah. In terms of our pricing strategy and the way that price is constructed in the industry, especially refining probably the best one to look at. The way that our refining prices are constructed, we have parts of this which is a service charge, which is essentially independent of the metal prices. And that's charged on tonnes and ounces of materials passing through the refinery. On top of that, we of course recover – make all our efforts to recover as much metal as we can for the customer. If we cover a little bit more than that, there may be a small gain on the metal contract and that metal gain is a revenue stream to us and that is price dependent. So in broad terms, a lot of the pricing is independent on the metal price but some have the dependency on the metal price itself.

Jane Toogood: Okay. And for the first part of the question, maybe just start to clarify – I wasn't quite sure what you meant by consignment stockists. But there were a couple of charts you might've missed a few drops off the call that we just talked about from slide 7 and the proportion of business and – yeah, go on.

Thomas Wrigglesworth: Yeah, no, I was on for that. So I'm guessing, so maybe I haven't understood correctly this pie chart, but eventually, you know, an automotive customer will ask you to effectively process their scrap autocats, you hold that as I understand and correct me where I'm wrong, and then, you know, you hold that metal for them, which is what you're talking about this inventory that you're then able to, you know, borrow, but you're contractually obliged. I just wondered – is that only the business or are you buying in independent – you purchase scrap from the market, which you process yourself where you own the whole chain as opposed to being part of a cycle for a customer? And that's what I meant by consignment stockist.

Jane Toogood: Okay. So we'll just try and explain very simply what we're doing in terms of –

Mark Bedford: Yeah, I think the best way to look at this in terms of the refining business is there is a certain amount of refining that we do, which is what we described as closed loop. In other words, we're providing a product to a customer. The customer will return that to us for refining. We'll separate out the precious metal and then we'll either hold that metal on account for them and/or just transform it back into another product for that same customer. On the other side of the business, there is what we would call open loop refining where there are a number of collectors and semi-refiners who are collecting metal on their own account and they will return that metal for us. And we simply return the metal to them without there being this automatic transformation into a new product. So I think the best way you really to think of this is what we would call open loop, which is with external customers and close loop, which tends to be with our own business within Johnson Matthey and also customers who buy products from us and have products refined by us.

Thomas Wrigglesworth: And can you dimensionalize those two, how big is it?

Jane Toogood: So I think in the end what we talked about here, we did talk about area roughly sort of 50-50, internal-external. I probably wouldn't want to split out the other parts.

Thomas Wrigglesworth: Okay. Thank you very much. Very helpful.

Operator: Thank you. The next question comes from line of Sebastian Bray from Berenberg. Please ask your question.

Sebastian Bray (Berenberg): Hello. Thank you for taking my question. If I might start with one on platinum versus palladium. The current market consensus appears to be the palladium remains tight and I think you've endorsed that during the call as well. What exactly is stopping people easily switching back to platinum? And how long would this process if initiated take for autocatalysis. This is my first one.

The second one is, JM, a few years ago, sold its golden silver refining business and it's competing with other players, the names BSF, Unicorn, Sumitomo Metals and Mining jumped to mind, which have full-service recycling, also take metals outside the PGMs. Is this a problem when bidding for scrap, which could potentially contain valuable other metals? And finally, a last one, could you give me a feel for what the average grams of platinum and palladium for an average car would be for pgm? And how much higher this could be for fuel cells? Thank you.

Jane Toogood: Okay. What I'll do is I'll ask Mark if you could just comment on the palladium, platinum and how long –

Mark Bedford: Okay. Yep. Thanks for the question. I mean, as we know what we can or the market can look at doing. There is the possibility of substitution of some of the palladium in gasoline catalyst with platinum. What I would say about this is that although it sounds simple on paper, in practice, it's not trivial technically to do that. So in terms of a timescale, it could be several years before wide-set substitution of palladium by platinum occurs in autocatalyst. So its impact on the market is probably still quite distant in terms of the kind of dynamics we see at the moment.

Jane Toogood: I think the second question that was about whether we'd sold our gold and silver business, whether that's a problem in terms of people asking us to refine their scrap and of course it's not a problem. We are extremely competent in what we do and we're really good at the very difficult path, particularly getting the right purity of the platinum, palladium. Again, Mark, if you want to add any extra colour to that?

Mark Bedford: Yeah. Well, some of the companies that you do mention especially, you know, some of the bigger mining companies dealing with a much broader spectrum of input than Johnson Matthey now focuses on. We are very firmly focused and specializing in PGMs. Some of the other refiners tend to be taking in rather lower grade materials on a much larger scale which contain a much larger cross-section of the periodic table.

Jane Toogood: And then the third question. What's the third one?

Sebastian Bray: Loading PGM for autocatalyst and fuel cells.

Jane Toogood: So relatively you mean – so is there a relatively more –

Sebastian Bray: If you can give me an absolute number. Is it about 3 to 6 grams per vehicle of platinum group metals, typically for a car and how much is it for fuel cells?

Jane Toogood: Okay. I think it's variable, obviously. Mark, if you can give a comment on that?

Mark Bedford: Yeah. The kind of number that you talked about is not untypical for loading in the average IC engine car. As things stand today, loadings in typical fuel cell vehicles which are being developed are quite significantly higher than that but are coming down rapidly.

Sebastian Bray: Thank you very much.

Operator: Thank you. The next question comes from line of Geoff Haire from UBS. Please ask your question.

Geoff Haire (UBS): Good morning and thank you for the opportunity to ask the questions. Most of mine have been answered. It's kind of one more, just going back to the recycling of lithium ion batteries. Can you maybe help us understand what exactly you're targeting to recycle? Is it the anode, is it the electrolyte, is it the cathode? And will the current refining technology that you have at the moment be used? Or will you have to effectively come up with a new technology and therefore also build new refining capacity to do that?

Jane Toogood: I think – so again, with this, it's too early really to talk more in detail about this at this stage. All I would say is we do have really good competencies, but of course we are always developing our technology all the time to improve our efficiency and effectiveness of our processes. We've got some great technology researchers and we are able to build as well on our technologies, but I don't think I can comment further on whether we would use new or different technologies, et cetera at this stage. Okay.

Geoff Haire: Okay. Thank you.

Operator: Thank you. The next question comes from the line of Adam Collins from Liberum. Please ask your question.

Adam Collins (Liberum): Yeah. Hello. Good morning. I had three on precious metal services. So the first one is around the trading desk. Historically, that business has been driven by volatility as well as volumes. Although we're not nearly back to where we were in 2009 in terms of metal volatility, there have been periods in the last year or so where it's been quite high, particularly for palladium and rhodium. So I wondered if you could just sort of comment on this trading conditions in that area. So that's the first one.

The second one is around the market conditions currently in pgm recycling. Couple of areas there. So firstly, in the European market, it looks like a little bit of capacity is coming out of the market. There's been some refinery closures in both the UK and Italy. I'm wondering if you could just comment on whether you think the market is tight.

And then on the sort of the mid term growth outlook in terms of recycling volumes, in the last few years, there's been quite a lot of growth in chemcats, original installations. And if I'm not mistaken, there was a good amount of palladium added to cars around about 10 years ago because of regulations. Do you expect a good flow of end-of-life material in the next few years in that area? And then just finally, on the comments about the working capital stresses that have occurred in the recycling business in the last few courses, I wasn't clear whether you were indicating that there's been a deterioration in the last few months over and above what was indicated at the last set of half yearly results from Johnson Matthey. So I wonder if you could just clarify that. Are you signalling there's been a deterioration there?

Jane Toogood: Right, okay, so three questions there. Obviously, so just to repeat, it's not a trading update, so I can't go into all the details now. That is something to add on. The team

will go through in depth at our full year results. With regards to, I think, the trading desk and your question about the trading desk and volatility, I mean basically again, no trading update. But of course if you look at our proportion of sales of that trading desk in the context of the group's overall performance is unlikely to be a big contributor. I think if you look at the first slide, you can see that.

When you look in terms of the market conditions and pgm recycling, at the moment, of course we've had a period of unscheduled downtime in 2018. It was actually [inaudible] one of the competitors and any disruption in refinery is likely to have an impact on the market. And so it is reasonable to assume that some of that downtime there contributed to the tightness in the market. Okay. That's helpful. I think the third question I've probably answered by saying that we can't say anything on the trading update at this stage. I think that deals with all that. And there's one other comment. Mark, if you want to add us a bit?

Mark Bedford: You mentioned that the sort of wave of metal coming back from the carpool essentially in autocatalyst. I think what we're seeing there is in the United States we're kind of right in the middle of that wave and there is obviously that end of the market is extremely buoyant at the moment. I think the interesting thing for the future of course is to look at possible trends in the Far East and in China, in particular as a lot of the battle now being laid down in cars in China won't be coming back to the market probably for another 10 or 15 years. So there's kind of a movable wave of palladium in particular, which is going around the globe coming back from the carpool and I think it's going to keep the secondary refiners pretty busy for quite a while to come.

Adam Collins: May I ask a couple of related questions on that? So as you were suggesting, it appears as if the flows are going to shift slightly towards palladium and away from platinum over time given the 10-year historical installation rates. Does the shift away from platinum and palladium have any impact on the profitability of the business? Clearly, that's not an issue at this stage where the value of the two metals is similar. But if in the long run, the price changes to the historical averages, would that be a factor or does it not really matter from your point of view, whether it's an ounce of platinum or an ounce of palladium that's recovered?

And then on the market tightness, I mean, yes, of course you've had an outage – you of course had an outage. But there are a couple of other players that are taking capacity out of the market indefinitely in Europe, which is slightly at odds[?] with your indications that you are investing, which I presume is more Asian-facing. Do you have a sort of sense why they would be taking capacity out of the market given that the prognosis is for growth?

Jane Toogood: Okay. Let me deal with the latter question actually. I'm not going comment on why other people – what other people were doing their capacity. What I can say is we are investing both in the efficiency and the effectiveness of our refining and also in the capacity and that's not – we're not just investing in Asia. Okay. So we're investing around the globe. That's important to know and I think it would – on the comment about whether it makes any difference, whether it's palladium or platinum, do you want to comment on that, Mark?

Mark Bedford: Yes. In essence, it doesn't make a huge difference to us. We were able to deal with a whole suite of PGMs. We're somewhat agnostic in terms of the refining business of how that metal splits actually pans out. Clearly, the dynamics are something that we have to

deal with all the time. But it really makes no fundamental difference in the nature of the business depending on how that's split develops.

Adam Collins: Good.

Jane Toogood: So if I can just wrap that up. We are – I think I talked about this, in the way we deal with our capacity, we are right size to meet both JM's needs and our customers' needs now in the future. And we're also quite modular and flexible to be agile as the market changes and that's important, as well that I reinforce that with you. Okay. Thank you.

Operator: Thank you. The next question comes from the line of Chetan Udeshi from JP Morgan. Please ask a question.

Chetan Udeshi (JP Morgan Cazenove): Yeah. Hi. Thanks. You know, first question was just around that hundred million pounds of investment that you talked about in the business over the next couple of years or two, three years. Can you give us a sense of how much of that is just going into, you know, maybe improving the, the sort of resiliency and consistency of the process so as to not have these outages and how much of that is going actually into capacity?

And the second question was, in terms of competitors in this business, correct me if I'm wrong, but I heard a figure of 40% segment share that JM has in pgm defining business. I mean, who are the key other competitors in this set of refining market? Are the competitors that you have in the autocatalysts market or do you also see, you know, some independent [inaudible] refiners being quite active in this business as well?

Jane Toogood: Okay. I'm afraid I'm not going to comment on competitors. So that's not for now or at all, in fact. In terms of the capital, the capital I gave you is everything wrapped up together and is also a part of our capital spent across the group.

Chetan Udeshi: And you know, I heard you say that the extent of secondary refining as part of the total availability of pgm is going to rise from maybe 25 to 35 to 40, but suggest maybe the growth should be strong. So why is it that you would internally have a low single-digit kind of growth aspiration in this business?

Jane Toogood: So our business is right size for our growth, which is actually also good and for our customers growth and we're investing to improve efficiency and effectiveness and resilience of our refineries and also to ensure we have the right capacity for the future. So I think I mentioned we have invested in new refinery in China for example, where we see strong growth in the future. And the way that we can do that is modular and flexible, so we tend to be agile to move as the market develops over the next 10, 15 years.

Chetan Udeshi: Thank you.

Operator: Thank you. The next question comes with – we are taking from Martin Evans from HSBC. Please ask your question.

Martin Evans (HSBC): Yeah, thanks. It's just a on the slide three just really a little bit more on the Health side of [inaudible] and market demand for PGMs because obviously most of the focus in terms of refining is only autocats and so on, and Clean Air. But Jane, you mentioned that the historic foundation of Health was pgms and we know about carboplatin and so, but what's the current kind of trend within the drugs industry for the uses of these all of PGM generally? Has there been – Is that growth or is it a fairly small niche stable market? Thanks.

Jane Toogood: Okay. I think I'll have Mark comment on this.

Mark Bedford: Yeah, I mean there're always – I mean platinum group metals already extremely interesting in some sort of pharma side because of their potency. I'm not aware of any new development in the pgm space, which is going to change the use of – I can't see where the next cisplatin group of compounds is coming from. Interestingly, one of the bits of the market, which is growing quite strongly for us, which is not actually on the drug side, it's on the medical device side and that's where our business comes in because a huge amount of new medical devices that are being used for things like ablation catheters and so on use PGMs in wrought forms. They are used because they are chemically inert and this has become quite a substantial use of PGMs over the years and not to be overlooked. A lot of these medical devices which are made are actually single use and they are products which tend to attract decent added value in terms of the expertise we can bring to them.

Martin Evans: Good. Thanks very much.

Operator: Thank you. Dear participants, once again, if you wish to ask a question, please press star and one on your telephone keypad. The next question comes from line of Adam Collins from the Liberum. Please ask a question.

Adam Collins (Liberum): Yeah, just a quick one following up on that question about the substitution potential for platinum over palladium in autocats. With regards to electronics, do you think that there's some potential now for some substitution to platinum instead of gold or palladium in terms of electroplating electronics area, that would seem to be quite an interesting area if it can be cracked?

Mark Bedford: Adam, I think it's a really interesting question and a very interesting potential for platinum, now the price is developing in the way it is. Platinum is an exceptionally good conformal coating in a lot of electronic components. It has substantial use already in memory storage as you probably know. But the prospect of it developing more as a plating and conformal coating electronics could be quite interesting.

We do have a decent amount of technology and expertise in that area. So it is something certainly we are looking at.

Adam Collins: Okay. Thank you.

Operator: Thank you. Dear speakers, there are no further questions at this time, please continue.

Jane Toogood: All right. Thank you very much. I'll pass over to Martin.

Martin Dunwoodie: Great. Thank you very much, Jane and Mark for the presentation and also the Q&A. Thank you very much everyone for joining today. If you have any questions further to this call, then please do come back to us in Investor Relations. And with that, I will say thank you and goodbye. Goodbye.

Operator: That concludes our conference for today. Thank you for participating. You may all disconnect. Have a nice weekend ahead.

[END OF TRANSCRIPT]